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Influential Stimulus of Form-Generating Towards Neuro-Aesthetic Design

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ABSTRACT

Students explore design to achieve design aesthetics, values and constructability; implementing design requirements can lead to creative-led, practical designs in architecture education. While most students have concentrated on identifying the essential criteria that lead to the creative deployment of the neuro-aesthetic design thesis projects, the influencing factors still need to be discovered. None of the architectural studies focused on identifying the form generator as influencing stimulators and their supporting facets delivered under the institutional syllabus system. Therefore, this study has three objectives: to identify attributes of design exploration phases, categorise them, and establish which phase influences neuro-aesthetic design by nurturing this value into the architectural education syllabus. The methods employed were distributing semi-structured questionnaires to managers and applying focus group discussion to students' respondents. The process was used in ten (10 aspects), and the analysis revealed the design stage's generators and critical-influencing stimulators in this action research. The investigation revealed four for the pre-design phase, six for the design development phase and three (3) in the grooming phase. The Form Generators (FG) identified to provide a framework for such four FGs in the pre-design stage related to the design aim, issues, objectives, and client. Hence, to the best of the author's analysis, the design process is the design development, and the grooming through internal and external panels is involved in the studio. At the design exploration stage, alternative designs and innovation are developed.

1.0 INTRODUCTION

Design process and development ideas vary at different levels of architectural professionalism. For professional architects working in the actual practice field, the design process includes seven phases: pre-design, schematic design, design development, construction documents, building permits, bidding and negotiation, and construction administration. These phases establish project deliverables and deadlines as agreed with the client. In the architectural education (AE) context, even though the students are exposed to the architectural design process, which is limited to three major phases: pre-design, schematic design, and design development, they must develop a complete design proposal. Zhang, Z. L. et al. (2023) extensively explore the potential of artificial intelligence for assisting architectural design processes in practice and the AE—the benefit of sharing the form-generating process through industry-university collaboration and between educational institutions worldwide. While most students have concentrated on identifying the essential criteria that lead to the creative deployment of the Ideal Excellent Building (IEB) in design thesis projects, the categorisation or "influencer in design phase" still needs to be discovered (Thravalou, S., & Philokyprou, M. (2023). The application of the study is that it highlights the most critical phase in the design development phase. Even though attributes are applied, the design process is not a one-way route, but to and fro in managing the planning system outdoors and indoors; architects must be involved in further detailing. The function of form generation influencing stimuli is still maintained as a unique phase in educating architectural education (AE) and junior architects. Therefore, it is essential to identify the most critical phase by students where the marks are super loaded.

The uniqueness of any design process in creating a building form is almost a hidden scenario. The classic example is when the action research in the form-making process is practically unveiled. It is recommended that the AE contribute to live projects and social contexts to be more realistic than the ideal unreal. The similar form-making process by most architects in their firms and architecture students in architectural education rarely revealed and discussed the influence and diversity of approaches and challenges in design exploration by Hammadamin, A. et al. (2024). Even though the current technology demands the designer's input at various stages in generating design alternatives, optimising the neuro-aesthetic challenged the way architectural education is highly influenced at different phases. For instance, the structural components and emulating aesthetic features, the traditional method in the design process are still valid due to its scale and human sensorial touch and its relevancy regarding the neurological development of a creative mindset. Despite the architectural teaching and learning challenges faced by all architectural education across the globe during COVID-19, blended learning and e-learning have become a standard paradigm. The awareness of artificial intelligence's (AI) presence in generating adversarial networks (GANs) provides the ability to create floor plans. Other tools, including Latent Diffusion Models (LDMs) and any segment models (SAM), are beginning to be incorporated into specific software tools. The rapid technological advancement in architectural education requires a suitable strategy before its implementation in the practice of AE. Other challenges, including the recent influence of AI, have a high impact on AE. The status and understanding of the challenges of AI in form generation in the post-millennium age. This research aims to identify the most influential stimuli of form generation towards neuro-aesthetic design. In architectural education, a vertical studio tests various strategies by mixing conventional and post-millennium design thinking in the design process, and multiple sources of inspiration have been observed. Thirty-six Master of Architecture students were evaluated in an informal group discussion setting to identify their form generation in managing their skill and creativity in coming up with the expectation of excellent building criteria.

The phases in the pre-design stage relate to the design aim, objectives, project research exploration completeness, and personnel involved in the studio. At the study stage, VS's success depends on creativity in the design process, the development of alternative designs, and the VS team's innovation. In the post-design step, VS's success is linked to the design development process, input of critique sessions, and execution plan by students. The cooperation of all leading researchers is highly expected to ensure a good design outcome.

This novelty focuses on the source of inspiration, the quality of the end product, and the construction of the "Ideal Excellent Building." The influencing stimuli make it win and visually appealing in form and function. Understanding the design expectation is the most significant influence in excellent building design with creative, innovative, cost-saving, efficient, passive solar + ventilation, Green Building Index (GBI), responsive, tropical, sustainable timeline and all-users (7G), end-users friendly, pedestrian friendly, complete

amenity), safety, high practicality and buildability, visually head-turning effect) and aesthetically brings in an iconic image. What is wrong with the scenario? Is it the creative, innovative, cost-saving, efficient, passive solar + ventilation), Green Building Index, responsive, tropical design? Or is it the sustainable timeline and users (7G), end-users friendly, pedestrian friendly, complete amenity) Or is the final form influenced by safety, practicality, and buildability factors? Or is it the visually head-turning effect) and aesthetically brings in an iconic image and form?

The study assumes that all of the aforementioned powerful stimuli are accurate, but it aims to classify the most important ones that have a significant influence on students' ability to generate architectural forms. The study compares the most and least impactful stimuli. The research drivers provide a comprehensive view of the influencing stage in the design process, as experienced by students pursuing architecture studies in the vertical studio. The first research question is, what is the most influencing stimulus in the design process? Therefore, the first objective, (RO1) is to identify the most influential stimulus in the design process. The method we used centered around reading activities that involved a structured coding approach. Starting with Research Methods Number One (RM1): Document Analysis derived from Systematic Literature Review (SLR), it offers stimulation as proof throughout the entire design process. The second question is, what factors have the greatest impact among the recognised stimuli? Research Objective Number Two (RO2) aims to prioritise the most significant Stimulus – RF2 in accordance with the findings from Research Method 1. The Research Method 2 is the Focus Group Discussion (FGD), which primarily make use of semi-structured questionnaires to carry out the ranking procedure. The third question examined in the study is: which design phase exhibits the highest and lowest hierarchy? Finally, the third research objective (RO3) is to identify the most and least impactful stimuli.

1.1. Influencing Stimulus

The sources of inspiration in the design process originated from the multi-sensory human system, which sparked ideas and imagination. Economic, environmental, and social factors and material availability significantly impact innovation (Kucuku, Y., 2023), highlighting the human senses and psychological sensitivity related to humans sensing seasons and exploring multisensory architecture as a tool for inspiration—the practical realm rather than within the educational sphere. The design process and mind exploration vary among students as they have the freedom to articulate their backgrounds, experiences, and interests in response to their project brief. Kaitouni S. I. et al. (2024) strongly advocated for the utilisation of digital workflows in terms of the optimisation of an ideal design. The simplest may be the best approach to solving architectural puzzles. Many attributes influence the form-making process, especially for famous buildings in actual practice. The exact moment when the architects are triggered with the idea that generates the built form remains crucial. However, various physical and spiritual attributes influence stimuli. The imagination related to the end products' space quality is also in the thinking of designers. Besides that, the external relationship within the neighbourhood context is respected. The same goes for the planning acts; internal space planning also contributed to the final built form. There is no magic, but the operation of the internal and external systems must be workable and intervene in the design process—the sectional and elevational views are also part and parcel of the proposal. Therefore, there is no way that the proposal by the designer can be replicated elsewhere since each site and building function is unique. It carries its value and weight. Chohan, A. H. et al. (2023) highlighted how the roles of teaching philosophies and practice requirements psychologically influence future architects' behaviour.

1.2. The Form Generator

What is a form generator? Various aspects and clues inspire building design that finally ends up as the built form. The evolution of the built form changed over time due to natural and cultural factors. Formiga, B. et.al. (2022) highlighted how architectural forms can influence emotional reactions from their human senses and vice versa. The beauty and geometry of a flower, leaves, sea shells, natural flora and fauna may inspire a biophilic approach to generate a beautiful design process and form based on visual appreciation.

The evolution of built form in each decade is the most dominant; architects highly influenced the trend in the 1920s in Western countries in the United States and Europe. Ludwig Mies Van de Rohe, Walter Gropius, Frank Lloyd Wright, and Le Corbusier were prominent architects. In the past, architects were also an artist by profession.

The image of the building on the concrete façade was the trend in 1920-1930. In the 1930s, private cars were luxury items; therefore, petrol stations were designed where a petrol attendant was necessary. The 1940s were Art Deco style with streamlined modernity, influenced by international style and industrial designers that worked with glass and concrete monopolising the material. Modernist architecture was more in favour until the 1960s. From the 1960s onwards, celebrating colours in various lifestyles enhanced the dramatic formal invention in architecture. 1968, Mies Van de Rohe built the Seagram Building in New York. Louis Isadore Kahn was involved in earlier modern movements in Philadelphia. Richard Rogers and Norman Foster were famous architects who worked in Kahn's office in the 1970s.

Muzharul Islam and Tadao Ando were with him during the brick building façade for buildings. How does the material selection in architecture stimulate the human sensory or sensory-motor in the human brain to analyse contemplative experience? Djebbara Z. et al. (2024) further discussed this sense of the human experience as a contemplative neuro-aesthetic towards form in architecture as part of their sensorimotor exploration and expression of socio-economic and time. The AT&T building in New York is among the most famous buildings built in the 1980s. In 1997, the Guggenheim Museum was completed by Frank Gehry. Postmodern architecture from Michael Grave was influenced by post-punk and new-wave music. The Renault Building was designed at this age by Sir Norman Foster. Skyscrapers were built in most Western countries. With her abstract and artistic style, Zaha Hadid was an in-trend architect between the 1990s and 2016. The expression of art and mathematical balance inspired Zaha Hadid. Form follows function, vocabulary, biomimicry, climatic passive design, deconstructionism, art and craft, and the principle of design that generates a similarity of contrasting effects to the final form the Emirate Tower in Dubai competed. The development was intended in the Middle Eastern countries.

It was the year for Sir Norman Foster and Richard Rogers when Burj Khalifa, the tallest artificial skyscraper, was completed in 2010 in Kuwait—2020's millennium architecture where Torres Abispado in Mexico completed. Central Park Tower is the tallest residential tower, completed in 2021. The 2020-2040 post-millennium expected Sgrada Familia in Spain to be completed by 2026. "The Line" is a linear smart city in Tabuk, Saudi Arabia, materialising the Saudi Vision 2030. Economic status and local climatic factors have significantly influenced stimulators and new-form generators.

1.3. Neuro-aesthetics Design

A simple, harmonious balance and visual richness sometimes fulfil "Excellent Building" design as a contemplative neuro-aesthetics and architecture as a sensorimotor exploration, as Djebbara Z. et al. (2024) concluded. Another word is neuro-aesthetics, a recently coined term, which is the scientific study of the neural consequences of contemplating a creative work of art, such as the involvement of the prefrontal cortex (in thinking) and limbic systems (for emotions). The psychological reflection of the three-dimensional values of space reflects the human sensory-motor experience from the materials' pattern and texture, creating tectonic excitement and entertainment.

Berman, D. B. (2008) had a firm idea of how the design of a building with a careful selection of materials may change the world regarding the quality of life. The highest ranks are given to innovative designs that fulfil the functionality, tectonic buildability, efficiency, and practicality criteria. The main criteria for an excellent building are based on progress marks as stipulated in the critique session. In this research, the term "Ideal Excellent Building" (IEB) is the suggested terminology to describe the ultimate best design moderated by internal and external examiners during the design review session.

Implicitly treat the physical model development from the massing to the particular models at the early stage to the final stage as a reflection of the designer's thinking process. Kamel, M. A. E., et. al. (2023). The expected quality by final year students is based on innovative criteria: rationale of the idea, the intricacy of design, problem-solving skills on the highlighted issues, responsiveness to the environment in the site context, universal design compliance and ground-zero user-friendliness. Grobman, Y. J. et al. (2023) highlighted that the architectural building design: concepts and challenges as part of the design process promote sustainability.

1.4. Vertical Studio

The term "Vertical Studio" (VS) in this research was first introduced on the campus by the studio leader of the master of architecture program in October 2022 in the Studies of Architecture, UiTM. Still, the vertical studios are standard and widely applied in other venues. The VS refers to the management and operation of

the master's students in the final year. Studio management of the Vertical Studio combines final-year students from the Semi-Final Semester and Final Semester Studio. The vertical studio is branded under various names to relate the architectural studio with collaboration with industry and the peer learning process, and Alba D. et al. (2024) admitted high challenges in architectural teaching in the millennium age.

2.0 THE MATERIALS AND METHODS

The classic method of architectural education began in the face-to-face architectural design studio, virtual studio design as discussed heavily by Khan, A. R. et al. (2022), and the current one in the post-COVID-19 studio. The fundamental principle in architectural teaching and learning is that the conduct is considered action research, and the design assessment complies with the "open house concept" where practitioners collaborate in grooming architectural students. There is no way a building is replicated, and each building form is unique. Every time a design is created, it is a life experiment; the fact is that learners must realise that end users will live inside the building and perceive it individually. However, for public and urban buildings, the case is different. The buildings are open for public debate. Basu, N. et.al. (2023) highlighted that the urban context, especially the accessibility and link, allows a significant image during day and night vision, mainly applied to public buildings and public places. (Finally, only end users will qualify for the best feeling as they occupy the designed building, even though stimulation is done before the end product at the design stage. These are the visionary skills required of an architect, with the ability to have high imagination skills to visualise the future space and create a cheerful ambience. Lawrence, D. L. et al. (1990) warned that the built environment and spatial form required analytical skills. The skills in manipulating form (basic form and combination) and transformation are supposed to be mastered at this stage. Hammadamin, A. B. et al. (2024) reflected on the current scenario of the learning challenges of architectural education, especially in artificial intelligence (AI) and the digital age in the early twenty-first century. The skills and the current information need both intellectual and emotional intelligence to produce a good design with a sense of place.

The research design is inspired by the objective of identifying the most influential stimuli in the design process based on the student's background. To achieve this objective, the studio (Studio 2) consists of 12 final semester students and the senior students from Studio 1 consist of 24 semi-final semester or junior students. Thirty-six (36) students were merged into one studio called the Vertical Studio for the first time. The selected students from both studios have working experience before they pursue their master's level. Their background experience and skills vary from student to student, and the design principles they apply and idolise designers or architects greatly influence their approaches. Still, this research is limited to students' reflections throughout their architectural experiences in their vertical studio within the selected study period between October 2022 and October 2023. This research analysed the students' reflections on the most influential stimuli in the decision-making and design process of excellent buildings in their design subject, in which the extract of feedback was based on Focus Group Discussion (FGD) only.

2.1. The Research Methodology Form Generator's Influencing Stimuli

The methods were employed due to their efficiency in gauging the learners' experience in the design studio. The following research methodology, as presented in Figure 1, is the first research method (RM1): Document analysis from the literature review to identify the influencing stimulus. The following step was the second method, where the second research method (RM2) was conducted. The analysis of attributes from the literature was categorised and coded into three design stages. Kowaltowski, D. C. et al. (2020) have practised action research and architectural sustainable design education in the studio since 2018 and found that students sometimes get stuck and need a space to voice out their opinions. Therefore, a focus group discussion (FGD) as the third method is recommended to obtain students' feedback on the influencing stimuli based on the design stages of their proposals. However, on top of FGD, Irwan, D. (2023) suggested that the practical work methods in refining and managing data in design proposals shall include digital tools to evaluate the feedback in future research.

Students discussed the research with the researcher at this stage, and semi-structured questionnaires were used in the debate. RM4: Establish and rank the influencing stimuli based on the design stages. The following figure summarises the methods employed in this research.

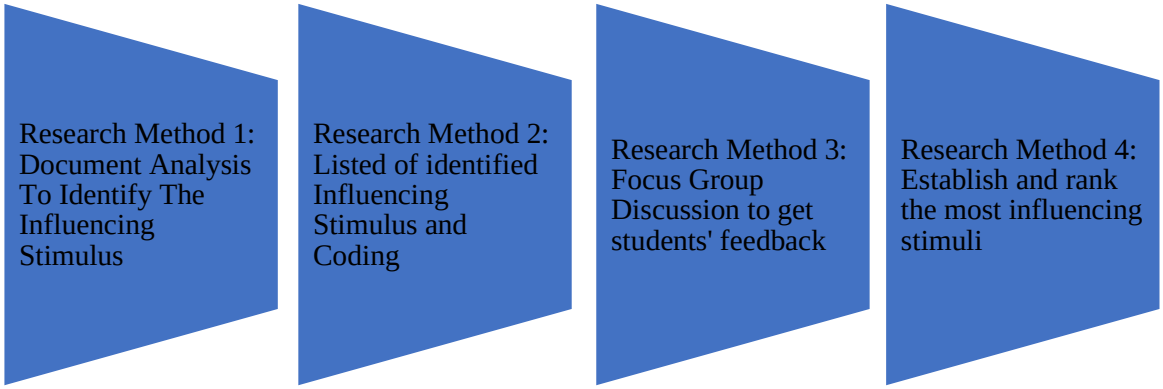

Figure 1. Summary of research methods employed to analyse the influencing stimuli in the design stages.

3.0 FINDINGS

The document analysis based on the literature review and the practice of design suggested that three significant design stages were identified as the most influencing stimuli stages that impact the form generator; the major stages or phases involved in design are the pre-design stage (PDS), design development stage (DDS), and grooming style stage (GSS).

3.1. The RF1: Identified Influencing Stimulus from the document analysis

The four FGs in the pre-design stage are closely related to the design aim, issues, objectives, and methods. In contrast, the design development injected the project research exploration completeness, and the studio personnel, including tutors, studio leaders, and panels of internal and external practitioners, groomed the designers and architects in the making.

3.1.1.Pre-Design Stage (PDS)

The pre-design stage occurs in Studio 1, where students extract the data according to their interests and inclinations.

At this stage, Studio 1 and 2 agree that the more profound the research, the stronger the opportunities for them to develop ideas and generate the form. The best criteria for students to choose a site are ones with cultural and natural strengths. The best-selected criteria are the ones that motivate students themselves in terms of interests and engagement for a one-year duration working on the selected design thesis. The assessment of PDS during the Crit 1 session of the semester requires the following details by students:

Table 1. The Description of Pre-Design Stage

Brief Inspiration	The creation of the brief @ major inspiration—The aim, objectives, issues, scale, Schedule Of Area (SoA), and project parameters shall comply with the syllabus.
Site Profile	The selection of site context and size (urban/rural/location/natural and cultural strengths—heritage + economic activity), the local site issues (identification of gaps and opportunities), and challenges—problem statement that assists students in developing the new proposal as a powerful tool to enhance their creativity and talent.
Client + End Users Profile	The project research explores the design strategies that cover the selection of clients as the project's funder – prediction of the future market + return of investment [ROI] + creation of a new magnet/landmark as a reflection of the corporate's in terms of the architectural identity or brand identity, and construction systems such as IBS systems, space frame construction, and tent construction.
Innovative Theory + Principles	The project's motivation will be cutting time, space, and cost savings. Creative ideas + concepts touch the heart of the audience or panel, especially when the proposal and presentation show an in-depth study of the end users' issues and current needs.

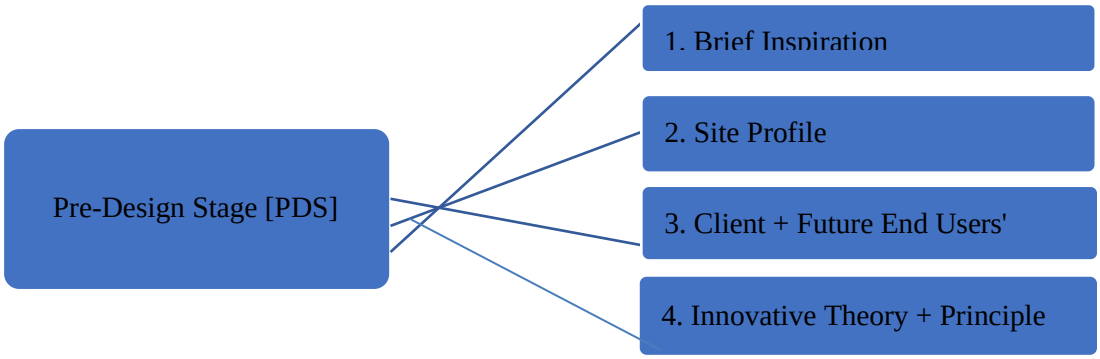

Figure 2. The Pre-Design Stages [PDS]

3.1.2. Design Development Stage (DDS)

The DDS is the project research exploration, where students apply their design principles strategy and use manual models of software tools for the design process towards completeness. The DDP process usually occurs after the Crit 1 session, where the preliminary design stage is established. The timeline was in between Crit 2 and Crit 3. It is listed as follows in six significant elements:

Table 2. The Description of the Design Development Stage (DDS)

The Purposive Group	The document on the end users' profile, typology, and space function is the purposive group typology of proposed new buildings and functions. The selection of purposive groups will be determined to be residential, institutional, commercial, or new typologies (such as mixed development, SOHO, condotel, etc.), as well as the external planning of the proposal.
The Program	The uniqueness in design provides clues regarding design specialisation. Should it be the end users' activity flow with or without any particular machinery application? The primary activities will be conducted in an open space, research centre or laboratory with special equipment for operation and storage. Is it with or without a workforce, high-tech, artificial intelligence, or a private and confidential security system? Those are clues for the design proposals regarding form, transformation, colour selection, and geometry in fulfilling the external and internal space requirements, relationship and layout.
The Design Principles	During the earlier stage in the architectural school of thought, students are exposed to various design principles, biomimicry, urban heritage, urban revitalisation, social-cultural study, politics and economics and community development, tropical approaches, design theory, worldwide architectural style and various research styles and methods. The other guiding principle that provides the design input is a theoretical framework or the master plan manifesto.
The Massing Study	Influence of External Planning towards the Massing and Built Form – the application of urban design theory in the first semester of their Master's in Architecture assists students in analysing and making them more rational in thinking. High accessibility, legibility, permeability, robustness, visual appropriateness, richness, and personalisation are prioritised in their decision-making. Finally, the choice of the urban transportation system, traffic flow and proposed 2D and 3D massing studies are established.
Internal Planning	The internal spaces relationship, planning, and layout are further re-checked to establish an excellent operational flow, workflow, and process system for significant end users from the start until the end of the complete loop, which students shall master.
The Futuristic Innovation	Typology regarding The Built Form and Transformation, Architectural Style, and Special Study will soon come together to establish the proposal.

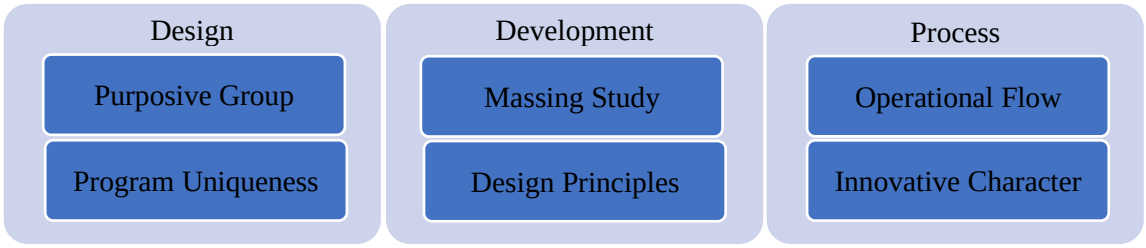

Figure 3. The Design-Development Stages

Vertical Studio's success at the study stage depends on the excellent building process, the development of alternative designs, and the team's innovation. The decision-making before and after the critique sessions and the final execution plan depends on the Vertical Studio's "Grooming Style" (GS):

3.1.3. "Grooming Style Stage" (GSS)

The Vertical Studio has a significant structure regarding weekly activities and scheduled critique and tutorial sessions within the semester. Usually, there are four major critique sessions within sixteen (16) weeks of the semester. The studio operation complies with the syllabus for design thesis subjects for both studios (Studio 1 and Studio 2). Both studios have their studio leader but share the critique session date and panels. During the DTL (limited to internal lecturers and tutors), students are allowed around twenty minutes to present in the tutorial session. After that, they had a question-and-answer session with the panels. The critique sessions with the panel were where the combination of internal and external panels criticised the student's work performance and marked their evaluation simultaneously. The students play their role as the "architects to be" through this grooming process and typically open up their hearts and minds to analyse critiques and gain the benefit from this session.

The studio leaders (SL) individually have their style of managing the studio. Some have more "independent teaching styles," where the SL allows students more freedom to explore their design. Besides this style, SL provides a "structured teaching style" with a series of guiding workshops in each week's session. The teaching and learning styles vary, and the students must adopt both styles to succeed in the design exploration journey.

At this point of the session, students with different experiences are given opportunities to adapt and adopt based on the studio leader's grooming style. Since the studio leader varies semesterly, students have incomparable studio experiences from one badge to another.

Table 3. Description of Learning Process at the Design Stage

Influencing Stimulus	The design expression by students' representation reflects their backgrounds, unique personalities, interpersonal and presentation skills, and exceptional verbal and graphic communication at this stage, which is accepted. The presentation style primarily reflects the power of influencing others or convincing people found among students. In-depth research sharpens the intricacy of detailed research work and has more chances to influence people.
Learning Style	The personnel involved in the studio team, as studio leaders, critique panels, and tutors' style, the management system, and learning style demonstrate the "fully guided style" or "dependent style." points and expect students to follow instructions, sometimes limiting their freedom to express ideas and be themselves. The learning style for andragogy is supposed to be very close to the office style, where they are more independent and ever-ready for discussion and presentation.
Peer Guiding Style	and DTL panels on imposing style – Internal tutors and External panels either throw in ideas and leave designers to absorb professional advice or leave them room for self-decision-making. This style of grooming offers a quick and mature andragogy style. The responses by students are typically positive rather than too defensive on their design proposals since they are aware of the panels' expertise and professionalism.

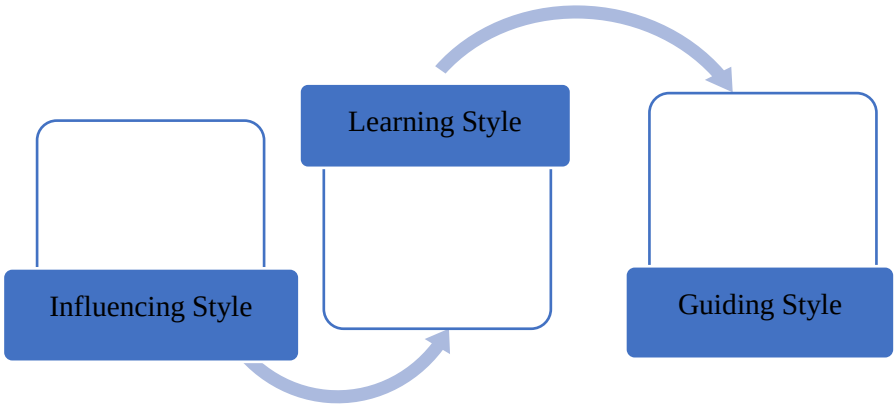

Figure 4. The design process relates to guiding style with interpersonal skills among students and grooming style stages from professional and practising architects.

3.2. The RF2: The Identified Influencing Stimulus based on the questionnaires in the Focus Group Discussion (FGD) in Studio 1 and Studio 2

Based on the research, three primary stages in the design process significantly influence the creation of the built form. The identified stages are according to the sequence of works practised by students. The following list of stages in design is identified as influencing stimuli.

i. Pre-Design Stage
ii. Design Development Stage
iii. Grooming Style (Pre-Design, During Design, Post Design)

Table 4. Focus Group Discussion Result by Vertical Studio 2

Stage of Design in the Design Process	Pre-Design Stage Percentage [%]	Design Development Stage Percentage [%]	Grooming Style Stage Percentage [%]
Vertical Studio 2 [Final Year – second semester]	32	58	10

Table 5. Focus Group Discussion Result by Vertical Studio 1

Stage of Design in the Design Process	Pre-Design Stage Percentage [%]	Design Development Stage Percentage [%]	Grooming Style Stage Percentage [%]
Vertical Studio 1 [Final Year First Semester]	20	70	30

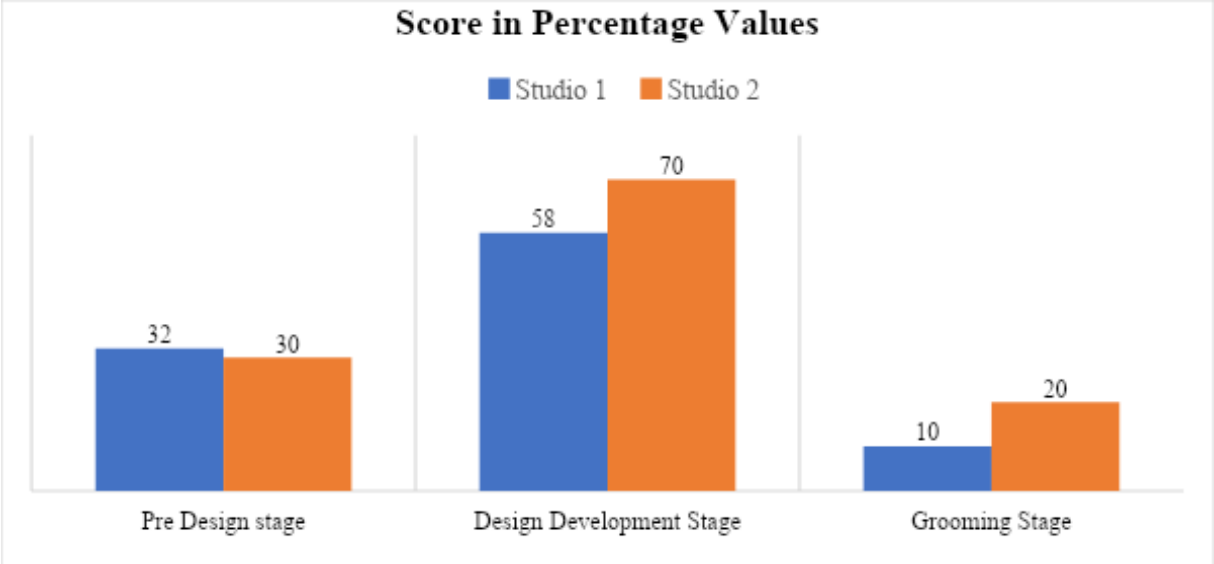

Figure 5. The Histogram on the Influencing Stimuli: comparison result between Studio 1 and 2 in percentage values.

3.3. The RF3: The presentation of the most influential and least influential stimulus stages.

Based on the research, three primary stages in the design process significantly influence the creation of the built form. The identified stages are according to the sequence of works practised by students. The following table illustrates the stimuli identified as influencing.

Table 6. Table of Results on Studio 1 versus Studio 2 Likert Scale based on Focus Group Discussion.

Stage of Design in the Design Process	Pre-Design Stage %	Design Development Stage %	Grooming Style Stage%
Studio 2	32	**58**	10
Studio 1	20	**70**	30
Subtotal	52/200	**128/200**	40/200
Total Percentage	26%	**64%**	20

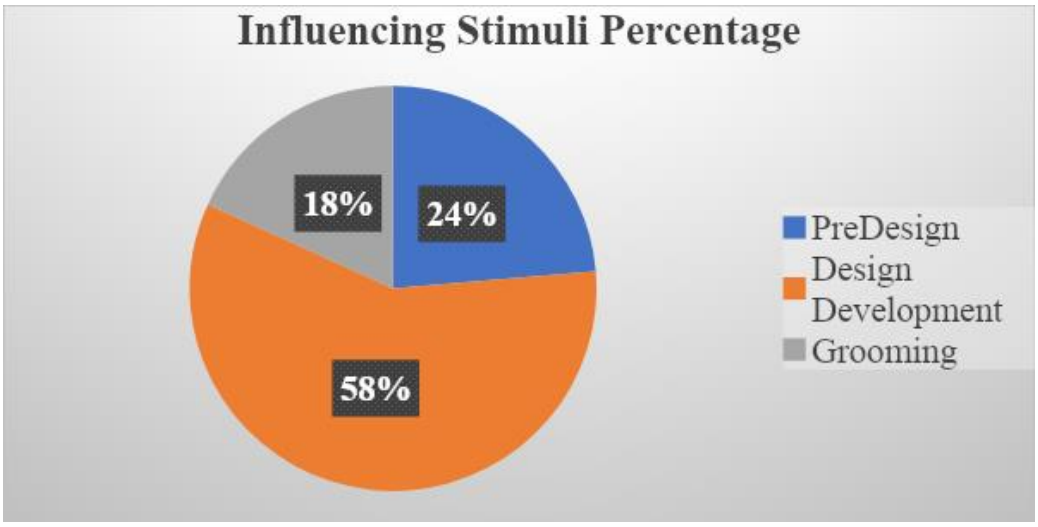

Figure 6. Pie Chart of Results on Studio 1 versus Studio 2 on the most influencing stimulus.

4.0 DISCUSSION

Based on the research, three primary stages in the design process significantly influence the creation of the built form. The most significant influencing stimulus is the Design Development Stage (DDS), with a score of fifty-eight per cent (58%), where students in both studios participate most actively in their external and internal planning stages. At this stage, students explore various architectural tools, including physical models and artificial intelligence (AI) generation tools, and design software such as Sketch and Revit [analysis of form and transformation, colour, texture, level, space organisation, relationships, end-user circulation indoors and outdoors, and traffic circulation]. The previous study identified the traditional and digital tools in architectural exploration. Carrera, L., et.al. (2024) recognised the impact of architecturally qualified data in deep learning methods for automatically generating social housing layouts—automation in Construction. Where it is limited to quantity only, students can explore various architectural and urban design tools as part of their research experience and experiment to achieve their research objectives. Kamel, M. A. E., et.al. (2023) discussed the physical model in depth as the three-dimensional study of external and internal space planning. Digital software applications and physical tools (such as manual and three-dimensional 3-D print models) were both applied by students in both studios. They agreed that the skin of any building is the corporate identity's branding that stands as a landmark building as seen by the public, as stated by both Foroudi M. et al. (2021) and Pallasmaa, J. et al. (2024). Besides the final touch of the built form, Luyten, L. (2022) insisted that structure is a primary generator of architectural design.

The least influencing stimuli are the grooming style stage in design exploration and output assessment. Sawyer, R. K. et al. (2024) researched how creative thinking is closely related to mental health, well-being and neurodevelopment. Belferman, E. et al. (2022) suggested the participatory experience of play, planning and service for future designers to experience themselves in the created spaces. Berawi, M. A. et al. (2019) strongly promoted a self-inclination towards the conceptual future development trend. The creative behaviours and output prove self-efficacy, self-discipline, and self-belief in specific architectural principles and concepts. Clow, L. T. (2024) supported the interactive community, such as the microgrid model, which shall be allowed to aid design exploration of the reciprocal relationship between creativity and technology. Genius invention and talent in excellent building design. However, the result showed that the respondents agreed that there was a high percentage for the grooming stage, especially for late bloomer students. This is where the ideas from panels have the most decisive influence on their design due to the need for more characteristics and design flair among weak students. This student is usually a dependent designer and is considered a good follower designer rather than a leading architect. The limitation of the study is that it is conducted for master-level students only; therefore, it is a more comprehensive exploration of undergraduate students and practising architects. Kia, A. et al. (2020) suggested that interactive form generation within students may increase high-performance architectural future space, and they could develop their ideas in design development within the stipulated time frame, regardless of their level of experience and background., Finally, the efficacy of spatial planning and architecture is not an isolated entity. Mahgoub, Y. (2024) amplified responsible urban development by integrating individual building designs into the cityscape to create a responsive built environment.

5.0 CONCLUSION

The most influencing stimuli in any design exploration depend significantly on the creative behaviours at all stages. The initial objectives are to identify attributes of design exploration phases, categorise them, and establish which phase is the influencing stimulus in achieving neuro-aesthetic design. The methods employed were semi-structured questionnaires distributed to managers and focus group discussions involving students. Jiang, F. et al. (2023), where generative urban design for master level students: a systematic review on problem formulation, design generation, and decision-making is necessary for research attainment. For this research, selected students from both studios underwent a series of focus group discussions (FGD) as respondents. In the FGD, semi-structured questionnaires were used in the focus group discussions. The session was conducted in the studio without them realising their response was evaluated. Finally, the critical output is proof of self-efficacy, self-discipline, and self-belief in specific architectural principles and concepts. The reciprocal relationship between creativity and technology adds value to self-development and motivation towards creating innovation. Establishing the design development phase is the stimulus that influences the achievement of neuro-aesthetic design. A combination of genius invention in art, science and technological advancement,

and talent promotes the creation of excellent building design.

In conclusion, the result reflected that the respondents agreed that the highest percentage demonstrated the design development stage as the most influencing stimulus rather than the pre-design stage, and the grooming stage reflected that students' self-design exploration journey was the topmost influencing stimulus stage. Each student personalises the entire design exploration according to their interests and inclination toward leadership and the decision-making process. The outcome of the personnel of a graduate architect and later as a professional architect is that they will be more responsible, creative, and brave in facing millennial challenges.

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