



Institutional Capacity Increasing of Green Building for Sustainable Development

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ABSTRACT

The aim of the research is to contribute to a better understanding of the green building assessment tool concept and its role in achieving sustainable development through the development of an effective green building rating system for residential units in terms of the dimensions through which the sustainable development tool passes. Green building practices aim to reduce negative impacts on the environment and human health and are therefore more sustainable than conventional construction methods. The activity method is descriptive through online and offline face-to-face activities, discussions, practicum, pre-test and post-test. The population is FPTK UPI Bandung civil engineering students who are still active as students. The outputs of this activity are: 1) improvement in the cognitive, affective and psychomotor domains; 2) the concept of green building development for sustainable development; 3) flowchart models. The results are expected to reduce negative impacts on the environment and human health and are therefore more sustainable than conventional construction methods.

Keywords: *Green Building, Civil Engineering, Institutional Capacity, Sustainable Development*

1. INTRODUCTION

Civil engineering is one of the necessary disciplines for sustainable development. Civil engineering will continue to be needed because it is related to the availability of supporting facilities and infrastructure that support people's lives. Civil engineering functions to plan and monitor infrastructure development. Technically, civil engineering evaluates construction plans according to the rules and determines the materials to be used. To implement sustainability, civil engineering considers the development of technology, environment and green buildings [1]. In fact, not all civil engineering stakeholders are able to consider technological advances, the environment and the development of green buildings in realizing sustainable development.

The development sector is the most prominent economic driving sector in a country. Currently the government in Indonesia is intensively making continuous improvements in the development sector. According to the IEA (2015) in Widiarsa (2021) Increased human activity and climate change have had an impact on environmental damage, especially global warming. The building sector contributes to issues of environmental damage and climate change through significant carbon emissions, up to 34% [2]. The results from the Green Building Council Indonesia or GBCI

(2013) show that around 30-40 percent of carbon dioxide emissions come from buildings. Therefore, buildings play an important role in the process of environmental degradation. One effective way to deal with the destruction of nature by the construction industry is to implement green buildings [3]

The current building concept is a building concept that meets green building criteria [4]. Green is not interpreted as an all-green environment, but as the harmony between elements of the global environment. In the concept of green building is specifically defined as an application of sustainable building [5]. The planning and construction of green buildings is based on the principles of sustainable development.

The harmony between humans and the environment is realized through green building. Green building also includes other dimensions such as time, nature, socio-culture, space and engineering. Buildings that are environmentally friendly and based on the protection of the global natural environment are understood as green buildings [6].

Green building can be described as "sustainable building" or "efficient building" [7]. The US The Green Building Council (one of the first organizations to influence the construction industry towards green

practices) defines green buildings as “Buildings designed, constructed and operated to provide enhanced environmental, economic, health and productivity performance” [8]. Green building is also a process that increases ecological, economic and social efficiency. The construction approach includes a commitment to minimize disruption to the environment and ecosystems through more efficient use of natural resources [9]. Green Building has an understanding as a term that describes economical, energy efficient, environmentally friendly and can be developed into sustainable development [10]. The principles of energy saving, water conservation, waste minimization, pollution prevention, resource efficiency, and environmental quality improvement are the goals of Green Building. Green building principles and methods apply at all stages of a building's life, including location, design, construction, operation, maintenance, renovation, and deconstruction [11].

Green Building is a design concept to produce a built environment that is built and runs in a sustainable or sustainable manner. Sustainability is a condition in which all elements involved during the process of utilizing a system are mostly able to function independently, have little experience in replacing or not causing other sources to decrease in quantity and quality [12]. Green buildings are defined as buildings that minimize environmental impact through conserving resources and contributing to the health of their occupants. Broadly speaking, Green Building emphasizes comfort and strength [13]. The government's role in implementing the green building concept has been carried out in various ways, starting from making regulations issued by the Governor, Minister, President to the National Action Plan which is issued with various targets every year. In addition, the government through the Ministry of Environment (KLH) promoted the concept of sustainable cities with the *Bangun Praja* Program in 2002 to encourage local governments to pay full attention to important issues in the environment [14]. Based on the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 02/PRT/M/2015 concerning Green Buildings, it is necessary to implement buildings that effectively combine technical, economic, social and environmental aspects to realize sustainable development. The application of sustainable buildings that are efficient in the use of resources and contribute to reducing greenhouse gas emissions, needs to meet green building requirements at every stage of implementation to achieve significant energy and water savings, efficiency, healthier, more comfortable building performance, and by energy support the environment. The concept of developing a Green Building includes environmental awareness and the main aspects of architecture in the form of strength, function, comfort, low cost, aesthetics, efficiency and energy. In fact, the concept of the building designed is not as expected. The concept of the building being built does not follow the percentage division between the land area and the building area that should be. In addition, the material

used has not used Green Building material. One of the applications of Green Building in Indonesia which is still far from the concept of Green Building is in the City of Probolinggo. According to Rezza [15] the implementation of Green Building in Probolinggo City is still far from its initial concept. This is due to the inhibiting factors, one of which is an inadequate budget and not many consultants are able to fulfill the implementation of Green Building with an effective and efficient budget. In addition, the material used has not used Green Building material. One of the applications of Green Building in Indonesia which is still far from the concept of Green Building is in the City of Probolinggo. According to Rezza [15] the implementation of Green Building in Probolinggo City is still far from its initial concept. This is due to the inhibiting factors, one of which is an inadequate budget and not many consultants are able to fulfill the implementation of Green Building with an effective and efficient budget. In addition, the material used has not used Green Building material. One of the applications of Green Building in Indonesia which is still far from the concept of Green Building is in the City of Probolinggo [15].

Civil Engineering students are prospective workers in the field of civil engineering who work in education, consultants, contractors and others to build road infrastructure, bridges, waterworks and buildings in the real world. The civil engineering students were given material on mapping measurements, technical, financial and environmental feasibility studies, geometric designs and calculations, calculation of certain and indeterminate static structures, hydrological analysis, construction, operation and maintenance. The potential of civil engineering students in the formal curriculum in learning must certainly accommodate Green Building in the application of learning. The theme of Green Building has been included in the final assignment of students of the Civil Engineering study program FPTK UPI Bandung. In fact, the theme of Green Building has not been fulfilled properly, this shows that the theme of Green Building for civil engineering students has not been properly accommodated by the academic community of the Civil Engineering study program. The indicators were seen at proposal seminars, results seminars and Civil Engineering undergraduate meetings. Some lecturers, assistants and students think that the Green Building theme is not the responsibility of civil engineering personnel but is the responsibility of architectural personnel. Civil engineering personnel are only responsible for the calculation and design of civil engineering buildings without having to focus on Green Buildings. The aim of this activity is to increase the institutional capacity of students in developing green buildings to implement sustainable development. Institutional improvement of civil engineering students is carried out through training methods. Training on green building concepts can certainly increase the knowledge of lecturers and students to improve the quality of education [16].

2. RESEARCH METHODOLOGY

The activity method is descriptive through online and offline face-to-face activities, discussions, practicum, pre-test and post-test. The location of activities at the UPI Bandung Campus and ZOOM Meeting for all civil engineering students throughout Indonesia.

The population is civil engineering students of FPTK UPI Bandung who are still active students. The sampling technique is random. The research instruments used are computer software and hardware, data collection instruments in the form of tests (understanding evaluation) and non-tests (student observation format), and non-test (student observation format, interview, and documentation). Primary data taken are data from activity participants, and secondary data in the form of satellite images of residential locations. The data analysis techniques used are analysis of understanding, attitudes and skills of activity participants and spatial analysis. The method of calculating the research results is Paired sample t-test.

Paired sample t-test formula to Equation (1) :

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}} \quad (1)$$

Information:

Md = Average value of magnification test 1 with test 2 (test 2 – test 1)

xd = Deviation of each subject (d – md)

$\sum x^2 c$ = Sum of squared deviations

N = Subjects on sample

db = Determined by n-1

The calculated t value is compared with the t table to interpret the level of significance. Paired sample t-test is used for calculations using SPSS 21.0 software as a comparison.

3. RESULTS AND DISCUSSION

The results of observations that have been made in the study show that there is an increase in the capacity of Civil Engineering regarding the evaluation of the development of Green Buildings for Civil Engineering. This can be seen from the values obtained from the results of the pre-test and post-test.

3.1 Results of Evaluation and Pre Test Score of Green Building Civil Engineering Students

Institutional Capacity Building for the construction of green buildings for civil engineering students is evaluated before being given treatment using a pre-test form. The average result of the pretest conducted on 74 civil engineering student respondents in increasing the institutional capacity of green building development was that the level of understanding of green building development was 62%, the rest with an adequate level of understanding of green building development, the percentage was 22%. and with a good understanding of green building development the percentage is 16%. The level of understanding of the respondents is depicted in Figure 1.

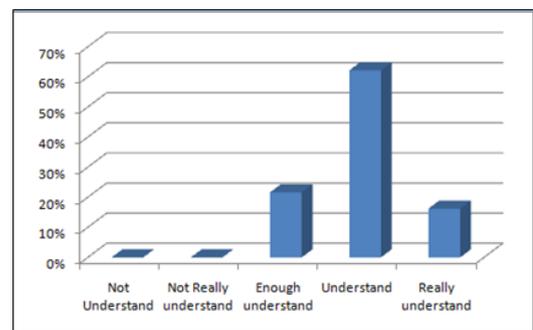


Figure 1. Results of the Pre-Test Evaluation of Civil Engineering Students' Understanding of the Development of Green Buildings for Sustainable Development.

3.2. Results of Evaluation and PostTest Score of Green Building Civil Engineering Students

Institutional Capacity Building for the construction of green buildings for civil engineering students is evaluated after being given treatment using the post test form. The average post-test results conducted on 74 civil engineering student respondents in increasing the institutional capacity of green building development after being given treatment experienced an increase in understanding, namely very understanding with a percentage of 54%, understanding with a percentage of 39%. and quite understand the percentage of 5%. The level of understanding of the respondents after being given treatment is depicted in Figure 2.

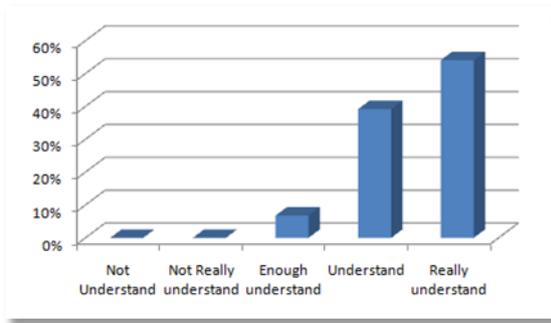


Figure 2. Post Test Evaluation Results of Civil Engineering Students' Understanding of Green Building Development for Sustainable Development.

Based on the explanation above, it can be concluded that the level of respondents' understanding of the construction of green buildings to increase the institutional capacity of civil engineering in realizing sustainable development is depicted in Figure 3.

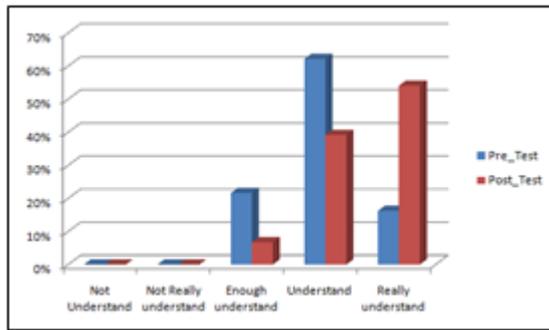


Figure 3. Comparison of the Level of Understanding of Green Building Development for Sustainable Development before and after being given treatment.

3.3. Comparison of Pre-Test and Post-Test Results with Paired Sample T-Test Results

Based on the results of the analysis, a conclusion can be drawn. The average pretest result before being given treatment was 70.13, while the posttest average after being given Green Building development for sustainable development learning was 80.10. The evaluation results that have been carried out differ significantly, as illustrated in table 1.

Table 1. Paired Sample Statistics

		mean	N	std. Deviation	std. Mean error
Pairs 1	Pre-Test	70.1351	74	10.30803	1.19828
	Post-Test	80.1081	74	14.34847	1.66798

Table 2 Correlation of Paired Samples, describes the correlation value which indicates the relationship between the two variables in the paired sample. This is derived from the bivariate Pearson correlation coefficient

(with a two-tailed 50 test of significance) for each pair of variables included.

Table 2. Paired Sample Correlation

		N	Correlation	Sig.
Pairs 1	Pre-Test & Post-Test	74	0.232	0.047

The results of the analysis can be obtained from more than the average value of the sample. You can also get the t value in the Paired Sample T-test table compared to the t table. The significance value (2-tailed) is 0.000 ($p < 0.05$). So that the results of the pretest and posttest experienced significant (significant) changes. Based on descriptive statistics, the pre-test and post-test scores were proven to be higher than the post-test scores.

The results of data processing show the number of respondents as 74 people. In calculating the results of increasing the institutional capacity of Civil Engineering students there is a very significant difference between the pretest and posttest which shows an increase in understanding before being given an evaluation of green building construction to realize sustainable development and after being given an evaluation of green building development materials to realize sustainable development

4. CONCLUSIONS AND SUGGESTIONS

4.1. Conclusion

The conclusion of the activities that have been carried out is to increase the institutional capacity of Civil Engineering students regarding Green Building for sustainable development by providing Green Building development evaluation material to realize sustainable development in learning for civil engineering students. This activity resulted in an increase in the capacity of civil engineering students' understanding of Green Building for sustainable development. This can be seen from the level of understanding with material that can be understood more, more interesting, fun and not boring because the analysis of the evaluation of green building development is relatively easy.

4.2. Recommendation

Based on research results, the application of green building assessment to implement sustainability can improve the skills of civil engineering students. Therefore, efforts are needed to improve teaching materials and deepen socialization in the development of sustainable green buildings

AUTHOR'S CONTRIBUTIONS

IMP conducted a study on institutional capacity building for civil engineering students on green buildings

for sustainable development. The author participates in the alignment of the sequence and drafting of the manuscript. ASH contributed to sequence alignment and editing of the manuscript. All authors read and approved the final manuscript.

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