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THE EFFECT OF MANUAL SKETCHING ON ARCHITECTURAL DESIGN PROCESS IN DIGITAL ERA

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ABSTRACT

The advancement of digital technology allows an architect to be more precise and detail in designing a building. However, the ability to draw manually is an added value for architects. Manual sketching or drawing allows a dynamic relationship between eyes, brain, and hand movement. It is a unit in building perception. In architectural education, a manual sketching subject is taught in the early semester. The purpose is to improve perceptions of form and space. This research is important to understand the role of manual sketching in the world of design.

The research involved second-semester architecture students who have the average ability. The participants were 138 students. The research was conducted by collecting questionnaire data and testing students' drawing skills. The drawing test was conducted to determine the ability of students to recall building objects that had been practiced before. The test results were then assessed and correlated with questionnaire results.

Research results showed that the on-site drawing of an object strengthens visual memory. So, manual drawing is a necessary provision to collaborate with digital technology in designing buildings in the present and future

Keywords: - Architectural Sketches, Learning Process, Visual Memory

1. INTRODUCTION

Digital technology in design is essential to get a complex design. Traditionally, a design process relied on architect's brainpower in starting the project until the next stage. The design technology concerns how to create digital models (skp, 3d studio), create working drawings, and generate structural calculations and building physics. Moreover, BIM technology offers consistency of information in a digitally detailed document (JinXu).

Architecture students who master manual design techniques and learn digital software will have the ability to use both digital and manual skillfully [1]. Architecture and drawing are a unified activity that includes abstract and tangible process and results. Drawing in the architectural process is part of the design process. The drawing result represents space in an abstract way. Also, architectural sketches are the perception of space and form.

Designing is a process of recalling the stored visual information in mind [2]. Moreover, Bellardi stated that the DNA of an idea is (manual) sketches that position this sketching activity as an important stage in the design process [3]. However, nowadays, architecture students and young architects are increasingly unfamiliar with manual sketches. So, this gap is necessary to observe in architecture and design education. This research contributes to the educational aspects of architectural design and professional practice in designing in the digital era.

This research was conducted in the middle of the second semester (fig 1). It was an evaluation of the learning process that has been passed for nine months. The learning outcomes focused on building

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assessment includes perception of edges, perception of spaces, perception of relationships, perception of light and shadows, and perception of gestalt [4] This category was based on Betty (fig. 2). Edwards' learning ability assessment on drawing skills. After the assessment, the following process is confirmation of findings to the participants to obtain certainty of findings.





MANUAL SKETCHING AND 3. **ENVIRONMENTAL PERCEPTION**

A sketch is a simple drawing used for other purposes [5]. Moreover, a sketch is usually rough, spontaneous, and often not done neatly. In sketching, someone needs to observe an object intensely at a specific time. So, observing an object with a sketch will result in a better understanding [6].

Observational drawing is a visuomotor task in which visual data (an item, a photo, or a figure) must be converted into marks on the paper with the goal that the duplicate in a perfect world matches the first [7]. All things considered, it is a genuine illustration of association among vision and activity. In most day by day circumstances, these two frameworks participate very well, permitting us to follow up on or dodge objects in our current

space in mind and not on whether the finishing drawing is good or not. The goal helps narrow the assessment of sketching results on the proportions of the building objects. Then, the research question is how the effect of manual sketching exercises on the enrichment of visual memory?.



Fig. 1. Some architectural student who practise sketching on the spot in the first year.

2. RESEARCH METHOD

(3)The research was conducted quantitatively using experimental methods. The independent variable of this research is manual sketch activity, while the dependent variable is visual memory. Respondents were second semester architect students and the total were 138 students (fig. 1). Then, the data for this research were collected by using questionnaires and testing students' drawing skills. For two semesters, students were given exercises to draw various building objects. The practice method can be 'realistic' object drawing or drawing from photos. Drawing test during the research aims to find out students' ability in remembering building object that had been trained. Students are asked to draw based on their memory (without looking at photos or buildings directly) with limited time (15 minutes).

Students must draw several building objects: 1) one of the most preferred material tasks about building objects, and 2) their house or dorm (fig.3). Then, the research team assessed the test results, and the score ranges were 4,3,2,1. The E-ISSN: 1817-3195



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circumstance. Nonetheless, with regards to replicating those equivalent items, it ends up being an exceptionally testing task for everything except a couple of us. At a first look, this should be astounding as observational attracting just expects us to portray the substance of our own visual discernment. The trouble that a large portion of us experience demonstrates that observational drawing doesn't arise from the get-go being developed, for example, strolling, however rather requires broad practice into adulthood. Drawing specialists, for example, proficient craftsmen and draftspersons, can create persuading portrayals regarding these equivalent items. Obtaining of ability is known to be identified with the variation of existent systems to the undertaking requirements, and examining master execution may uncover measures that are unnoticed in beginners.

Freehand sketch is a form of thought that is expressed in a frame and can be understood by others (a transformation of form from a physical element (thought) into a tangible form that can be realized (freehand sketch). An architectural designer possesses mastery in drawing sketches by hand because it has a high impact in the conceptual phase. Because by using freehand sketching, ideas will be well represented, the details and elements needed will also be fulfilled quickly. So, freehand sketching is an efficient way of thinking, mental stimulation, producing mental impressions, and criticality backing the development and correspondence of complex spatial ideas [8]. It also depends on imagination, memory, conception, innovation, sensation and intuition.

Based on research [9], there are 6 things that should have in the freehand sketching process:

1. Thinking tool

It is a means of producing, considering, advancing and testing thoughts (visual - motivation measures progress - planning crystallization of thoughts - imagining - taking notes). Powerful plan critical thinking relies upon an undelayed input circle of seeing, envisioning and drawing. The exercises of drawing and review the independent sketch resembled an "unbiased" demonstration in the plan cycle [10]: Subjects picked up distance and entered, as it were, a metalevel. Along these lines, the "obstruction of the real world" showed itself as the portrayed noticeable situation. The substance of the representations gave motivations for additional procedures. Newfound, applicable information was coordinated bit by bit. Now and again a total dismissal of the portrayed thought was essential, since it end up being not utilitarian after close investigation.

2. Communication tool

Freehand sketching is a means of correspondence between the draftsman and himself, modelers, work groups, teachers and design students. It is a means of exchange between modelers and business owners as a theoretical language of understanding and correspondence between plan cycle meetings. Strikingly, drawing and outlining freehand by originators has been a important communication tool by which they express their thoughts during the reasonable phase of new product development (NPD) [11]. These representations can be immediately drawn; in this way they assist planners with creating groundbreaking thoughts just as to comprehend which NPD issues they need to address. In addition, research [12] stated that sketching as a characteristic mode for human correspondence and imaginative cycles presents open doors for improving human-PC cooperation in geospatial data frameworks.

3. Interpretation, Analysis dan Comparison tool

Sketch helps in making vision and translation plan problems and answers and differentiating between options to choose the best.

4. Expression of Innovation

Individual articulation of the underlying thought and also a means for the process of improvement; expression of thought whether Interpreting. clarifying. visual. recording psychological impressions. Designers are devoted shoppers of pictures. A large number of them encircle themselves with pictures may demonstrate inspirational at some point, should a proper open door introduce itself. Moving visual presentations are regularly two-dimensional portrayals of structures went before drawings and unquestionably outlines [13]. With expanding levels of vulnerability emerging from visual ambiguities, master planners may feel that they have expanded opportunity to deliver assorted goals to such ambiguities that can drive forward advancement and innovation during the cycle of idea improvement. Past examination has additionally indicated that at elevated levels of visual equivocalness experienced fashioners show more even than vertical changes, with the previous being pointed toward forestalling untimely obligation to configuration structures. In this sense apparently

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master creators have a decent level of inhibitory authority over the vulnerability goal measure, keeping a dynamic harmony among indeterminacy and determinacy in order to empower a rich and imaginative investigation of the plan space preceding possible obligation to a picked configuration structure [14].

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5. Exploration and Development tool

It is used to explore if there are problems in the design and find solutions to those problems. It also helps the sketcher to design shapes and helps build ideas to reach the final thought. Freehand drawing concerns the investigation of the current world, its structures, subtleties and scenes [15]. Research [16] stated that the subsequent item can fulfill both the specialized useful prerequisites and the client feelings animated by the aesthetical necessities dependent on the styling bends.

6. Documentation tool

It is used in eye-hand coordination to be a means by which images can be imported, reported on and also assist in verifiable documentation. It is the best proof to report the first appearance of structures which give it an amazing picture in its detail and profundity [6]. Various examinations have expounded that, in light of setting aside more effort to make the sketch, it has the ability to bring back more keen pictures. Rather than other documentation techniques, it catches the most special minutes for the structure communicating the human experience which can't be rehashed. Outlining as a sort of documentation apparatus elevates attention to Building's worth and gives the people in the future a concise portrayal of the city's compositional legacy inside its materials, surfaces, colors, statures, extents and different subtleties

Drawing is building perception. Moreover, drawing expresses the culture, reflecting society, public spaces, and urban spaces. The activity of 'seeing' is the beginning of a perceptual process, which is a 'closely' curiosity to look for differences and store information as a solution. Perception is different from reality because there are factors of place and time and even past experiences. Psychologists argue that a mistake happened when someone builds perception based on what they see [4].

Perception is collecting information through senses. Then, it processes, analyses, and compares information with prior knowledge. After that, it constructs specific responses based on experiences. Different experiences can produce different responses from the same facts. Perception has been built at the beginning of life when the senses have worked perfectly. Also, perception can be said as a creative process. Every people has different perceptions according to their understanding and environment [17].



Figure 3. During evaluation, student draw a building from his memory.

4. RESULT

The total of respondents is 138 architecture students. Of those students, 50.7% got a drawing subject in their high school, and 49.3% did not get a drawing subject in their high school. This comparison shows students' educational background before entering the architectural study program. During the nine-month educational program, students were asked to draw in a structured and routine manner. As a cursory description, the time required to complete these daily tasks varies significantly with the following details:

Table 1. Studen	ts' Daily Task Routine
Time	Total (Percentage)

Time	Total (Percentage)
< 30 minute	34 (30%)
30 minute – 1 hour	50 (44%)
1 - 1,5 hour	12 (10.6%)
1,5 – 2 hour	17 (15%)
Total	113

Based on Table 1, most students (44%) spend 30 minutes – 1 hour every day to practice drawing.

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The teaching team evaluated all the works, and the score ranges were 4,3,2, and 1. After the evaluation, 100 people met the assessment criteria. The results showed that the average score of campus assignment (MK) is 2.45. It was better than the average score for homework (MR), with a score of 2.18. If each student's MK and MR scores are aligned, then there are three major groups.

 Table 2. Group based on Evaluation Result

Group Total Students

Group 1: MK scores > MR scores 56 students

Group 2: MK scores equal to MR scores 11 students

Group 3: MK scores < MR scores 5 students Figure 3. The Comparison of Evaluation Result :1) drawing by remembering objects that have been practiced; and 2) drawing by remembering objects that are encountered every day

Based on Figure 4, MK (red bar) tends to lean to the right side (has a better score), and MR (blue bar) tends to lean to the left side (lower score).

Based on the score group (see Table 1), most students (56 students) have a better memory of buildings that had been drawn before than a memory of buildings that they encountered every day but were not drawn (group 1). These results showed a common phenomenon that people will tend to remember an object that has been noted. However, those students tended to draw assigned objects and did not draw an unassigned object.

Figure 5 and Figure 6 show some examples of drawing results by remembering (without looking at the object).



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Figure 5. Drawing Former Assigments from Memory



Figure 6. Drawing Respectives Houses from Memory

Those pictures in figure 5 and Figure 6 are the comparison of drawing results by three students. Student A drew Vredeburg Fort and his/her house; Student B drew the Music Hall in Keraton Yogyakarta (Yogyakarta Palace) and his/her house, and Student C drew Bank Indonesia in Yogyakarta and his/her house. Each student drew each building in 15 minutes. The evaluation results showed the quality of detail and the quality of the proportions of the building.

At evaluation time, students were expected to give input regarding the preferred learning atmosphere. The reason can be attributed to students drawing capabilities. Data were collected by using open questions about the reasons for choosing the course. After the data were collected, they were analyzed using content analysis to obtain students with medium-low drawing ability, and the second group is a combination of students with high and medium drawing ability. Those groups have a choice of courses that show their preferred character to support their learning. Although some choices of courses show similarities, the reasons can be different. Figure 4 shows the students' group chart.

5. DISCUSSION

The drawing evaluation shows that students can remember well objects and buildings that have been practiced before, even though they do not see these objects every day. On the other hand, students are less able to remember objects that they casually see every day. <u>31st January 2022. Vol.100. No 2</u> © 2022 Little Lion Scientific

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Students can draw one of the buildings in the Kraton Yogyakarta with a fairly good level of detail. However, they find it difficult to draw their own bedroom or house that they see every day. This result confirms what Ching

said about the process of putting objects in memory with the stages of seeing, imagining, and representing. Also, manual drawing practice can be improvised and is self-reflective.

Sketching activity trains to imagine both the framework and the enclosure simultaneously [18]. Also, sketches record anything that the eye or camera cannot catch. This record is easy to be represented again [2]. Then, drawing activities is a practice to 'see'[4]. This practice connects the artist and their surroundings to form a more complete understanding [19]. Regarding the architectural learning process, the on-site drawing process is similar to survey activities. It is essential for architects [3].

Manual drawing or drawing with hands can use 'seeing' then 'drawing' method, as an artist does [4]. The first step is consciously realized to have visual thinking by focusing on the visible. The richness needs to be created in the 'seeing' process. In the drawing process, sketches are usually adjusted to people's memory. This is what makes a distinctive drawing. The drawing will apply perceptive consciousness. Manual drawing is unique because not only it has a personal touch, but also it has the perception that a person constructs in his/her mind.

The design of a space is based on perception and memories formed during the learning process. Perception is the first response when we interact with space or the surrounding environment. Furthermore, perception is important to be identified and manipulated to design better space and surrounding environment [20].

Building perception can be done through design elements. There are four design elements: namely conceptual elements, visual elements, relational elements, and practical elements [21]



Figure 7. Information Filtering Process to a Sketch (Putra, 2019)

cannot be separated in the visual experience. Conceptual elements include point, line and volume; visual elements include shape, size, color, and texture; relational elements include direction, position, space, and gravity; and practical elements include symbol, meaning, and function.

The gestalt paradigm states that the characters of a space depend on the object in that space. Moreover, Anheim argues that space is formed because of the relationship between two objects [22]. The most important part of perceiving a space is identifying objects in its environment [23].

Drawing activity is a learning process to close the distance between geometric understanding and spatial understanding [19]. In addition, research [11] stated that in the event that learning is tied in with changing the manner in which we see something, and outlining is a methods by which we come to see, at that point drawing can be believed to be firmly connected with learning. To be sure, it very well may be recommended that when engineers utilize their portraying as a method of coming to consider something to be another route as they do every now and again when planning, they are utilizing their drawing as a method for learning. Drawing or outlining is an outflow of involvement. From drawing exercises, we will see profoundly and reasonable for the marvel around us.

The process of forming one's spatial awareness can be achieved through the stages of 'seeing' an object. Spatial perception is formed based on life experiences and the surrounding environment (fig. 7).

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Perceptions that are formed as a response to the surrounding environment can be better with the power of intensive and pleasant manual drawing. This sketching activity is very important to be mastered by a designer because it can encourage 'unexpected discoveries' influenced by 'sensory' and 'conceptual' factors [24].

Furthermore, Suwa explained that a sketch does not only represent visual aspects. The nonvisual aspect in the sketch is a crystallization of perception's functional aspect. This opens up an opportunity for a sketch as a means of stimulating creative ideas [25]. The complexity of designing activities requires the use of computer and sketches together [9]. However, the advancement of computer technology cannot replace the role of manual sketching or drawing, but it will be an excellent collaboration [13].

Today, architecture student must know the concept of design idea in CAD environment that can give benefits from the opinion on peers and supervisor. CAD can create an instant and clear feedback with one action. The architecture students learn not only by concepting and work in design process nor reflecting in design process. So,the clear feedback is a fundamental in architecture design process. CAD system can help students to gain more control by the system [26]



Figure 8. Drawing Process (Ching, 1998)

CAD technology can create a digital model of three dimension object. The digital model can give freedom to architect for create objects and spaces by form on the screen has the best visual impact. There are many software that used for two and three dimension drawing models. Digital two and three dimensional modeling can use for simplify simulation activity [27]. Developing CAD technology technology can give opportunity to help architecture education development especially by design progress learning. CAD software can help architecture student understand several design process but the students must aware with building physical phenomena [28].

[29]The advantages of computer-aided architecture design are easy storage and sharing, easy to create design revision, it can draw several alternative design, 3D visualization. This is the best and quickest communication with running projects (structural, mechanical, electrical, landscape,and interior design).

But the other hand, disadvantages of computer architecture design are It can reduce ability of students design and imagination, Less people interaction between student and advisors, Inadequate literature about design, low quality design, and technology addiction. Based on the observations made in this study, manual sketching activities as an effort to strengthen visual memory can be taught with interesting methods. The correspondent stated that the selection of a particular image object was based on the interest in that object. The use of information technology. especially social media, can be used creatively in the learning process. According to a previous study [30] observing sketches from social media has an important role, especially as an input for the local government. This finding can corroborate new findings by analyzing data taken from social media

In the learning process, architecture students who do manual drawing have a better design quality and intuition compared to students who design directly using a computer [31]. Moreover, drawing by hands can be a medium for understanding and appreciating the surrounding environment. In addition, an architecture student must first master manual sketching or drawing before learning to draw by using a computer [5].

After mastering the skills of constructing shapes and spaces in mind, students can continue to practice digital technology. Using drawing techniques that combine manual sketches (traditional methods) with digital methods is a hybrid effort that needs to be done in the current design process [32].

Basically, the drawing process is a stage of seeing, imagining, and continuing to represent the observed object (fig.8). Drawing activities not only produce an image, but also help train the creative thinking 31st January 2022. Vol.100. No 2 © 2022 Little Lion Scientific

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process. According to Mahmud [33], the learning process is searching, remembering, and being efficient. If Ching's opinion about the drawing process is discussed with the learning process, then after the seeing stage to imaging, it is the searching stage. (fig. 9)



BEING EFFICIENT



From the imagining process to the representation, it is the remembering stage of the observed object. Meanwhile, from representing to seeing is the stage of being efficient.

If you look at these stages, then the activity of drawing manually is a very important thing in the learning process

6. CONCLUSION

From this study, it can be concluded that on-site drawing is a very important thing to do in early semesterThe manual sketching activity in the learning program will help students build visual memory. This richness of visual memory is very necessary in the practice of designing. Furthermore, the method should be adapted to the conditions of each student. This study encourages the need for manual drawing training for design purposes in the digital era.

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