



THE ARCHITECTURE OF PESANTREN: CURRENT ISSUES, CHALLENGES AND PROSPECT FOR DESIGN FRAMEWORK

| Received April 20th, 2023 | Accepted September 21th, 2023 | Available online December 30th, 2023 |
| DOI <http://dx.doi.org/10.18860/jia.v7i4.21006> |

Nensi Golda Yuli*

Department of Architecture
Faculty of Civil Engineering and Planning
Universitas Islam Indonesia

Ilya Fadjar Maharika

Department of Architecture
Faculty of Civil Engineering and Planning
Universitas Islam Indonesia

Frank Eckardt

Faculty of Architecture and Urbanism
Bauhaus Universitaet, Weimar
Germany

***Corresponding Author:**

nensi@uii.ac.id

ABSTRACT

Pesantren (Islamic Boarding School) is an indigenous educational institution originally from Indonesia and perhaps a unique form of the traditional Islamic education system and spreading to Southeast Asia that neighbouring countries. However, studies on pesantren rarely address physical elements and architecture. Learning pesantren architecture challenges us with representation: definition, how to visualize its form and program, and the design. Finding a body of knowledge on pesantren to excavate "architectural features" is important to study its prospect in architectural terms. This paper attempts to analyze pesantren from the architectural perspective, focusing on the specific feature and finding its current issues, challenges, and prospects for the design framework. Two combination research methods were used: Systematic literature review and case study. A systematic literature review was conducted in the first stage to map the distinctive spatial quality of pesantren. In the second stage, three case studies were conducted to report and analyze the current issues, challenges, and prospects for the design framework. The research shows that the variety of physical conditions is the main current issue of pesantren. The main challenge is the shortage of financial availability while the spatial need to cater to population and development is more increasing. Those conflicting narratives open local responses through incremental design processes in which contextual design frameworks are needed.

KEYWORDS:

The Architecture of Pesantren; Traditional Pesantren; Design Framework

INTRODUCTION

Pesantren (Islamic boarding school) is a unique form of the traditional Islamic education system in Indonesia and has spread to Southeast Asia neighbouring countries, albeit in various local names [1] [2]. After Clifford Geertz published his research about *santri* and *abangan* [3] [4], studies about *pesantren* were done by many researchers, mostly about *pesantren* as an education system [5]–[7]. Some scholars learn *pesantren* within the dynamic interaction between traditional and modern education [5] [7] and note that there are adaptations of the unstructured tradition of education into a more structured modern education system [8] [9]. However, studies on *pesantren* rarely address physical elements, let alone architecture. Studies in this area mainly address deficiencies such as poor conditions, uncomfortable situations, and overload capacity in the dormitory of *pesantren* [10].

Understanding *pesantren* requires a historical overview of Islamic educational institutions, which have evolved over generations. In the Islamic world, the history of education started as early as the Prophet Muhammad (P.B.U.H.), who taught his disciples clandestine from house to house to the form of the

madrasa that evolved as the "university" exemplified by Al Karaouine University in Fes, Morocco. Students learn Islam in the *halaqa* system (a circle of learners mainly for memorizing the Quran) and *fiqh* (Islamic jurisprudence). This *halaqa* can be conducted nearly everywhere, although mainly concentrated in spaces around the mosque. This *halaqa* evolves into a more structured madrasa system where specific dedicated places are provided, or the school (madrasa originated from Arabic *darasa*, to learn) [11]. Unlike the narrow understanding of madrasa as a school system, *pesantren* is a combination of the madrasa, the dedicated place of learning, and *halaqa*, the activity of learning circle is conducted in houses of the community around the school, in which all concentrate on the local mosque.

MADRASA AND PESANTREN: OVERVIEW IN DEFINITION, CURRICULUM, AND UNIQUE ARCHITECTURAL TYPE

In Indonesia, the context of *pesantren* and madrasa still has a confused understanding of the definition, curriculum, and architectural style. *Pesantren* is a local understanding of madrasa, and it views the Islamic concept of madrasa [2] [12].

Madrassa characterized Islam as a combination of *pesantren* and public school [13]. The development of the madrasa is similar to national development in Indonesia since the empire, colonial period, and independence period. Education in Madrasa changed from the form of recitation in the house to the Khan Mosque Nowadays, it has transformed into school system, as commonly seen across Indonesia [14][15]. This process is the institutionalizing formal process of madrasa [16]. Madrasa as Islamic school is an effort to modernize Islamic education and respond to Dutch Colonial education politics [17] [18]. Madrasa adopted *pesantren* and the school education system [19]. From *pesantren*, madrasa adopted the religious sciences and religious attitude [20]. The classical system, general subject, and management education are school characteristics in madrasa [21]. They are believed to be the continuation system of *pesantren*, modified in the public school system run by the classical system [22]. There are two types of madrasa in curriculum content: The first type is, 30% of religious content and 70% other contents. The second one is 100% religious content[23]. In an architectural aspect, the classical system in madrasa involves the creation of numerous classrooms with a layout of teacher and students seating similar to that in public schools. Residence obligation in madrasa is not mandatory. If there are dormitories in madrasa, there is no close relationship between students and teachers, while in *Pesantren*, *kiai* and *santri* (students of *pesantren*) are like close family relation. The classroom setting in madrasa is different from *pesantren*. There are *sorogan* system (in the centre place surrounded by the *santri*) and *bandongan* system (*kiai* reads and explains the materials, and *santri* writes it- like in the classroom setting but sit on the floor). Mosque is not the important place that has to be available in madrasa, same with the house of the head of madrasa and the teachers. Madrasa has a rigid plan for its existence and development, unlike in *pesantren*. *Pesantren* is built and developed incrementally based on its needs and the stakeholders (*santri*, teacher, alumnae, founding, et al).

Pesantren is an educational institution that prepared *santri* (students in *pesantren*) as an agent of change, developing morals and creeds based on the Quran and Hadiths [24] [25][26] [27]. Its educational system grows and adapts to dynamic life based on the demands of the community and is still by Islamic values [28] [29] [30]. The existence of *pesantren* is the religious response from the local community for acculturation to the local Islamic culture [31]. *Pesantren* can diverge into two models [32]: traditional *pesantren* (*Salaf* system), which conducts religious education and character development, and the modern system (*Khalaf* system), which teaches religious and general education as well as life skill training and integrated approach that combined these two systems [2]. When the *pesantren* was founded in the first time in Indonesia is still debated as *Pengajian* activity after the collapse of the throne of Majapahit [33] or based on the *Kuttub* education institution

during the Umayyad Kingdom [34] or from the *pesantren* system of Hindus in the pre-Islamic era [33]. Other research stated that *pesantren* adopted from the Middle East Islamic Education from Al Azhar, Cairo [35]. The five elements of *pesantren* included *kiai*, mosque, *santri*, dormitory, and teaching classical books [36]. In the architectural aspect, *pesantren* has minimum three room functions: mosque, *kiai*'s house, and dormitory for *santri*. The mosque in *pesantren* is a multifunction room; a place for prayer, and a communal space that pushes social cohesion between *santri*. The dormitory structure in *pesantren* indicated simplicity, humility and politeness. Many parties claim that *pesantren* is an indigenous educational system in Indonesia based on not only Islamic tradition but also the culture of local communities [6], [28], [37].

In Indonesia, the term madrasa has already manifested through a structured curriculum and materialized as a school building, imitating ordinary public schools but offering more Islamic subjects [10], [38]. *Pesantren*, however, has been evolving into a more distinct feature recognized by its elements: Dormitory, mosque, the presence of respected teacher (*kiai*), and students (*santri*) who learn traditional Islamic books of Yellow Book (*Kitab Kuning*)[39]. *Kiai* of *pesantren* is central, which may be extended to their kin, and this inheritance authority creates a network of learner communities [40]. In the modern era, this educational system has been institutionalized outside the formal educational system, where it allegedly marginalized [39], [41], and as the space of indoctrination [7].

The historical narrative above invites two intriguing fundamental questions in architectural discourse. The first is how to explain the narrative above through spatial and architectural language and theory. Can we "define" *pesantren* architecturally? Can we reveal the phenomenon through space? Can we develop spatial representations or architectural vocabulary from the phenomenon, such as the form and program or the armature and fabric, to borrow the City's duality [42]? The second will be the question of prospects, especially in creating theoretical ground for designing *pesantren* within the new context of information flow. Manuel Castells has rendered that this information technology age is reshaping society and the world city system[43]. Now, learning can be borderless and can be taken from everywhere, hence the *pesantren* meets its critical challenge: its existence and relevance.

DESIGN FRAMEWORK BY PLOWRIGHT AS THE FUNDAMENTAL BENCHMARK TO VIEW THE PROSPECT OF DESIGN FRAMEWORK IN PESANTREN

Plowright stated that the fundamental design framework is force-based, pattern-based, and concept-based [44]. The force-based framework focuses on the design thinking and negotiation of complex forces and all forces accessible and ordered to follow up by the designer. Object in this framework has structural and behavioural relationships. Negotiation is an important

part of this framework. The second framework is pattern-based. This is believed to be the core of architectural design. This framework focuses on pattern application. Cultural and social content is still present in this framework but held in a pattern that is applied independently. A concept-based framework allows designers to use metaphors, analogies, questions, and big ideas. The concept organizes all aspects of architectural design into final form. This framework is around the creation of a central idea to manage part of the part of the design proposal.

The design framework in *pesantren* was recently in the grey area, while this building typology resembles a combination of residential and school functions. However, its presence as a traditional education institution existed organically amid a local culture based on community needs in rural contexts. Plowright framework seems to be one analysis strategy to propose the prospect of design framework.

METHODS

Methodologically speaking, in answering the above questions, this research utilized a combined method of Systematic Literature Review (SLR) and case study. The SLR was used to mine architectural vocabularies from the *pesantren* literature addressing the first domain of the research question. Research needs to explore how far *pesantren* studies in Indonesia and Asia have gone by much research since the first publication of Clifford Geertz about *pesantren* in East Java.

The case study was utilized as the testing ground of the first step finding to develop the mapping of spatiality and architecture of *pesantren*. This mapping was the first step towards design theory for *pesantren* in the context of the information age. Both methods are described in detail in the following part.

INITIAL SCOPING OF SYSTEMATIC LITERATURE REVIEW (SLR)

Our literature study started with general mapping to see how *pesantren* were studied. We found that Clifford Geertz’s anthropological study was the foremost research on *pesantren* as early as 1960, although there is less description of the architectural context. The relation of each paper in any context draws as connected paper in Figure 1 and drives to make any framework to literature mapping. Finding this initial research, we began our systematic literature review, from 1960 to the recent to mine architectural vocabularies in *pesantren* discourses.

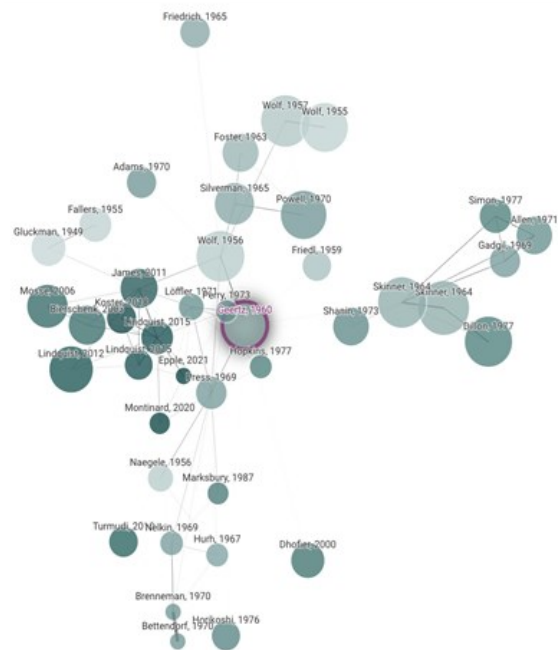


Figure 1. Connected studies about Pesantren from Clifford Geertz Research
Source: connected paper.com

DATA SCREENING PROCEDURE OF SLR

We utilized Publish or Perish by Harzing to extract the Scopus abstract and citation database index with the word “pesantren” as a search string in the keywords and title. Table 1 shows the result of the scrapping. In comparison, researchers also see the literature from connected papers to find out about the first study in pesantren in a whole context.

Table 1. Data Collection Procedure

Search by Harzing of PoP on Scopus	Results of the search and screenings
First screening: search string “pesantren” in keywords and title	444 articles
Second screening: selecting only journal articles in English	327 articles
Third screening: selecting relevant articles through abstract reading, mentioning, or indicating relevance on the physical aspect of pesantren	26 articles
Fourth screening: reading the journal content relevant to research questions	14 articles

We treated 14 articles as our primary data. Analysis was performed by coding all relevant words or issues to extract any relevancy to architecture. We identified some variables: location, general issues or problems related to architecture, and detailed information on the properties such as size, characters, etc. To add the location detail, we traced the exact coordinates of the research object/*pesantren* mentioned in the article through searching with Google and Google Maps to determine their distribution and the spatial context of the studies.

CASE STUDY

We noticed that architectural characterization from the literature alone would not give a deeper understanding of architecture of *pesantren*. Hence, a case study was necessary to “validate” the significance of architectural characterization in real space, the current issues, challenges, and the prospect for a design framework. We set some methodological background to choose the cases, namely: (a) the availability of access to the area and the internal stakeholders of the *pesantren*, (b) the possibility of showing a variety of morphology rather than choosing a similar type of *pesantren*, (c) possibility to find an exemplary case, i.e., the good practice of architectural and spatial quality. Three traditional *pesantren* in Central Java were chosen, namely (a) *Pesantren Al-Hikmah Benda, Brebes* (location: GPS-7.220613657331574, 109.03803739721303, (further abbreviated as “AHB”), (b) *Pesantren Asrama Pendidikan Indonesia (API) Tegalrejo, Magelang* (location: GPS -7.461904621186556, 110.26765076838026) (further abbreviated as “API”), and (c) *Pesantren Pabelan, Muntilan* (location: GPS -7.577630804548677, 110.25688161507706) (further abbreviated as “PPM”).

These three *pesantren* are in Central Java and they have many *santri* (students). AHP has about 8000 *santri*, API has about 5000 *santri*, and PPM has about 2000 *santri*. They are in the rural-urban fringe. AHB is near the City of Brebes, API is near Magelang, and PPM

is in Muntilan. All of them are medium-sized cities in Indonesia. Architecturally, PPM has distinctive characteristics as the Aga Khan Award IV of Architecture recipient in 1977.

METHOD OF ANALYSIS AND CONCLUSION STRATEGY

The Analysis started with the primary data from the literature review, mentioning the keywords that appear in the paper related to architecture vocabulary through the summary of architectural issues in each research. Each keyword about architectural vocabulary is analyzed and grouped into two analysis strategies: depictive and normative narrative analysis that uses 2 of 3 types of architectural critics by Wayne Attoe (Attoe, 1981). The research also did a comprehensive analysis by comparing the substantial literature review to three case studies of traditional *pesantrens* to prove how dynamic the empirical studies of *pesantren* are and conclude about the current issues and challenges in *pesantren*. In the case of studies, the research analyzed three *pesantrens* for the spatial information, the development of spatial and room of *pesantren*, including the role of *kiai* in improving the building. Empirical Analysis is about what exactly happened in *Pesantren* that related to the architectural studies to conclude the morphology of *pesantren* and tried to make any speculative design framework in *pesantren* that can help understand the process of architectural design in *pesantren*. The design frameworks model by Plowright was used to analyze the prospect of design frameworks in *pesantren*. The forces, patterns, and concepts in the three case studies are described as the proposed potential framework in the architecture of *pesantren*.

RESULT AND DISCUSSION

RESULT AND DISCUSSION FROM SYSTEMATIC LITERATURE REVIEW (SLR) PROCESS

Fourteen articles were examined as primary data to analyze architectural vocabularies of *pesantren*; the details are presented in Table 2.

Table 2. The List of Primary Data

References	Research and detail location	Architectural issues	Architectural Words Utilized
Nilan [45] (2009)	Makassar, Indonesia	examples of poor physical conditions	two stories cement block buildings no glass in the window boys' personal dormitory space dysfunctional toilets classroom dormitory blocks crowded space
Lukens-Bull [2] (2010)	East Jawa, Pattani Thailand, and in Upper Southern Thailand	formal and functional differences between <i>pesantren</i> in Indonesia and Thailand	(no wall between) dwelling for boys and girls no man's land is simply space

Hamid [46] (2012)	District of Sumedang, Indonesia	historical narrative in developing learning facilities	Kiai's house laboratory learning places waqf areas learning facilities learning classroom mosque boarding houses meeting hall canteen sport court library cooperation pesantren
Muni fah et al. [47] (2019)	East Jawa, Indonesia	facilities for public interest and use	laboratories space for learning library bathroom parking area study room
Rahti kawa tie et al [48] (2021)	Pacet, East Java, Indonesia	physical facilities dedicated to increasing student's achievement	school facilities library facilities for extracurricular activities classroom
Fijriah and Ellisa [49] (2022)	Jombang, East Java, Indonesia	<i>The Ngalap Barokah</i> ritual is the main basis for the city transformation process and its impact on urban growth	residential area rented houses dorm area cemetery lodging restaurant houses for shops public toilets prayer room souvenir shops (GusDur) tomb The City's morphology the city icon (museum, monument, terminal)
Sudra jad and Wibisono [50] (2021)	Krapyak District Yogyakarta, Indonesia	three layers of spatial systems of Islamic religious activities within urban fabric/ area: religious, philosophy axis, and socio-cultural layer	mosques mushalla prayer room spatial pattern residential morphological attributes commercial mix use settlement
Bakri [51] (2021)	Banda Aceh, Indonesia	important aspects for eco- pesantren	classroom dormitory thermal comfort building orientation cross ventilation system green open space unorganized interior layout the opening element natural ventilation system urban setting
Herda yati et al [52] (2021)	Lebak District, Banten, Indonesia	infrastructure in Pesantren during Covid-19	study room dormitory worship area living room kitchen toilet bathroom social activities area independent isolation room
Nurtawab and Wahyudi [53] (2022)	Pesantrens in Indonesia	Facilities needed by pesantren in learning activities	classroom dormitory mosque
Fahmi et al. [54] (2022)	Bali, Indonesia	design strategy by avoiding religious symbols and	room for adherents' various religious belief no religious symbols in the building

Muafi ah et al. [55] (2022)	Ponorogo, Indonesia	child-friendly indicators for facility and infrastructure in three types of Pesantren (<i>salaf</i> , semi-modern and modern)	study room bedroom open green space toilets male and female dorms laundry place music studio various fields
Sauri et al. [27] (2018)	West Java, Banten and Jakarta, Indonesia	three types of room for <i>santris</i> ' activities; a physical symbol of the building; values in the mosque, dormitory and surrounding community	mosque dormitory

Table 2 shows that *pesantren*'s research locations from fourteen papers are mostly in East Java and West Java of Indonesia, and one is overseas, namely in Thailand (figure 1). From careful mapping, we also notice that *pesantren* are typically rural in coastal areas, especially in East Java.



Figure 2. Map of Pesantren distribution in articles (Source: author's GPS tracing of the locations)

ARCHITECTURAL INFORMATION FROM SLR PROCESS

The table also shows that all articles addressing the architectural issue have a variety of perspectives. Generally, all papers do not focus on architecture studies or building design as a body of knowledge. No research is specific about architectural building design. No authors are architects or affiliated with architectural schools. Nevertheless, they address room conditions or other spatial-related notions through the lenses of educational issues. The relation to architecture is impressed from descriptions of activities held in or around *pesantren*.

Figure 2 shows the words utilized in the articles. The words associated with study (classroom, study room, library) are the most frequent in articles, followed by words associated with living (dormitory, bedroom, bathroom), and then by places of religious activities (mosque, prayer room). Plenty of words show the 'detail' of architectural elements associated with *pesantren*.



Figure 3. Wordcloud shows architectural vocabularies used in literature.

Source: Author's utilizing wordcloud.com

We may learn from the cloud of words that those three architectural features are indeed the main features of *pesantren*. The rest of the words may also suggest the importance of addressing the 'level of detail' of *pesantren*. We may distinguish into two different revelations in text: words showing spatial entities and conditions as needs (such as meeting hall, shop, parking area, etc.) and issues (dysfunctional toilets, crowded spaces, etc.). In designing *pesantren*, this information must be addressed and inviting the method of user expectation and experience checklist as a client and user participation.

Furthermore, we expanded further the main perspectives of the article when dealing with the architectural feature in the following detail. We recall Wayne Attoe's elaboration on architectural criticism [56] to frame the perspectives of the narrative in the articles.

DEPICTIVE NARRATIVE FROM SLR PROCESS

This narration shows architecture in a general report of *pesantren* condition, the formal aspects, including its deficiencies. All papers discuss *pesantren* as the context of the study. Twelve studies in *pesantren*, two studies (around *Pesantren Tebuireng* and *Pesantren Krpyak*) for urban studies and city

planning, and the impact from *pesantren*. No research was studied on architectural building design. Twelve papers discussed the physical facilities in general and the conditions. Two papers exposed local wisdom principles in *pesantren* and harmonization in minority areas.

Two papers explain *pesantren* and its impact on the surrounding settlements in urban design and city planning. Important facilities, such as dormitories, classrooms, and mosques, are seen as the existing condition, in a bad or good condition, as the support facilities for main activities in *pesantren*; teaching and learning religious knowledge.

The research analyzes information from non-architectural research topics to understand the physical condition of *pesantren*. This data explains, after significant research from Clifford Geertz, about *pesantren*, including viewing architectural context, the locus of research is still around the main significant area, East Java, and more around Java Island.

The fourteen articles describe physical facilities as their current issues and challenges. The possibility of improvement for these aspects should start by where *pesantren* will develop their institution first. Maintaining indigenous values as *pesantren* should also consider all the areas of *pesantren*, indoor or outdoor, as the learning place for all *pesantren* actors (*kiai*, *santri*, *ustadz*, and neighbour).

Firstly, the work from Nilan, Lukens, Hamid, and Munifah stated that *pesantren*, as a physical facility, accommodates learning space for *santri* in a modest condition. No comfortable preferences are set as the basic facilities requirement because they argued that users in *pesantren* must adapt to any situation and condition of their places. As a non-governmental institution, *pesantren* should make an independent effort to improve the facilities, as in Muazza's research, and try to make any standard of architecture guidelines, i.e., *eco pesantren*, *child-friendly pesantren*, including use term of sustainability for *pesantren* both in management and physical issues [48], [51], [55] and [27], to brand their *pesantren* in one architecture parameters. Any deficiencies, especially in physical accommodation, occur in *pesantren* throughout the length of the use of a *pesantren* building. The building standards, that are used to put a minimum target on physical facilities, cannot greatly impact user comfortability. The lower attention on the architectural aspect is caused by *pesantren*'s consideration. *Pesantren* considerate that *santri* have a good level of awareness in learning. They do not prioritize where to study but rather what is studied and its benefits in the future. Two researches focus on building design principles (*child-friendly* and *eco pesantren*). For a *child-friendly* principle, the building of *pesantren* is protected from natural disasters. The equipment and furniture adjust the safety standards of children. The density limit of the study room is a minimum of 1,75 m²/child. The density limit of a bedroom is at a minimum of 2,5 m²/child. The building inspections exist periodically and each room has

emergency kits. *Pesantren* has evacuation routes and assembly point for an emergency, open green space, field or sports hall, 24 hours security and smoke-free area. *Pesantren* has adequate bathrooms and toilets (1:30 for male *santri* and 1:20 for female *santri*). For *eco pesantren*, the design principle is that *pesantren* uses nearby materials, provides green open space, increases the variety and the quantity of vegetation, and provides a habitat for animals.

Secondly is on the innovation in architectural/spatial features, including the impact on city planning [51], [52], [55][49] and [50]. *Pesantren* also tries to make the inclusive situation of their building to avoid the majority-minority issues in the settlement as the *pesantren* in Bali did it for organic tolerance in harmony [54]. As a place with many chances to gather huge population -live in there, or quick visit-, *pesantren* significantly impact social and economic activities. For example, local faith *Ngalap Barokah* and the philosophical axis around *pesantren* in Krapyak [49] and [50] provoke rapid urban development.

Thirdly is the interrelation between space and rituals or any psychological aspect of the users [48], [49]. *Pesantren* is indicated as the hub and generator of settlement activities. When rituals or places in *pesantren* have been glorified and become routine traditions, the space in *pesantren* transformed into a special space for religious value. Many pilgrims include *pesantren* as part of their pilgrimage route.

NORMATIVE NARRATIVE FROM THE SLR PROCESS

Refers to the building standard in dormitories and educational facilities, what we find in *pesantren* is far from this ideal standard. From the literature review, *pesantren* that try *eco pesantren* and *child-friendly* building principles have not met the ecologically sustainable development principles in using renewable natural resources, creating renewable energy, allowing waste management, and improving functional adjustment and biological diversity [57]. Universal consent about green architecture that defines the understanding of environment-friendly architecture [58] failed to be fulfilled by *pesantren*, especially in ventilation systems and landscape plans to maximize passive solar energy and energy-efficient lighting. The basic reason for these issues is that the plan of *pesantren* is not guided by an architect or building designer from their first existence to the development stages. All stages are in the incremental process, so many requirements of basic building standards for sustainability still need to be implemented, although *pesantren* has a large area for development.

Child-friendly building principles in *pesantren* are another ideal standard for *pesantren* because in many traditional *pesantren*, *santri* starts from the age of elementary school level (6/7 years old). The indicators for these criteria come from the UNICEF standard [59] for *child-friendly* spaces (CFS) consisting of places affected by a natural disaster, including play, recreation, education, and psychosocial support

facilities. It is fine for *pesantren* with stable finances and plans from the beginning before the construction. However, in the real condition, many *pesantren* grow and thrive to community needs that the first focus on accommodating a considerable capacity of *santri* who live there, rather than thinking the ideal condition of the building in specific criteria for children. Specific criteria about the proposition of total toilets to the amount of *santri* and ratio of beds in *pesantren* are hard to apply because of the nature of *pesantren*. There is no selection in the number of *santri*. It depends on how to spread more influence in religious study and Quran learning without seeing the ability to accommodate *santri* in sufficient and proper capacity.

RESULTS AND DISCUSSION FROM CASE STUDIES ARCHITECTURAL INFORMATION FROM THE CASES

We did spatial research in three traditional *pesantren*: *Pesantren Al-Hikmah* in Brebes, *API* (*Asrama Pendidikan Indonesia*) in Tegalrejo, and *Pesantren Pabelan*. They inform some aspects both in a physical building and its context. All research objects have a similar type of building and activities: dispersed in one complex of *Pesantren*, have many *santri* live in there and organic existence in the building development and recently have a significant role to the around communities in the socio-culture and physical development aspect.

Pesantren AHB. *Pesantren AHB* is in a rural area with around 8000 *santri*. The facilities in this *pesantren* are mosque, auditorium, dormitory, commercial area, house of *kiai* and *ustadz*, and classroom.



Figure 4. *Pesantren AHB*, Brebes

Pesantren API. *API* is in a rural area in Tegalrejo, Magelang, Central Java. It has around 5000 male *santri* and stay in the first location of *pesantren*. The spatial layout incrementally develops from the first building, consisting of a multifunction room, house of *kiai*, dormitory, mosque, and inner court to treat *santri* disciplinary, also the cemetery of the founding father of *pesantren* (*Kiai Chudlori*) that located at the back of *pesantren*. All male *santri* stay in 3 stories dormitories, learning and memorizing the Quran in the dormitory, classroom, hall, and multifunction room. *Pesantren API* has a new four-stories building in front of *pesantren* for the guest hall, classroom and prayer room, and office for *pesantren* administration. Each 16 sqm room in a dormitory is occupied by around 40 male *santri*.



Figure 5. *Pesantren API*, Magelang

Pesantren PPM. *PPM* is in a rural area in Mungkid, Magelang, Central Jawa. It is *Pesantren Pabelan*. Since the 1980s, almost 1000 *santri* have lived there. Neighbors around *pesantren*, who had the skill to teach *santri* about life skills knowledge, are allowed to teach in the Pabelan education system. The building was developed from local materials around *pesantren* and built by *kiai* and *santri* daily. The dormitory, classroom, and mosque were built sequentially through the development of *pesantren* and by alumnae contribution. Pabelan received the Aga Khan Award, the architectural prize, to appreciate their local commitment to the architectural context of the building.



Figure 6. Pesantren PPM, Magelang

From the cases above, we built a matrix to frame deeper information. The existing spatial information was gathered through depictive observation. The commentary narrative was developed by evaluating the spatial condition from a normative point of view. The realizer narrative was developed by carefully interpreting of stakeholders' (*kiai*, teachers/*ustadz*, and *santri*) expectations.

Table 3. The Architectural Features of Case Studies

Pesantren	Spatial information	Commentary Narrative	Expected Realizer Narrative
AHB	mosque, dormitory, classroom, hall, sports hall, commercial facilities, <i>Kiai's</i> house, library, pharmacy, canteen, radio office, clean water facility, management building for fishpond, coffee production building, building for <i>santri's</i> parents	scattered building configuration, developed from <i>Kiai's</i> house	Inclusive spatial development in and around the pesantren complex. Need more public space for free access neighbours as the social empowerment responsibility of pesantren.
API	mosque, dormitory, classroom, multifunction hall, guest room, office, <i>Kiai's</i> house	scattered building, developed from the main hall, oldest. Building (now multifunction room)	The oldest building exists as the symbol of Pesantren's history. Need a new building for supporting activities and dormitory through the increasing amount of <i>santri</i>

PPM	the mosque, dormitory, classroom, alumnae building, library, meeting room, office, <i>Kiai's</i> house, warehouse	Develop in the middle of a residential area, no strict boundary like a fence, main access, also neighbour access to the Pabelan River	Pesantren for all genders and midst of society without physical boundaries Society is the strategic control for <i>santri</i> activities, together with pesantren in teaching learning culture
-----	---	---	--

Considering three case studies, the architecture of *pesantren* does not explicitly emerge by its physical attributes. Research can learn from the morphological pattern of complex mass in *pesantren* and the building function there. Specifically, learning morphology can analyze built parts and open spaces without being isolated from the context [60]. Recently, the need for facilities of *pesantren*, not only the house of *Kiai*, dormitory, and mosque [8] but also other supporting facilities that can help the activities of *santri*. Modern facilities such as sports halls, libraries, commercial facilities, and guest rooms are needed by *pesantren* to support their institution's mission-vision. The morphology of *pesantren* occurs incrementally depending on the availability of funds and the need for *pesantren* in capacity. The development of *pesantren* started from the first place when *kiai* opened the Quran learning in his house which dispersed between the house of *kiai*, the dormitory, and the mosque.

MORPHOLOGY IN PESANTREN

The case study taught us the vocabulary of *pesantren* architecture that developed from simple residential and mosque functions to multifunction. As the basic learning in *pesantren*, the *halaqa* system requires any place in *pesantren* as a learning place for every component user. Three *pesantren* draw that in a whole area of *pesantren*. Our Table 3 simplifies our intention in developing a design framework for helping *pesantren*. The framework we propose is not in a sophisticated theoretical manner, but it is to keep the method simple and directly applicable for stakeholders of *pesantren*.

In creating the possibility to "write the future" for *pesantren* as design apparatus, we recall Françoise Choay's "The Rule and the Model" [61]. Choay differentiates theoretical writing on architecture and urbanism into the commentator and the realizer genre. Text characterization aims to develop an autonomous conceptual apparatus to conceive and build new and unknown space forms. The role of this text is to create mechanisms for generating built space. We saw that the above narratives fit this commentary narrative similar to Attoe [31]. What is still missing is the realizer. We saw from the cases that the realizer narrative is needed for *pesantren* development that attempts to point to the materialization and implementation in producing architecture.

CURRENT ISSUES AND CHALLENGES IN PESANTREN

The research shows that current issues in *pesantren* are architectural and non-architectural issues. For architectural issues, this research found that although the room variation in *pesantren* is good enough to accommodate their *santri*, the appearance of this room was an incremental process. They do not have any rigid master plan from the beginning, so development depends on the incidental needs of *pesantren*. This unplanned design made the crowd issues in the complex of *pesantren*. The total number of *santri* that live there makes the internal high-density population in *pesantren*. Many users have flexible access to improve *pesantren*, but it is in less coordination with the main important point of *pesantren* development. The less coordination makes the uncontrolled development on it. Another is about the health condition of physical buildings in *pesantren*. The cleaning quality of the rooms in *pesantren* has yet to give any guarantee of the minimum standard of healthy building quality. The overcapacity of users in *pesantren* caused the management not to handle this maintenance aspect smoothly. In the middle of the rise, *pesantren* education is needed. *Pesantren* and its area cannot anticipate this overcapacity issue. They only try to make some adjustments to the capacity. Development efforts to make any branches of *pesantren* sometimes have obstacles related to the regeneration process. A recent community needed is the public school in *pesantren*. These conditions affected the new challenges to *pesantren*.

THE PROSPECT OF DESIGN FRAMEWORK IN PESANTREN

The research found that architectural features, including the design framework in *pesantren*, have yet to be mentioned like other building's typology, e.g., school, hospital, house, or office. In curiosity, the combination of residential and school building typology can trigger the Analysis of the design framework in *pesantren*. Basic assumptions about *pesantren* refer to five elements of *pesantren*: mosque, house of *kiai*, dormitory, *santri*, and *pesantren* curriculum. House of *kiai* is the first place in *pesantren* and the first place of the activity in *pesantren*. The additional facility goes to the dormitory for *santri* before living with *kiai* and his family. The next one is a mosque. If the *pesantren* have a larger area for development, a mosque will be built near the house of *kiai* and the dormitory. However, if not, prayer activities, including teaching, are held in the place of *kiai*. The process of constructing the building in *pesantren* follows the functional framework and land availability. They need to prioritize the building's user capacity to enhance and develop *pesantren*.

Regarding the spatial configuration in the *pesantren* complex, there are no specific preferences except the mosque's orientation, which must be located from west to east (*qibla* orientation). Most of the houses of *Kiai* are naturally the center of the *pesantren* complex, with a mosque and dormitory around it. This speculative design framework can be

used as the early studies about the architecture of *pesantren*.

Pesantren's design framework is analyzed with the Plowright design framework model. The research found that in three case studies, it was dominantly with incremental processes in design activities. From the beginning, the *pesantren* started with the house of *kiai*, and then the design process went to the priority of the *pesantren* to develop. The location and function of the new building depends on need and land availability in *pesantren*. Sometimes, *pesantren* did land expansion to their neighbour in a swap model. They occupied the neighbouring area and then swapped it with the *Pesantren* area in another location to change it. All the case studies did not have any master plan from the first time, so it caused a random design process and development. It was exciting in *pesantren* when we saw how far the role of many actors in the design process is. Ownership in *pesantren* not only in *Kiai* as the head but also in alumnae, foundation, *santri*, external donator including in the idea of building design and new function. This incremental-based framework was analyzed using the Plowright model and described in table 4.

Table 4. Analysis of Research found about the prospect of design framework in *pesantren* using three Plowright Models

Framework model by Plowright	The research found in <i>Pesantren</i>
Forces	<ol style="list-style-type: none"> 1. Spatial limitation 2. Open the possibility to enclave or integrate with the community's rural/urban fabric.
The usual pattern in <i>Pesantren</i>	<ol style="list-style-type: none"> 1. Basic configuration of <i>Kyai</i> house, dormitory and mosque where position and orientation of new building considered by <i>kyai</i> house as the first existing mass. 2. Spatial morphology pattern of around village/ settlement
Dominant and potential concept to develop	The concept from <i>Kiai</i> (head of <i>pesantren</i>) to encourage another spatial improvement and development

Kiai in *pesantren* is the critical point of improvement and development of the architecture of *pesantren*. His patronage can bring the existence of *pesantren* to the community and larger. In three case studies, the vision and mission of *pesantren* about physical development planning started with the *kiai* idea. *Pesantren's* spatial pattern closely relates to the village or settlement around *pesantren*. Usually, because the first building for *pesantren* activities is in the *kiai* house located in an existing settlement and rural area, the new mass is considered by this location and orientation. In *pesantren* AHB, API, and PPM, all the buildings refer to the site of *kiai's* house, and development started from this mass. The mass configuration also relates to considering the existing spatial pattern around the settlement, e.g., prominent street position, natural landscape condition, and land availability of *pesantren*. Besides the capacity issue, the type of local houses around *pesantren* was not crucial

for *pesantren* development. It caused the architectural style and contextuality to be less priority than building function, so the strategy to make many rooms that could accommodate *santri* caused the lack of building context.

CONCLUSION

The architecture of *pesantren* cannot be definitively drawn as distinctive based on its physical attributes due to its commonalities with non-*pesantren* architecture. This architecture is simply a collection of “regular functions” of space with no or not necessarily specific symbols or landmarks. However, from morphology, a loose spatial configuration of the mosque, house of *kiai*, and dormitory create a *pesantren* complex, which is the core function supported by other amenities. There are parallel notions of these architectural features from the narratives and the cases.

This research found current issues in *pesantren* are in the physical condition and non-building standard requirement. *Pesantren* focuses on the maximum use of space according to the availability of facilities. So that the lack condition of facilities should have paid more attention to daily activities. Based on space limitations at the dormitory, it is only used as storage for the personal belongings of *santri*.

Poor conditions for the financial aspect to develop building ideal standard and land shortage are the challenges in developing and improving *pesantren*. The huge capacity of *santri* exceeds the standard of capacity

contrary to the *pesantren* vision mission that pushes their *santri* to live in modest conditions without building standard requirements. The incremental method used to develop *pesantren* caused a big challenge to map the basic configuration of the architecture of *pesantren* in programming.

The prospect for design framework in *pesantren* is how to formulate and learn the architecture of *pesantren* itself. The incremental process and many actors are involved in the whole building activity in *pesantren*, so it would be better to synchronize the expectation from the actors and the actual condition on site of *pesantren*.

The design process in *pesantren* depends on the user who lives there and the consideration from external parties such as alumni, the local community, and potential donors. The process has the potential to be carried out in linear and parallel stages. From designing problems to generating ideas and communicating concepts, the general framework in *pesantren* focuses on resolving the capacity issues in *pesantren* and then following the a pragmatic design solution.

REFERENCES

- [1] A. Azra, *The Origins of Islamic Reformism in Southeast Asia*. Allen & Unwin, 2004.
- [2] R. Lukens-Bull, “Madrasa by any other name: Pondok, pesantren, and Islamic schools in

- Indonesia and larger southeast Asian Region,” *Journal of Indonesian Islam*, vol. 4, no. 1. pp. 1–21, 2010. doi: 10.15642/JIIS.2010.4.1.1-21.
- [3] C. Geertz, “The Javanese Kijaji: the Changing Role of a Cultural Broker,” *Comp. Stud. Soc. Hist.*, vol. 2, pp. 228–249, 1960, doi: 10.1017/S0010417500000670.
- [4] C. Geertz, “The Religion of Java,” *Univ. Chic. Press*, 1961, doi: 10.2307/2090698.
- [5] G. A. N. Zakaria, “Pondok Pesantren: Changes and Its Future,” *J. Islam. Arab. Educ.*, vol. 2, no. 2, pp. 45–52, 2010.
- [6] E. Nurtawab, *The Decline of Traditional Learning Methods in Changing Indonesia: Trends of Bandongan-Kitāb Readings in Pesantrens*. Studia Islamika, 2019.
- [7] C. Tan, *Islamic Education and Indoctrination: The Case in Indonesia*. The University of Hongkong, 2011.
- [8] Z. Dhofier, *Tradisi Pesantren*. LP3ES, 1984.
- [9] K. A. Steenbrink, *Pesantren, madrasah, sekolah: pendidikan Islam dalam kurun moderen*. Lembaga Penelitian, Pendidikan dan Penerangan Ekonomi dan Sosial, 1986.
- [10] T. A. Suparto, “Exploring the Obstacles of Islamic Boarding School Health Post in Bandung Indonesia,” *Malaysian Journal of Medicine and Health Sciences*, vol. 17. pp. 78–85, 2021.
- [11] M. Hambal, “ḤALAQAH TRADITION IN BUILDING RABBANI CHARACTERS IN PESANTREN AL-ISLAM LAMONGAN, EAST JAVA, INDONESIA,” *Stud. Religia J. Pemikir. Dan Pendidik. Islam*, vol. 2, no. 1, Jun. 2018, doi: 10.30651/sr.v2i1.1740.
- [12] H. Madmarn, *The Pondok & Madrasah in Patani*, vol. 2. Penerbit Universiti Kebangsaan Malaysia, 1999.
- [13] A. Syar’i and A. Akrim, “The Development of Madrasa Education in Indonesia,” 2020.
- [14] N. Ahid, “Madrasah Sebagai Institusi Pendidikan: Sejarah Pertumbuhan dan Perkembangannya,” vol. 19, no. 2.
- [15] F. Hidajati, D. Wulandari, A. Kholiq, and C. Mahfud, “MADRASAH DAN SEJARAH SOSIAL PENDIDIKAN ISLAM,” *NUR EL-ISLAM J. Pendidik. Dan Sos. Keagamaan*, vol. 6, no. 1, pp. 1–14, Jul. 2019, doi: 10.51311/nuris.v6i1.115.
- [16] A. Harahap, “MADRASAH: FROM EARLY TIME TO NIZHAMIAH,” *J. Pendidik. Agama Islam Univ. Wahid Hasyim*, vol. 6, no. 1, pp. 24–43, 2018.
- [17] S. Yunanto, *Islamic education in South and South East Asia: diversity, problems and strategy*. Jakarta : Friedrich Ebert Stiftung, 2005.
- [18] Z. A. Ni’mah, “Formulasi Model Pengembangan Pendidikan Islam: Kajian Integrasi Madrasah, Sekolah dan Perguruan Tinggi dengan Pesantren,” *Didakt. Religia*, vol. 4, no. 1, pp. 209–240, Apr. 2016, doi: 10.30762/didaktika.v4.i1.p209-240.2016.
- [19] D. H.P and N. P, *Islamic education in educating the nation*. Jakarta: PT Rineka Cipta., 2012.

- [20] M. Arif, "Manajemen Madrasah dalam Upaya Meningkatkan Mutu Pendidikan Islam," *J. Epistemé*, vol. 8, no. 2, pp. 416-438., 2013.
- [21] Purwadarminta, *General dictionary of Indonesian Language*. Jakarta: Balai Pustaka, 1990.
- [22] M. R. Nashir, *Seeking for typology of ideal education format: Pesantren in the middle of changing stream*.
- [23] Z. H. Alfi Syahr, "Membentuk Madrasah Diniyah Sebagai Alternatif Lembaga Pendidikan Elite Muslim Bagi Masyarakat," *Intizar*, vol. 22, no. 2, p. 393, Dec. 2016, doi: 10.19109/intizar.v22i2.944.
- [24] C. A. Alwasilah, *Pokoknya Studi Kasus: Pendekatan Kualitatif*. Bandung: PT Kiblat Buku Utama, 2014.
- [25] M. Hidayat, "Model Komunikasi Kyai Dengan Santri di Pesantren," *J. ASPIKOM*, vol. 2, no. 6, p. 385, Feb. 2017, doi: 10.24329/aspiikom.v2i6.89.
- [26] S. Sauri, "Establishing the identity of insan kamil generation through music learning activities in pesantren," *Heliyon*, vol. 8, no. 7. 2022. doi: 10.1016/j.heliyon.2022.e09958.
- [27] S. Sauri, "A critique of local wisdom values in Indonesia's pesantren," *Pertanika Journal of Social Sciences and Humanities*, vol. 26. pp. 37–50, 2018.
- [28] Z. Dhofier, "Tradisi Pesantren: Studi Pandangan Hidup Kyai dan Visinya Mengenai Masa Depan Indonesia.," 2011, [Online]. Available: <https://www.semanticscholar.org/paper/8c2ec07d04db03501be0934166951ca640006187>
- [29] Kuntowijoyo, *Paradigma Islam Interpretasi Untuk Aksi*. Mizan, 1991.
- [30] M. Ziemek, B. B. Soendjojo, and B. Siregar, "Pesantren dalam perubahan sosial," 1986, [Online]. Available: <https://www.semanticscholar.org/paper/4f28153c712eea2305bc7ceee04293dcf15ce987>
- [31] Y. Hanafi, "The new identity of Indonesian Islamic boarding schools in the 'new normal': the education leadership response to COVID-19," *Heliyon*, vol. 7, no. 3. 2021. doi: 10.1016/j.heliyon.2021.e06549.
- [32] R. Silfiana, "A Traditional and Modern Education System of Pondok Pesantren in Perspective Philosophy of Education," *Islam. J. Pemikir. Islam*, p. 43, Apr. 2020, doi: 10.30595/islamadina.voio.6894
- [33] A. Azis, *Ensiklopedia Islam IV: cet.2*. Jakarta: Ihtiar Baru Van Hoeve, 1994.
- [34] Muhaimin, *Pemikiran Pendidikan Islam*. Bandung: Tri Genda Karya, 1993.
- [35] A. Hanun, *Sejarah Pendidikan Islam, cet. ke-1*. Jakarta: Logos Wacana Ilmu, 1999.
- [36] Z. Dhofier, "Tradisi pesantren: studi tentang pandangan hidup kyai," 1982, [Online]. Available: <https://www.semanticscholar.org/paper/e047c8224aeb2f02beee080a867b308dc053f083>
- [37] F. Pohl, "Islamic education and civil society: Reflections on the pesantren tradition in contemporary Indonesia," *Comparative Education Review*, vol. 50, no. 3. pp. 389–409, 2006. doi: 10.1086/503882.
- [38] F. Pohl, *Religious Education and Secularization: Indonesia's Pesantren Tradition and Civil Society*. Temple University, 2007.
- [39] E. Nurtawab, "Restructuring Traditional Islamic Education in Indonesia: Challenges for Pesantren Institution," *Studia Islamika*, vol. 29, no. 1. pp. 55–81, 2022. doi: 10.36712/sdi.v29i1.17414.
- [40] Z. Dhofier, "Kinship and Marriage among the Javanese Kyai," *Indonesia*, vol. 29, p. 47, Apr. 1980, doi: 10.2307/3351004.
- [41] E. Nurtawab, "The decline of traditional learning methods in changing Indonesia: Trends of bandongan-kitab readings in pesantrens," *Studia Islamika*, vol. 26, no. 3. pp. 511–541, 2019. doi: 10.36712/sdi.v26i3.11026.
- [42] B. Erickson, "The 'armature' and 'fabric' as a model for understanding spatial organization," in *Approaching Urban Design*, Routledge, 2001.
- [43] M. Castells, "Space of Flows, Space of Places: Materials for a Theory of Urbanism in the Information Age," in *The City Reader*, in 7th. 2020.
- [44] P. D. Plowright, *Revealing Architectural Design*, 0 ed. Routledge, 2014. doi: 10.4324/9781315852454.
- [45] P. Nilan, "The 'spirit of education' in Indonesian Pesantren," *British Journal of Sociology of Education*, vol. 30, no. 2. pp. 219–232, 2009. doi: 10.1080/01425690802700321.
- [46] H. Hamid, "Developing education strategy of islamic boarding schools (Pesantren): Study at three pesantrensof islamic union organization (Persatuan Islam) at the district of Sumedang, West Java-Indonesia," *Journal of Applied Sciences Research*, vol. 8, no. 12. pp. 5583–5590, 2012.
- [47] Munifah, "The use of management strategies to attract the public's interest in pesantren: A new model for pesantren dynamics study," *International Journal of Innovation, Creativity and Change*, vol. 8, no. 8. pp. 363–383, 2019.
- [48] Y. Rahtikawatie, "Investigating The Role of Religious Leadership at Indonesia's Islamic Boarding Schools in The Sustainability of School Management," *Eurasian Journal of Educational Research*, vol. 2021, no. 96. pp. 51–65, 2021. doi: 10.14689/ejer.2021.96.4.
- [49] H. Fijriah, "THE ROLE OF 'NGALAP BAROKAH' IN RAPID URBAN DEVELOPMENT: CASE STUDY OF TEBUIRENG, JOMBANG," *Journal of Islamic Architecture*, vol. 7, no. 2. pp. 233–242, 2022. doi: 10.18860/jia.v7i2.16385.

- [50] R. A. Sudrajad, "SPATIAL PATTERNS OF ISLAMIC RELIGIOUS ACTIVITIES IN KRAPYAK DISTRICT, YOGYAKARTA," *Journal of Islamic Architecture*, vol. 6, no. 4. pp. 301–312, 2021. doi: 10.18860/jia.v6i4.12575.
- [51] M. Bakri, "ECO-Pesantren assessment study of Islamic Boarding School in Banda Aceh, Indonesia," *Journal of Islamic Architecture*, vol. 6, no. 3. pp. 143–150, 2021. doi: 10.18860/JIA.V6I3.7967.
- [52] M. Herdayati, "Knowledge, attitude, and practice regarding covid-19among residents of pesantren," *Kesmas*, vol. 16. pp. 29–35, 2021. doi: 10.21109/kesmas.voio.5174.
- [53] E. Nurtawab and D. Wahyudi, "Restructuring Traditional Islamic Education in Indonesia: Challenges for Pesantren Institution," *Stud. Islam.*, vol. 29, no. 1, p. 55, 2022, doi: 10.36712/sdi.v29i1.17414.
- [54] M. Fahmi, "ORGANIC TOLERANCE AND HARMONY IN THE PESANTREN BALI BINA INSANI," *Ulumuna*, vol. 26, no. 2. pp. 500–524, 2022. doi: 10.20414/UJIS.V26I2.567.
- [55] E. Muafiah, "PESANTREN EDUCATION IN INDONESIA: Efforts to Create Child-Friendly Pesantren," *Ulumuna*, vol. 26, no. 2. pp. 447–471, 2022. doi: 10.20414/ujis.v26i2.558.
- [56] W. Attoe, *Architecture and Critical imagination*. John Wiley & Sons Inc., 1978.
- [57] H. Frick and FX. B. Suskiyatno, *Dasar-dasar Arsitektur Ekologis, Konsep pembangunan berkelanjutan dan ramah lingkungan*. ITB Bandung, 2007.
- [58] B. G. Tasci, "Project Based Learning from Elementary School to College, Tool: Architecture," *Procedia - Soc. Behav. Sci.*, vol. 186, pp. 770–775, May 2015, doi: 10.1016/j.sbspro.2015.04.130.
- [59] UNICEF, "GUIDELINES FOR CHILD FRIENDLY SPACES IN EMERGENCIES." 2011.
- [60] V. Djokić, "MORPHOLOGY AND TYPOLOGY AS A UNIQUE DISCOURSE OF RESEARCH," *SAJ*, vol. 1, 2009.
- [61] F. Choay, *The Rule and the Model: On the Theory of Architecture and Urbanism*. The MIT Press, 1997.