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Analysis of facility needs level in architecture studio for students’ studio grades

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Abstract. Architects must be able to play an active role and contribute to the realization of a sustainable environment. Architectural education has inherited many education research used qualitative and quantitative methods. The data were gathered by conducting (a) observation, (b) interviews, (c) documentation, (d) literature study, and (e) Questionnaire. The gathered data were analyzed qualitatively to find out what equipment needed in the learning process in the Architecture Studio, USU. Questionnaires and Ms. Excel were used for the quantitative analysis. The tabulation of quantitative data would be correlated with the students’ studio grades. The result of the research showed that equipment with the highest level of needs was (1) drawing table, (2) Special room for each student, (3) Internet Network, (4) Air Conditioning, (5) Sufficient lighting.

1. Introduction

According to condition and development of Indonesia in this day, Architects have an important role in the realization of sustainable development. Architects must be able to play an active role and contribute to realizing a sustainable built environment in Indonesia. Architectural education is one way to give birth to reliable architects. Therefore, explore more about architecture education that has existed since ancient times until now aims to get the right module in accordance with the times.

Architectural Education has been widely inherited from past educational systems that are still in use today. The apprenticeship system is one of the most appropriate processes in practical work as well as in the studio, where in the studio system is inherited from Beaux-Arts education to a learning by doing learning system by modeling or doing basic tasks in an inherited school workshop of the Bauhaus. Architectural education through the process in this studio which is expected will give birth to a professional architect [1].

In essence, the architecture studio is an estuary of various knowledge that is integrated in designing activities. Referring to studio learning process of Beaux-Arts era then architecture studio at present...
should be guided by professional tutors from practitioners. It is expected that students can get information on the real condition and the problems that occur in the process of designing in the community. This case is able to form the pride of his profession by looking at his tutor figure who is the spearhead of the success of the architecture educational process. This process of success is greatly influenced by how well the interaction is intertwined and the duration of coaching in the studio. Tutors should be able to become both facilitators and creativity stimulators of the students in the design process.

In other words, the studio has an important role in architecture education. Architecture students tend to do more learning and activity in the studio than in the generally classrooms. And architecture students are required to produce the drawing well. To support these activities, it is important for making the studio comfortable in accordance with its function. These aims to increase the concentration of students who will affect the level of student productivity.

2 Method
In this research, the method used is mixed-method, with Sequential Exploration research design (Figure 1). This method begins by doing data collection through interview or observation techniques to understand the various issues that fit the object and context to be studied. The results of the data were analyzed by qualitative approaches. And then, the research object becomes a basis for formulating the survey instrument that is used. The survey instrument is questionnaire. It is as in the quantitative method that is distributed for subsequent processing to obtain quantitative conclusions for subsequent interpretation [2].

![Diagram]

**Figure 1.** Eksplorasi Sekuensial Method

The collecting data method with qualitative approach used are (a) Observation, behavioral scientist defines observation as observation of human behavior or natural environment, culture, belief that has impact to human life. More broadly, observation involves a full range of activity monitoring activities and behavioral (behavioral) or non-behavioral (the qualitative) conditions. (b) Interviews, in qualitative research to obtain meaningful full data, interviews of students are used open and in-depth interviews or unstructured interviews that can freely explore as closely as possible the data needed so that the researcher's understanding of the existing case in accordance with the understanding of the The perpetrator itself. This research is where the role of researchers as the main instrument that is not always fixed on the interview guide. While, Focus Group Discussion (FGD) is used for interviewing the lecturers. FGD is a data collection technique with focus group interviews that can be used to disclose data and interpretation of a group of people based on the results of a focused or focused interview on a problem to be studied. Truth data is no longer subjective individual, but becomes a group truth. Because during the interview took place each person expressed his opinion. It is important to avoid the wrong meaning by the researcher. Interviews can be conducted by the researcher or by the researcher (interviewer) in charge of taking notes, observing the course of the interview data reminiscent of the interview. The interviewer should be able to establish an atmosphere with the opening, then give an overview of the day's topics, objectives and rules of the interview. Interviews were attempted to walk spontaneously and freely with a particular focus on the issues to be revealed and each participant was given an opportunity to express his or her opinion. The number of groups should be small between 8-12 people chosen based on their authority, ability to provide data,
experience of involvement in the problem to be studied. (c) Documentation, documentation method is data collection where researchers investigate existing objects in the existing condition.

The results of data collection obtained from qualitative approaches are reprocessed to form a questionnaire. But before, adjusted in advance with the study phase of the literature. The literature study was used to obtain the standards or criteria of studio facilities based on existing literature review and comparative studies. So that the existing studio standards are involved in determining the questions to be presented in the questionnaire to be used.

2.1. Experimental Equipment
To conduct research, the equipment used will be adjusted step by step, they are (a) Questionnaire. Questionnaires are used as research instruments at the quantitative approach. Questionnaires contain questions submitted in writing to a person or group of people to obtain answers or responses and information required by the researcher [3]. This study uses a list of questions that are structured in the form of questions with several options and will be sorted according to the importance of the respondents. The type of questionnaire used is the type of questionnaire Likert Scale. This type of scale questionnaire was taken from the name of Rensis Likert, educator and psychologist of the United States, who developed a scale to measure public attitudes in 1932 [2]. This scale is the development of the rating scale, specifically used to measure attitudes, opinions and perceptions of a person or group of people against an object of attitude or treatment. This scale is psychometric which is poured in the form of written response (questionnaire). While the rating scale is basically intended to provide an assessment of an object or treatment. Because the number of rating points gives the possibility of greater sensitivity and extraction of variance. So, for example the scale of 1-10 or even greater that scale 1-100. (b) Sampling. The sample method is used to determine the number of respondents who will fill in the questionnaire. Respondents will fill out the questionnaire according to the directions contained in the questionnaire. And the results of the tabulation of the questionnaires will be processed into data which then proceed with the analysis process. The sample method used is 2 steps, they are
(1) Purposive Sampling method, also called judgmental sampling, is sampling based on the judgment of the researcher on who is eligible to be sampled. Therefore, in order not to be highly subjective, the researcher should have a certain background knowledge of the sample in order to actually get the sample according to the requirements or research objectives. In this study, the criteria to be used are students who have undergone 3 design studios. Because, assumed mahasiswa who have undergone 3 design studios can be more familiar with and know the activities that occur in the studio design space in accordance with the syllabus of lectures. In addition, the lecture syllabus received is also more complex than the activity that occurs. (2) Slovin method, one way of determining the quantity of samples that meet the counts formulated by Slovin [4]. This method can be explained by:

$$n = N/(1 + Ne^2)$$

$n$ is the number of samples; $N$ is the sum of all members of the population; $e$ is the tolerance of the occurrence of error, the level of significance, typically 0.05-0.1 (Error tolerance); And $e^2$ is a power of two. (c) Correlation Analysis using Ms. Excel. Correlation analysis is used to find the relationship of two variables with data of both variable interval or ratio scale. The correlation coefficient has a value of $-1 \leq r \leq 1$ [2].

2.2. Problem Formulation

The problem formulation aims to clarify the problem and direct the research to be undertaken. The formulation of the problem in this research is to find studio facility conditions based on the importance of students of USU architecture in accordance with the needs of the course of Design Studio of the Department of Architecture USU. In order to perform the analysis, several parameters used and formulated are as follows: (a) Purposive Sampling Method. In this study, the criteria used in the Purposive Sampling method are students who have undergone 3 design studios. Because, assumed
mahasiswa who have undergone 3 design studios can be more familiar with and know the activities that occur in the studio design space in accordance with the syllabus of lectures. In addition, the lecture syllabus received is also more complex that affect the activity that occurs. (b) The Slovin Method. To use the formula, the first step is to first determine the level of confidence or confidence level (...%) of the truth of the research results (sure what percentage), or the level of significance of fault tolerance (0, ..) occurs. In this case, the 90% confidence level, believes that 90% of the research results are correct, or the significance level is 0.1 or there will be only 10% of errors. Data of students who are undergoing Studio Designing Architecture 4, Studio Designing Architecture 6 and Design Study Environments 2, where students who are undergoing this course are students of level 3 and level

4. Based on data of USU Architecture students, namely: Number of Studio students Architecture Design 4 is 93 people. The number of students of Architecture Design Studio 6 is 88 people. The number of SPLB students is 35 people. So, the sum of the total is 216 people. Thus, the magnitude of the sample according to the Slovin formula is \( n = \frac{N}{(1 + \frac{N}{e^2})} \) which then becomes \( 216 \times (1 + 216 \times 0.10 \times 0.10) \) is 68.35. Rounded to 69 people. Then the number of respondents to be addressed is 69 people I set to 70 people. With an unspecified error rate. This is because looking at the complexity of the questionnaire. Therefore, the researcher will increase the number of questionnaires and repeat the data until it reaches the number of 70 questionnaires that is filled exactly in accordance with the guidance on how to fill the questionnaire that has been determined. (c) Correlation Analysis using Ms. Excel. In this study, the results of the questionnaire tabulation on the order of facilities importance based on student assumptions will be correlated with studio values that reflect their productivity levels. Since the correlation coefficient or \( r \) has the value -1 ≤ \( r \) ≤ 1 [2], the correlation of the facility to the value of studio closest to 1 will be first, and so on. In other words, the first order is the equipment most needed by the students.

3. Result and Discussions
The results will be discussed in 5 subsections, namely: observation, interview, documentation, analysis in making the questionnaire, the result of data tabulation from questionnaire and the result of data correlation. The explanation of each sub-section are:

3.1. Observation
Based on observations made during one semester (6 months), at the studio Designing Architecture 6 and studio Designing Architecture 4, the researcher can know that student activity of Department of Architecture USU is very full. On the schedule stated that the schedule of Architecture Design Course ranges from 08.00-18.00 WIB. However, in reality the presence of the architecture students of the Department of Architecture USU is still not in accordance with a predetermined schedule. They are often not in the studio room as they should. There are also some students who sit outside of their studio room on the grounds of many things, for example: where they are sitting do not get adequate internet network so they have to sit outside the room in order to get the internet network to find the information they need to complete the assigned task. In addition, students seem to use their respective laptops that they carry from home. In other words, rarely do students seem to use the drawing table. As for the existing facilities, it appears that not all of the required facilities are available, such as: uneven lighting on every hot and stuffy springs part, uneven arrangement of tables and chairs, items scattered due to unmade storage Adequate, in certain parts of the studio space exposed to the sun glare so that interfere with student learning comfort because not all windows use curtains, the number of sockets that are not in accordance with the number of users so that many students who do not get the stop and difficult to charge the laptop. Finally many students who are outside their respective studio.

3.2. Interview
Interview were conducted on two type of community. They are students and lecturers. It is because we need to know about how they see the case from their own perspective. While interviews were
conducted on two types of respondents, namely: (a) Based on interviews obtained from students currently entering Architectural Design Studio 4 and Studio Designing Architecture 6, stated that they do not feel comfortable in the studio at this time. It is only between 30% and 50% so that the productivity they can achieve to do the learning and complete the task is only between 50% to 60%. The rest they have to do these tasks outside the studio, for example at home. Based on the results of the interview, some facilities that respondents recommend to be met in order to improve the productivity of learning and doing tasks, including: adequate internet network, air conditioning to improve their sense of comfort in the studio, given at this stage the students using the tool A computer outlet, a sufficient number of outlets is important for students to avoid having to share sockets, cabinets for storing items that are used daily so they do not have to bring home every day, such as books, miniature maker tools, miniature parts before being arranged, etc. This is because the amount of time they spend in the day is dominant to be in the studio, madding boards are made to facilitate the students in presenting the work, printers, dispensers, in order not to need to leave the room to buy a drink in order to optimize the time in doing the task. (b) Based on the interviews from the lecturers of the USU Department of Architecture conducted by the Foccus Group Discussion (FGD) Method on the Facility/Infrastructure Learning Aspect on October 7, 2015, together with one of the lecturers of the USU Department of Architecture, Mr. Imam Faisal Pane. Studio is not adequate for each course Architecture design, locker, air conditioner, need to use server for the final task so that tasks are only done on campus so that lecturers can mementau progress of the work of each student, printer, plotter, workshop room, wall exhibition.

3.3. Documentation

Documentation is the step where the researcher gets the data based on the photographs. On the photographs can be seen the equipment contained in the studio spaces (Figure 2).

![Figure 2. The condition and situation in Perancangan Arsitektur 6’s Studio](image)

In this case, Perancangan Arsitektur 6’s Studio condition and situation based on Figure 2, it can be observed that: (a) Uneven lighting from every corner of the room; (b) Cluttered items such as miniature, papers, and so on. This is because there is not enough cabinets to be able to deviate these items until neatly; (c) There are enough desks and chairs to allow students to discuss; (d) There is no projector or similar type of madding board to be able to present the work; (e) There is air conditioning; (f) Scattered and irregular tables; (g) Not all windows have curtains to block out the excessive glare of the sun and dampen the temperature in the room to keep it cool and comfortable.

Not only Perancangan Arsitektur 6’s Studio, but also Perancangan Arsitektur 4’s Studio to be observed. With this, they will show the differences and similarities of each studio. Thus, it can be concluded how the circumstances of Architectue’s design studio in the Department of Architecture USU based on documentation. Then, it will show us what facilities are there in each studio that will be adjusted to needs of students.
In this case, Perancangan Arsitektur 4’s Studio condition and situation based on Figure 3, it can be observed that: (a) Uneven illumination from every corner of the room; (b) There are no adequate cabinets to be able to store the goods until they are neat; (c) There are enough desks and chairs to allow students to discuss; (d) There is no projector or similar wallboard to be able to present the work (work information board); (e) There is no air conditioner; (f) There is no curtain on the window to block out the excessive glare of the sun and dampen the temperature in the room to keep it cool and comfortable; (g) Irregular sockets so that they do not look neat.

3.4. Analysis in making the questionnaire
There are 5 stages in the design process with basic continuous steps [5], namely: (a) Briefing. At this stage, students will understand the design proposal. (b) Analysis, students talk about planning analysis, space requirements according to standards, etc. In this case it will be referred to as Planning and programming. (c) Synthesis. At this stage is a problem-solving process to the constraints in the site, can also be interpreted as design objects and constraints that occur in teamwork to create a design. In this case it will be referred to as the analysis phase. (d) Implementation, talking about concepts, preliminary design, schematic design, design development, detailing or also called Design. (e) Communication, this stage will assist students in communicating or often referred to also present the results of his work. In this case it will be referred to as the Judging process. These five points will be translated to the determination of the process that is contained in each stage in the activities based on the competence of studio Design 4, Department of Architecture USU. In this case, the five phases will be described in more detail and converted in the form of learning stage (Table 1).

<table>
<thead>
<tr>
<th>No.</th>
<th>Tahap</th>
<th>Kegiatan</th>
<th>fasilitas</th>
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<tbody>
<tr>
<td>a</td>
<td>Proposal</td>
<td>a. Survey</td>
<td>a. Cabinet for tools</td>
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<td></td>
<td></td>
<td>b. Finding data</td>
<td>b. Internet Network</td>
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<td></td>
<td></td>
<td>c. Finding theory</td>
<td>c. Cabinet for books</td>
</tr>
<tr>
<td>b</td>
<td>Planning and</td>
<td>a. Survey</td>
<td>a. Cabinet for tools</td>
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<tr>
<td></td>
<td>Programming</td>
<td>b. Finding data</td>
<td>b. Internet Network</td>
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<td>c. Finding theory</td>
<td>c. Cabinet for books</td>
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<td>d. Work team and discussion</td>
<td>d. Group table for discussion</td>
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<td>e. Guidance with the lecturers</td>
<td>e. Whiteboard</td>
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<tr>
<td>c</td>
<td>Analysis</td>
<td>a. Finding Theory</td>
<td>a. Internet Network</td>
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<td>b. Work team and discussion</td>
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First, an observation of a predetermined case study is made. In this case, the study is the architectural studio space of the Faculty of Engineering Department of Architecture USU. From the observations made, got some symptoms. Then, conducted the interview and documentation of the students who studied in the room as well as some lecturers who teach the course. From the interviews and documentation, obtained some data, in the form of facilities and level of student productivity. This observation, interview and documentation is a process of collecting data from a qualitative approach. From the results of this process, the facilities obtained were reviewed with literature studies to be used in the questionnaire. From the literature review that has been done, there are several indicators of facilities according to experts. The facility indicator consists of five points. These five points are made into question groups. In each point, it consists of 2 questions. Both questions, obtained from activities based on the curriculum, Architecture Design courses 4 and 6, which have been reviewed previously. From 5 stages, grouped into 2 stages or 2 questions, namely: (1) Proposal Submission Stages and Report Making or also referred to as the Proposal stage. Where the first question consists of facilities based on activities at the stage of Proposal Submission, Planning and Programming, and Analysis. (2) Phase Workmanship Picture or also called stage Design. Where the second question consists of facilities based on activities at the Concept, Preliminary Design, Schematic design, design development, detailing and Judging. In the second stage, students need physical facilities in the form of equipment. They will choose the facilities they need from the most important to the least important. Facilities presented are facilities in the form of equipment that has been studied in advance based on the results of observation, interviews, documentation until literature study.

3.5. The result of data tabulation from questionnaire and the result of data correlation
The results of tabulation of data obtained from respondents based on questionnaires and then correlated with the studio values of each student presented in Table 2.

Table 2. The Level Of Interests Facilities In Studio Space Design Based on Results Correlation Against Students Studio Value

<table>
<thead>
<tr>
<th>No.</th>
<th>Facility</th>
<th>Correlation Against Students Studio Value</th>
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<tbody>
<tr>
<td>1.</td>
<td>Drawing Table</td>
<td>0.169</td>
</tr>
<tr>
<td>2.</td>
<td>Special Workstation for Each Student</td>
<td>0.138</td>
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</table>
The most important importance to the lowest level after the results of student assumptions are correlated to the studio values of the students. The numbers are sorted based on the correlation theory used to find the relationship between two variables with the data of both variable interval or ratio scale. The correlation analysis has a value of $-1 \leq r \leq 1$. The value closest to 1 is the most correlated or related value.

4. Conclusion

Based on the correlation between "student assumptions on the level of requirement of each studio facility that has been presented" with "studio value of each respondent", then these are the five facilities with the highest level of importance they need for the students' productivity to increase properly. The facilities of the studio are: (a) Table picture size 92 x 127 cm. Standardized drawing tables are an important part of architecture students. The standard image table used is 92x127 cm [6]. Because, the drawing table not only serves as a tool for students to draw the manual but at the drawing table they can put the laptop and other items such as books, stationery, parts of miniature or composition of the period that they will assemble to present the work with more optimal [7]. (b) Special workstation that can be used by each student. By teaching methods and facilities provided at the Ecole des Beaux-Arts architecture school, Europe's most distinguished school of art and architecture until the late 19th century. The school is considered the oldest educational institution in Europe that uses the studio system as a means of teaching. Ecole des Beaux-Arts provides a private studio in the form of En Loges that works so that a student can solve his ideas. During the process of discovery of ideas that lasted 12 hours, students are forbidden to communicate with others to sharpen his ideas. After completing the basic idea of his design, he may return to the studio together again to consult with his mentor [8].

The other equipments required by the students are: (c) Internet network. Internet network is needed to be able to assist students for finding data and information quickly to optimize the time. The more optimal time can make the level of student productivity increase in producing the output tasks that have been determined. (d) Air conditioning. Air conditioning is one of student priority. Because, a comfortable temperature will increase student productivity. Good thermal comfort and air quality in the classroom can have a positive effect not only on the health of the students in it but also can help improve the concentration and performance of student learning. Thermal dissatisfaction such as hot or cold classrooms can be associated with physical stress (thermally) and can cause students to become ill or less concentrated [9]. (e) Adequate lighting. Sufficient light becomes an important thing to be properly facilitated for students to work properly. The physical work environment is...
everything that exists around the workers that can influence themselves in carrying out the tasks charged. For example lighting, air temperature, space, security, cleanliness, music, etc. [10].

Acknowledgment
The authors would like to thank the Master of Architecture Engineering, Universitas Sumatera Utara and my counselors where this research is the result of the thesis. I also thank my parents and friends for encouraging me to complete this research.

References
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