Towards an Integration of Symbolic Meaning and Digital Architecture in Architecture Design Studio

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ABSTRACT
The symbolic approach is used in creating architectural designs that have meaning and a strong attachment to users, history, social, culture, and character of society or community, where space and architectural elements become symbols and storytellers. This physical symbolic manifestation is tried to be explored through the digital architecture process to produce a more optimal design development. Most studies focused on how to find the symbolic meaning in architecture, but this study discussed the integration of symbolic approach through digital architecture innovation and how to explore it in the architectural studio. The purpose of this exploration is to form and strengthen the symbolic elements of the architecture through digital architecture process. Research methods used are exploratory and experimental study of the applied design stages, by including the simulation stage of building performance and parametric design, to find the symbolic elements in architecture. In this study, digital architecture methods were found that can be applied and architectural elements that could be taken as the manifestation of a symbolic approach in architecture.

Keywords: *Symbolic approach, Building performance, Parametric design, Digital architecture.*

1. INTRODUCTION

1.1. Technological Developments and Innovations in Architecture

Innovation in architectural design requires application of new design strategies and new project delivery methods. New design tools, materials, building technologies and construction techniques contribute to make buildings more responsive to the environment and their occupants. The integrated approach, where design methods, technology and firm culture must coalesce to address issues and problems, and provide solutions that create value to the firm, client and society [1].

The innovations, especially in the development of the more application of digital architecture create higher efficiency, the better quality of work and improve the design processes in architecture [2–4].

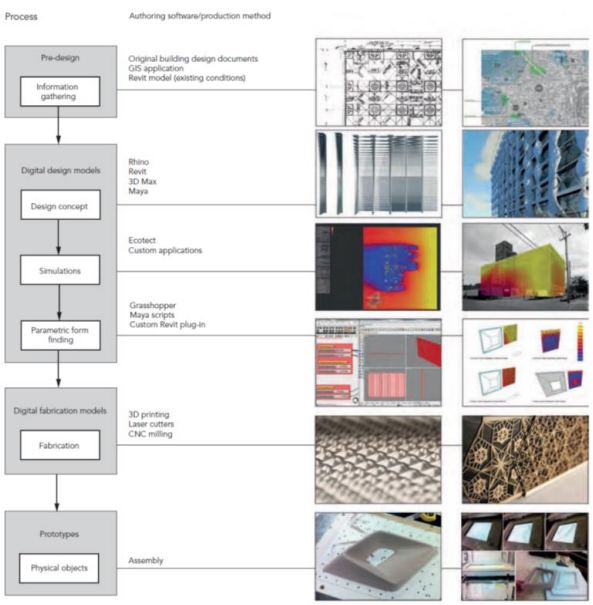

Figure 1 Technology development in architecture process [1].

1.2. Symbolic Approach in Architecture Design

An architectural design project is not enough to answer functions and circulation alone. It is necessary for design does not stop based on individual clients, but can also develop to the demands of the needs of corporations and state institutions. There are many things that need to be fulfilled, including the need to represent the vision and mission of the institution through design [5], show the institution's contribution to the environment and use the latest technology in design.

The symbolic approach is used in creating architectural designs that have meaning and strong attachment to users, history, social, culture, and character of society or community [6–8], where space and architectural elements become symbols and storytellers [9]. Fig. 2 shows some examples of architecture that applied symbolic approach in their concept e.g. City of Arts and Sciences by Santiago Calatrava, World Trade Center Transportation Hub by Santiago Calatrava, Tianjin Binhai Library by MVRDV–TUPDI, and Krushi Bhawan - a government facility by Studio Lotus.

Figure 2 Examples of symbolic approach in architecture [10].

1.3. The Integration of Symbolic Approach through Digital Architecture Innovation

In this study, this physical symbolic manifestation is tried to be explored through the digital architecture process to produce a more optimal design development. Specifically, the trial phase in design process will be carried out by simulating building performance or parametric design as design tools.

2. PURPOSES

2.1. Research Purposes

The purpose of this exploration is to form and strengthen the symbolic elements of the architecture through the digital architecture process. This study discussed the integration of symbolic approach through digital architecture innovation and how to explore it in the architecture design studio.

2.2. Expected Results

From this study, the expected results are digital architecture methods were found that can be applied and architectural elements that could be taken as the manifestation of a symbolic approach in architecture.

3. RESEARCH METHODOLOGY

3.1. Research Methods

This research is conducted through the observation method [11] on the assignment process in courses that are conducted in one semester (16 weeks of meetings, in a week the total study time is calculated for 16 hours).

The study began with creating the learning module in the Symbolic, Innovation, and Technology studio. The application of digital architecture in the process of searching for symbolic concept applications is tried to be carried out in the Symbolic, Innovation, and Technology studio course, taken by 6th semester students of Architecture study program at Universitas Ciputra Surabaya. This course is one of core courses in the learning process as an architecture student in Universitas Ciputra Surabaya [10].

The Symbolic, Innovation, and Technology course aimed to make students able to design interior architecture for public spaces according to the chosen entrepreneurial path with independent, creative, and innovative way, through the integration of symbolic concepts and simulations building performance or parametric design as design tools, pay attention to aesthetic and visual aspects, ergonomics, anthropometry, construction and materials, environmental issues, compatibility for functions and markets, and communicated in the form of technical drawings and design presentations.

Prior taking this course, in the previous semester's students had received material on the use of software and digital design processes in several courses, including:

- Interior Architecture Communication and Presentation 2, applied the software used in making technical drawings and design presentations.

- Digital Tectonics, explored form finding with the principles of digital fabrication
- Generative Structure System, explored and analyzed structural systems through a digital approach
- Digital Architecture, applied digital technology as design tools in architectural design by considering the performance aspects of the building.

Based on their prior knowledge, students are given a challenge to apply digital technology in Symbolic, Innovation, and Technology course. Exploration is implemented while guiding students in designing specified case study [11].

Several project typologies are used as case studies, where these types of typologies require deep conceptual exploration to realize their symbolic elements namely worship places, government offices, museum, and art spaces such as theatres, art galleries, and cultural centers.

The design method in the Symbolic, Innovation, and Technology studio uses a pragmatic approach where the design is carried out through a trial process. The results of the design are exploratory and the accuracy of problem solving will be known after going through a periodic evaluation process. If the design results are not able to solve the problem correctly, it will be tried again with other processing alternatives, and so on until a certain extent the results if the design is considered optimal. Specifically, the trial phase will be carried out with digital architecture in the form of building performance simulations or parametric design as design tools [12,13].

Meanwhile, this study also exploring opinions on students through a reflection form conducted at the end of the lecture regarding the lecture process that has been carried out. From this survey, qualitative data was taken to see whether the process of integrating digital architecture in exploring symbolic concepts could be understood and successfully carried out by students. The next step, analyze and categorize the student results and perspectives to get the conclusion about architectural elements that can be found with the integration of symbolic meaning and digital architecture and how the course development based on the evaluation [14].

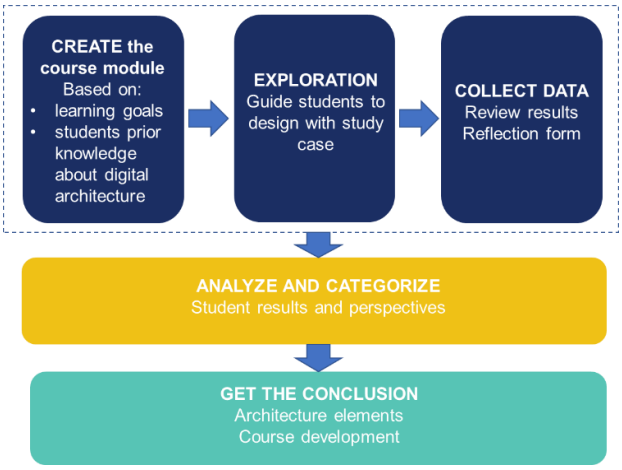

Figure 3 Research method workflow diagram.

3.2. Research Data

This research use qualitative method by observe and analyze the data from Symbolic, Innovation, and Technology course module, the student project results which are the results of observation and deep research, design concepts, working drawings and 3D modeling, and student opinions from student's reflection form which consisted of several questions about what they have learned during this studio, how to implement digital architecture in their project, and what things need to be improved which are summarized from the 31 respondents who answering the questionnaire.

4. RESULTS AND DISCUSSIONS

4.1. Integrating Symbolic and Digital Architecture in Architecture Studio

The results of this research started by observing the process of finding symbolic forms with the digital architecture method. This diagram below (Fig.4) tries to describe how to formulate a work process in design, combining a qualitative (subjective) design process, namely a symbolic approach from philosophical meaning in the form of cultural and ideological expressions in certain contexts according to their identities, but evidenced by design work steps with digital simulations.

Building form elements that found from exploring the symbolic approach can be strengthened by digital architecture processes, including choosing the right site, finding the building orientation, form finding based on parametric design, and building performance simulations. Digital architecture methods support the discovery process of these building form elements in a more measurable and precise way.

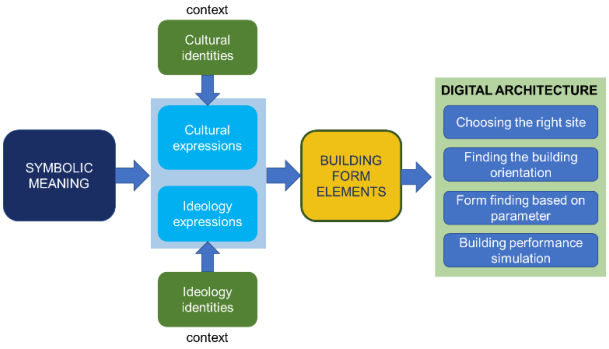

Figure 4 Digital architecture methods to strength the exploration of symbolic meaning in architecture.

Furthermore, Fig. 5 shows that from this schematic concept, the integration of the stages started with the learning process in architecture design studio, started with observation and deep research, concept development to final design development and final presentation, where all stages can apply digital architecture methods.

Design simulations are conducted by several software tools to achieve the desired design optimization, namely:

- Rhinoceros-Grasshopper with the Ladybug plugin to get accurate climate and site conditions data at the observation and deep research stage
- Rhinoceros-Grasshopper explores the design based on the required parameters at the concept stage
- Dialux Evo for lighting simulation at the stage of developing the concept
- Digital presentation in the form of video rendering and virtual reality at the final presentation stage.

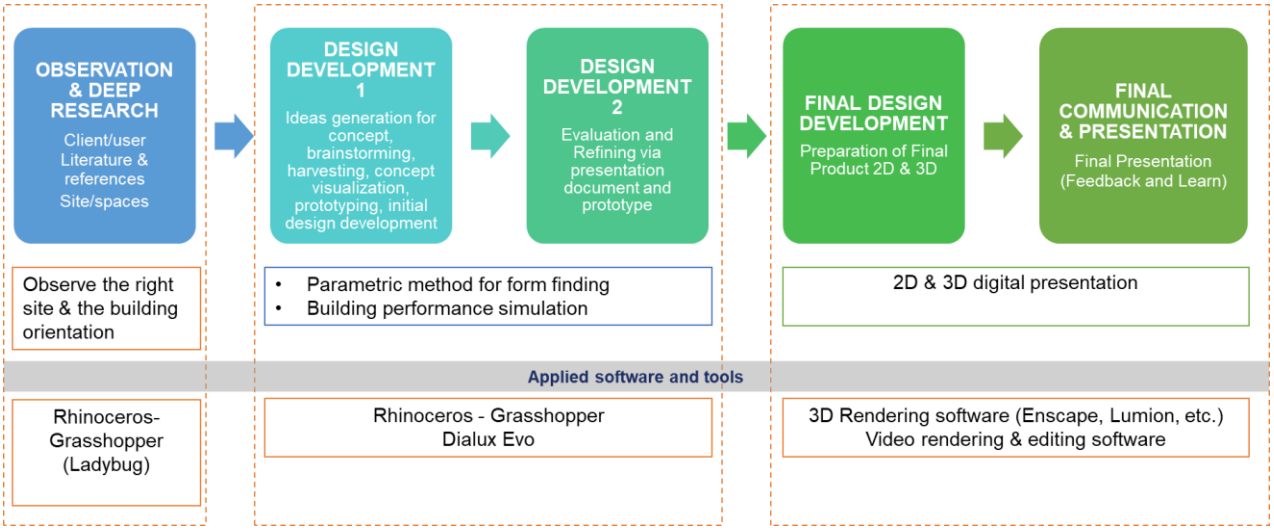

Figure 5 Integration of digital architecture in architecture design studio with symbolic meaning as case study projects.

4.2. Students Projects

In this sub-chapter, some examples are shown of student projects that applied digital architecture as tools to achieve the symbolic approach in student application of design in Symbolic, Innovation, and Technology studio. In these examples it is shown that their work is not only attractive, but also measured with precision because through simulation and digital architecture methods that are integrated in every design phase.

First example that shown in Fig. 6, Fanani designed the Majapahit Art Gallery, with parametric design finding the orientation of the facade, shading devices on the facade that use brick materials as a symbol of the uniqueness of the area. In addition, he explored by conducting building performance simulations, especially simulations of solar radiation on the surface of the building to find the most effective roof design and strategies to reduce solar heat through modification of design elements and placement of green areas on the site.

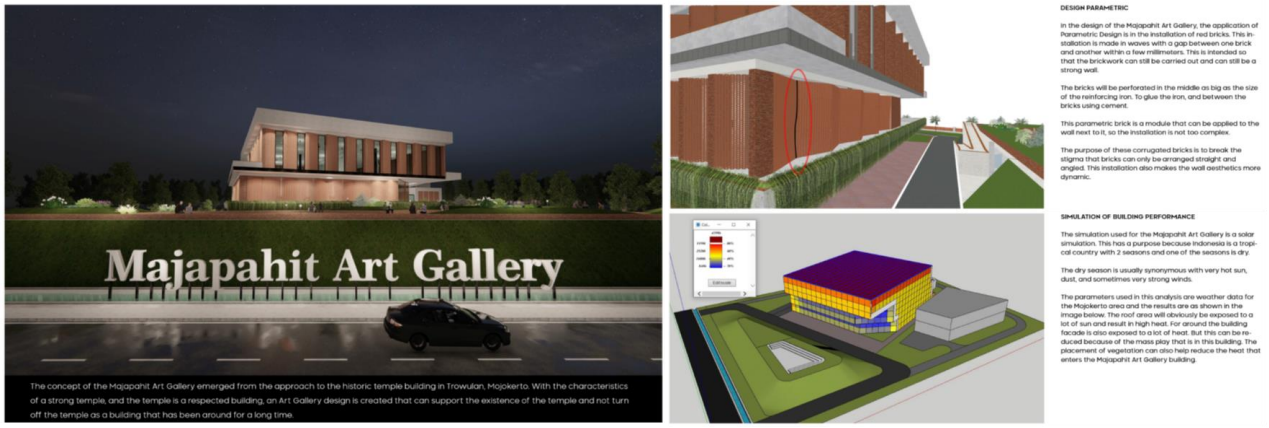

Figure 6 Application of integrating symbolic and digital architecture by Fanani.

Another example that shown in Fig. 7, Jennifer designed the Contemporary Art Gallery in West Surabaya by using the concept of a multisensory experience for visitors. The digital architecture process is applied by using the parametric design method to find the stage background design as an interior element, then using lighting simulation with Dialux Evo to design the desired space ambience.

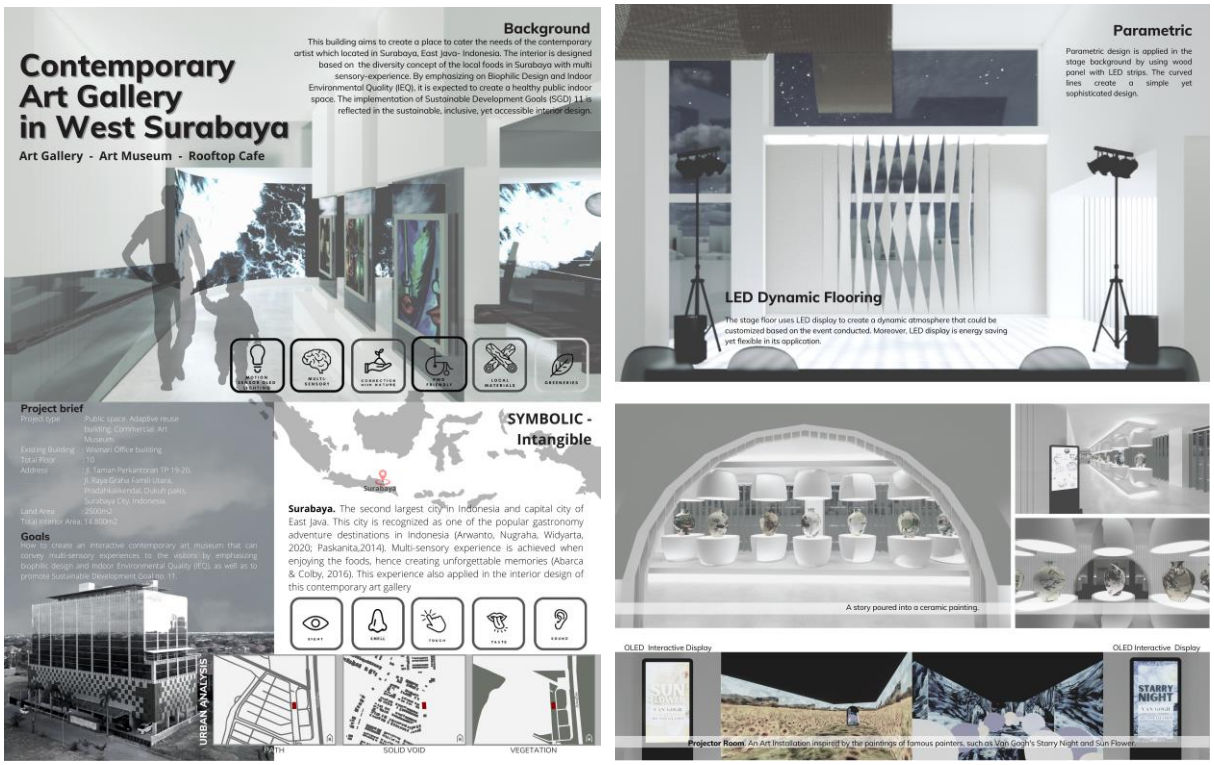

Figure 7 Application of integrating symbolic and digital architecture by Jennifer.

Meanwhile, from the student perspectives, it gets the facts if students find that digital architecture can help them for faster process, better understanding of symbols and more able to explore shapes for designing buildings.

The students output by applying this method are deepening of symbolic concepts, digital technology used by students helps to find forms in design that are more diverse, flexible, in accordance with the symbolic concepts raised. The presence of design elements explored with parametric design supports the achievement of the required concept.

5. CONCLUSION

As a result of exploration in the architecture design studio, digital architecture methods were found that can be applied as process in architecture design studio and architectural elements that could be taken as the manifestation of a symbolic approach in architecture. The symbolic approach can be strengthened by digital architecture processes, including choosing the right site, finding the building orientation, form finding based on parametric design, and building performance simulations.

The experimental process of integrating symbolic meaning and digital architecture in the architecture design studio is still in the early stages. For further study, it is necessary to understanding the symbolic architecture deeper by students and tutors so that the exploration of form finding and the application of symbolic concepts can be felt in the overall architectural design. In addition, the ability to use more capable software and to read data, also perform analysis of the simulation results is needed by students.

ACKNOWLEDGMENT

This research was funded by Architecture Department, School of Creative Industry Universitas Ciputra Surabaya. The authors also express the gratitude to those who have contributed in this study, especially students and tutors in Symbolic, Innovation, and Technology course.

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