Evaluating the Configuration of Space at SMK Negeri 12 Malang Utilizing Spatial Syntax

Muhammad Zidan Hanif[1], Rizqi Maulana[2], Dini Yenitasari[3], Alyaa Daniswara[4], Elok Mutiara[5*].
[1,2,3,4,5] Architecture Department, Faculty of Sience and Technology, UIN Maulana Malik Ibrahim, Malang, Indonesia

[1]200606110133@student.uin-malang.ac.id
[2]210606110006@student.uin-malang.ac.id
[3]210606110017@student.uin-malang.ac.id
[4]210606110061@student.uin-malang.ac.id
[5*]elok.mutiara@arch.uin-malang.ac.id

***Abstract*-. These instructions give you basic guidelines for preparing papers for conference proceedings. SMKN 12 Malang is located at Jl. Pahlawan, Balearjosari, Kec. Blimbing, Malang City, East Java 65126. This school results from the function transfer from SMA Negeri 12 Malang. Previously, this high school had also experienced a change of location in a relatively short period of time. An evaluation of the spatial configuration of SMKN 12 Malang showed that the transfer of the building from SMA to SMK without careful spatial planning had a significant impact on the quality of the learning environment. Using the Space Syntax method, this research aims to analyze the connectivity, integration, and intelligibility of the existing and proposed spatial layouts. The results showed that the existing layout had several shortcomings regarding connectivity and space utilization efficiency. Simulation and re-analysis resulted in the proposal of a new, more optimized layout. The evaluation of the proposed layout showed significant improvements in all three aspects studied, so it can be concluded that the application of Space Syntax principles has the potential to create an effective and efficient learning environment.**

Keywords; Space Syntax; Connectivity, Integration; Intelligibility

I. INTRODUCTION

SMK Negeri 12 Malang, located in Blimbing, Malang City, East Java, transitioned from an academic high school to a vocational institution in 2007 to address the demand for specialized technical training. Despite this shift, the school's spatial layout has remained largely unaltered, lacking a tailored configuration to support its expanded curriculum, which now includes programs in automotive, multimedia, software engineering, and accounting. The current layout presents significant challenges, particularly in circulation and zoning, resulting in inefficient space usage that affects the quality of both learning and operational flow within the school environment.

Using spatial syntax analysis, this study examines the existing configuration of SMKN 12 Malang to assess connectivity, integration, and intelligibility across the school's facilities. Through tools like DepthmapX, the analysis identifies key spatial issues, such as insufficiently connected circulation routes and poorly integrated zones, which limit access between classrooms, labs, and communal areas. These constraints disrupt the flow of movement and create barriers to effective learning interactions. The findings underscore the need for a more strategic layout that could address both functional and accessibility requirements.

By implementing a redesigned spatial plan based on these insights, SMKN 12 Malang stands to significantly improve its operational efficiency and enhance the learning experience for its students and staff. Improved connectivity and integration between key areas could foster better interactions, facilitate easier navigation, and support diverse educational activities within a cohesive structure. Ultimately, this restructuring would not only streamline school operations but also contribute to a more conducive and dynamic learning environment that better supports the goals of a vocational high school.

II. RESEARCH METHODS

This research adopts an evaluative and comparative approach to examine the spatial changes in the existing layout of SMKN 12 Malang, focusing on key metrics of connectivity, integration, and intelligibility. Using the space syntax method within DepthmapX v0.8.0, the study applies quantitative techniques to measure spatial effectiveness, while descriptive methods support a comprehensive discussion of results. The focus is to highlight how the building's reconfiguration, transitioning from its original academic high school (SMA) layout to a vocational school (SMK) layout, impacts operational flow and accessibility across the school's varied facilities.

The research process begins with an in-depth observation and assessment phase, which includes precise measurements and modeling to establish a complete layout plan for the current building structure. This layout is initially analyzed through a bubble plan to clarify

relationships between different spatial zones. Following this, a detailed analysis is conducted using the convex map function in DepthmapX v0.8.0, providing quantitative insights into the layout's connectivity, integration, and intelligibility. These insights are obtained independently of the existing spatial arrangement, allowing for an objective assessment of each space's potential to facilitate smooth navigation and interaction. The final stage involves using DepthmapX's visual graph analysis tool to identify layout patterns, offering further insights into spatial organization and user flow throughout the school.

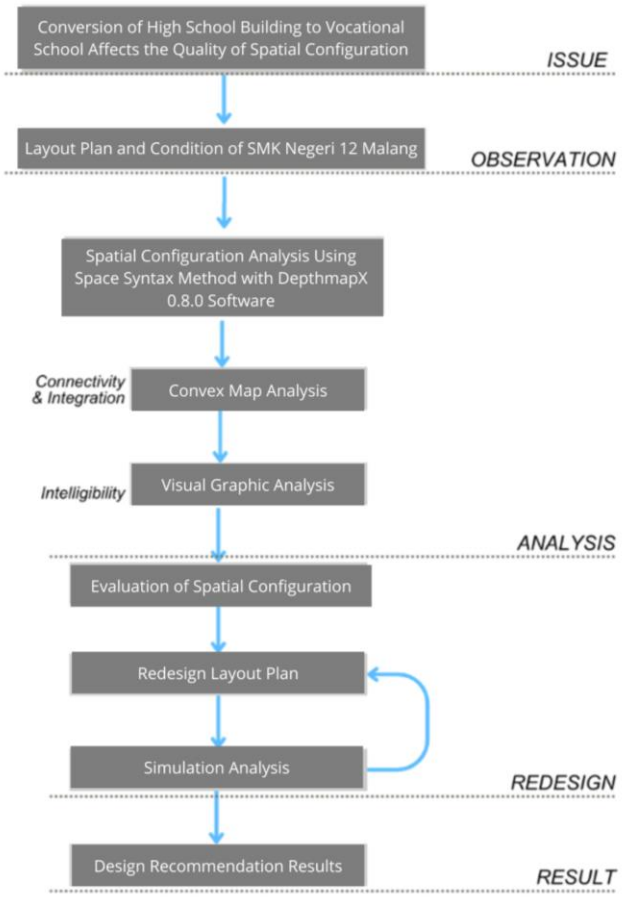

Figure 1 Research Procedure Diagram

Based on these analyses, the study proposes a redesigned layout for SMKN 12 Malang, which is re-simulated within DepthmapX to assess improvements in spatial efficiency and overall functionality. This reconfiguration is compared against the existing layout to determine the positive impact of the proposed changes. By optimizing connectivity, integration, and accessibility, the redesign is expected to streamline movement within the building, enhance ease of access to educational spaces, and foster a learning environment more suited to a vocational high school. Ultimately, these improvements are anticipated to create a more conducive, interactive, and supportive setting for both students and staff, reinforcing SMKN 12 Malang's role as a modern vocational institution.

IV. RESULT AND DISCUSSION

In the existing layout plan, circulation axes are not clearly defined, which results in each zone being somewhat isolated and distinct, creating a spatial organization that resembles a clustered arrangement. This lack of interconnectivity leads to a disjointed flow throughout the space, where movement between areas is limited, and interaction among users is restricted by the segmented structure. Zones appear independent of one another, making navigation less intuitive and reducing spatial efficiency. In the redesigned layout plan, however, clear and intentional circulation axes are introduced, connecting each zone in a structured, cohesive manner. This redesign follows an axial spatial organization, establishing primary and secondary pathways that interlink the spaces more fluidly and encourage continuous movement. The axial layout enhances spatial clarity, supporting a more efficient and accessible environment where users can navigate seamlessly, interact across zones, and utilize the space more effectively (Figure2).

Figure 2 Building Layout plan

In the existing layout plan, the spatial organization is inconsistent, with several areas following a linear organization that creates a segmented and somewhat disconnected arrangement, while one specific area adopts an axial organization. This mixed approach results in a layout that lacks coherence, as the linear zones do not align with the axial organization present in other sections. The segmentation reduces the overall connectivity, making navigation less intuitive and hindering the flow of movement between spaces. In the redesigned layout plan, however, all areas are unified within a single, cohesive configuration based on an axial spatial organization. This unified axial approach establishes clear circulation routes that interconnect every zone, creating a seamless flow that promotes easy navigation, accessibility, and interaction throughout the entire layout. The redesign optimizes spatial connectivity and transforms the previously disjointed areas into a more efficient, integrated environment where movement is more intuitive, and the

overall spatial organization supports both functionality and accessibility (Figure3)..

Figure 3 Building Plan Second Floor

In the existing configuration, the layout organizes spaces into a single zone; however, the connections between these areas are not well-defined, as shown in the bubble plan (Figure 4). This lack of clear pathways and spatial relationships creates a sense of ambiguity, making navigation within the zone inefficient and reducing overall functionality. Users may find it difficult to intuitively move from one area to another due to the unclear connections, which impacts both spatial flow and accessibility. In contrast, the redesigned configuration maintains the single-zone approach but incorporates a central circulation space that significantly improves the clarity of connections between spaces. The bubble plan of the redesigned layout illustrates these enhanced connections, with each area now clearly linked through the central circulation, allowing for more intuitive movement and improved spatial coherence. This central organization not only facilitates smoother navigation but also reinforces a sense of unity within the zone, supporting a more functional and user-friendly environment that promotes accessibility and interaction across all areas.

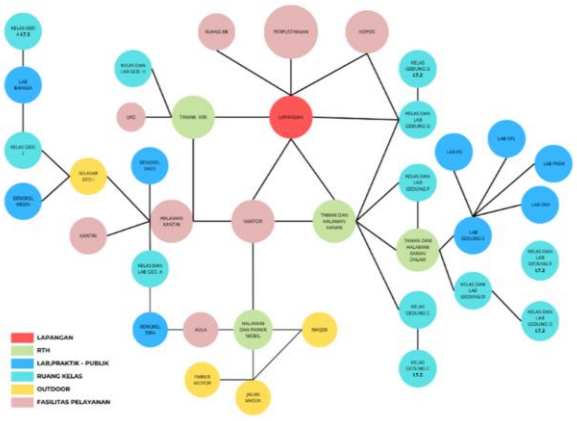

Figure 4 Building Room Configuration Existing

In the existing space configuration, circulation spaces lack interconnection, resulting in limited pathways and reduced spatial integration. This disconnected layout means that users have fewer options for navigating between spaces, which restricts movement and creates a less efficient flow throughout the area. The absence of multiple pathways not only reduces accessibility but also limits the adaptability of the space, as individuals must follow a constrained route to reach their destination. In the redesigned configuration, however, circulation spaces are thoughtfully connected, creating a network of pathways that significantly enhances spatial integration. With multiple circulation routes available, users have more flexibility in their movement, which promotes smoother transitions and supports a more dynamic, accessible environment. This interconnected layout fosters an improved spatial experience by enabling easier navigation and offering versatile circulation options, making the space more user-friendly, adaptable, and cohesive (Figure 5).

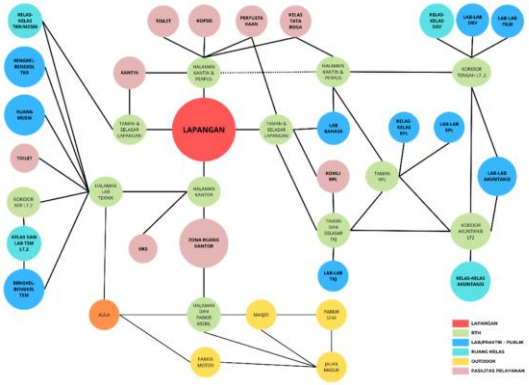

Figure 5 Bubble Diagram of Room Connection

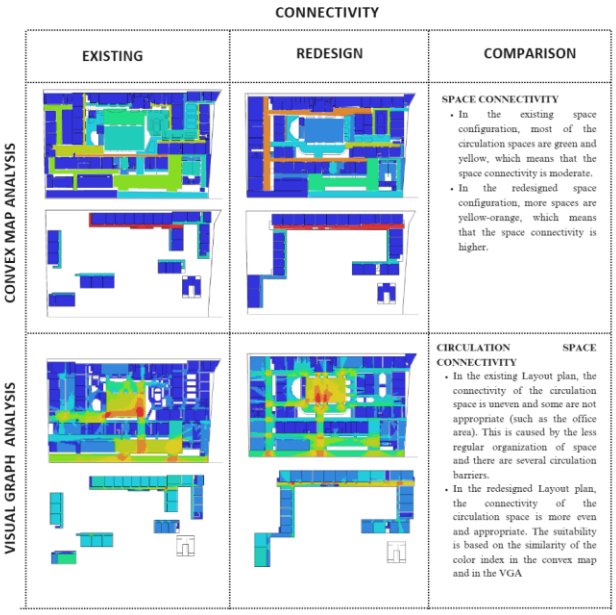

Figure 6 Conectivity Analysis

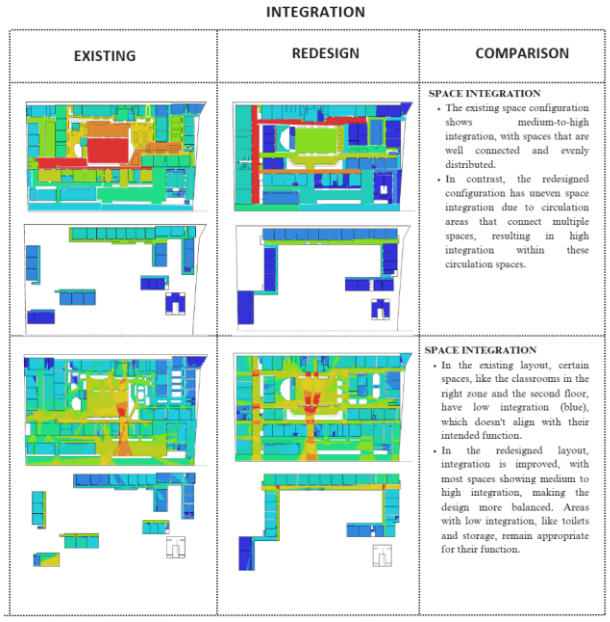

Figure 7 Integration Analysis

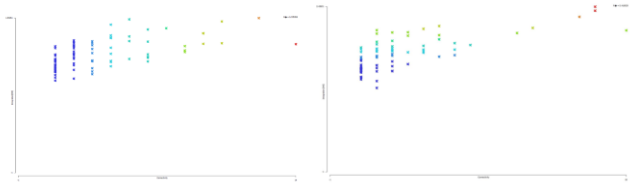

Figure 8 Analytical Diagram of intelligibility value

The redesigned space configuration enhances readability, making it clearer and more intuitive for users to navigate. This improvement is reflected in an increase in the intelligibility value, which rises from an existing score of 0.38 to 0.42, indicating a modest gain of 0.04 in spatial clarity. While this increase marks progress in making the layout more user-friendly, the value of 0.42 remains relatively low, suggesting that further adjustments could improve the space's overall readability and accessibility. The lower intelligibility score is largely influenced by the limitations of the convex map tool, which relies on a more abstract, imaginary indexing of spaces that does not fully capture the complexity of the actual environment. Consequently, the space clarity analysis produced by the convex map is less precise than that generated by Visual Graph Analysis, which is applied directly to the layout plan and offers a more accurate, real-world evaluation of spatial readability. This difference highlights the importance of using a tool that aligns more closely with the physical layout, as it provides a clearer picture of how well the configuration supports intuitive movement and spatial comprehension for users.

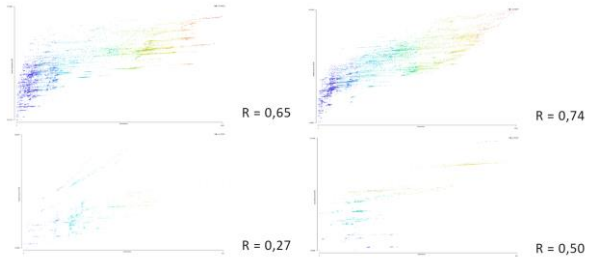

Figure 9 The Intelligibility value in the redesigned layout plan

The Intelligibility value in the redesigned layout plan saw a significant increase, reflecting a marked improvement in the clarity and organization of the spaces. Specifically, on the 1st floor, the Intelligibility value by 0.9, elevating it from a moderate level to quite high, which indicates a more coherent spatial arrangement. Meanwhile, on the 2nd floor, there was an increase of 0.23, transitioning from a low level to a moderate level of Intelligibility. This enhancement in intelligibility is further substantiated by the visual graph analysis, which demonstrates that the redesigned layout provides better clarity of space overall. The improvements can be attributed to a more orderly organization of space on the 1st floor, coupled with enhanced connectivity between areas on the 2nd floor, thus contributing to a more intuitive and user-friendly environment.

IV. CONCLUSION

Various factors influence the functionality of a school, one of which is the conversion of buildings, such as SMKN 12 Malang, which transitioned from SMAN 12 Malang in 2007 without having well-prepared spatial planning documentation.

The results of this research indicate that the absence of a well-structured spatial planning leads to a spatial configuration and arrangement patterns that do not meet the expected standards. This is evidenced by the comparison of the spatial configuration analysis results between the existing layout plan and the layout plan resulting from the evaluation. With zoning based on function and an organized, interconnected arrangement pattern, the analysis of the evaluated layout plan produces higher values of connectivity, integration, and intelligibility.

REFERENCES

[1] Firdaus, Sekolah Menengah Kejuruan, 2012, p. 398.
[2] P. M. Indonesia, "Standar Sarana dan Prasarana untuk SMK/MAK," 2008.
[3] Pengantar Standarisasi, Kamus Besar Bahasa Indonesia, 2009.
[4] Peraturan Pemerintah Republik Indonesia, 2010.
[5] Permendiknas, "Permendiknas Nomor 40 Tahun 2008 tentang Standar Sarana dan Prasarana SMK/MAK," Available: https://luk.staff.ugm.ac.id/atur/bsnp/Permendiknas40-2008SarprasSMK.pdf.
[6] F. D. K. Ching, Architecture - Form, Space and Order, 3rd ed. Jakarta: Erlangga, 2007.
[7] B. Hillier and J. Hanson, The Social Logic of Space. Cambridge: Cambridge University Press, 1984.
[8] B. Hillier, "Space Syntax as a Theory as Well as a Method," London: Laboratory, University College London.
[9] E. T. S. Darjosanjoto, Penelitian Arsitektur Di Bidang Perumahan dan Permukiman. Surabaya: ITS Press, 2006.
[10] W. Barada and D. Mutiari, "Analisis Space Syntax Rumah Susun Berbasis Gang Kampung," Simposium Nasional RAPI XII-2013 FT UMS, 2013.
[11] J. P. Siregar, Metodologi Dasar Space Syntax Dalam Analisis Konfigurasi Ruang, 2014.