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DEVELOPMENT OF A GUIDEBOOK FOR BUILDING EVALUATION ACCORDING TO BUILDING PHYSICS

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ABSTRACT

This study intends to analyze the feasibility of building evaluation guidebooks. Building Physics attaches great importance to the comfort and health of occupants. Designing a building without taking into account Building Physics will cause inconvenience to the occupants of the building. However, students understanding of healthy buildings that meet the principles of Building Physics tend to be low. It might happen because students only understand the theory of Building Physics. Based on this, developing a building evaluation book that aims to improve students' skills in building health is very important. Through evaluating community residential buildings, students are expected to be able to create healthy buildings according to the principles of Building Physics. This study uses a research development approach (Research and Development) by adopting the ADDIE development model only in three stages; analysis, design, and development. This research produced a product in the form of a student book that can guide students in evaluating community housing. The designed book went through several analysis stages; validity and practicality tests. The tests were carried out by lecturers and students of the associate's degree of Civil Engineering study program at Unimed. Based on the research, the resulting book product proved to be feasible and practical for use by students so that later they would be skilled in evaluating the health of buildings under the principles of Building Physics, namely healthy buildings in harmony with nature.

KEYWORDS: Building physics, comfort, building evaluation, guide.

INTRODUCTION

Regarding buildings in harmony with nature, studying and understanding Building Physics in Civil Engineering and Architecture is very important. Without following the Building Physics rules, the results of the buildings created will be meaningless. Building Physics is very concerned about the comfort and health of the building's occupants. The buildings that consider Building Physics will experience benefits such as; spatial arrangements, material selection, appropriate and efficient

physical arrangements, and harmony with the environment. Comfort is one of the conditions for humans' mental and physical health. The comfort achieved is highly dependent on human factors and the environment. To achieve the level of thermal comfort, the manufacture of a building requires knowledge, engineering, and innovation, [1]Tiyok Prasetyoadi, 2010.The Building Physics course aims to minimize the effects of nature which are bad for buildings and affect comfort. So far, the building physics course material has not been able to improve students' skills in building design following the principles of building physics. Improving students' abilities and skills is needed, so they can plan and design buildings that comply with Building Physics principles. A good quality of education can be achieved if the learning is carried out effectively. Besides, it can improve the skills and experience of students. Good quality education will produce individuals who are superior and beneficial as a whole for society, nation, and state. [2[Government Regulation Number 65 of 2013 concerning Process Standards states that every educator in an education unit must prepare a complete and systematic Learning Implementation Plan to participate actively and provide sufficient space for student initiative, creativity, and independence. Creating learning activities that can support solving life's problems requires skills and reasoning to connect facts and opinions related to those problems. Referring to the vocational level in the IQF, a learner must be able to master the concepts both theoretically and practically, [3] Government Regulation Number 73 of 2013. To achieve these abilities, students must train their abilities and skills so that they will be able to face the challenge of their environment. In this regard, to improve students' skills in healthy buildings, it is necessary to do learning by evaluating existing buildings. For this study, developing teaching materials related to the Building Evaluation book according to the principles of Building Physics is necessary.

2. MATERIAL AND METHOD

The approach to this study is based on observations, interviews, and building literature following Building Physics. In developing the Building Evaluation book, the research method used was the Research and Development (R&D) method adopted from ADDIE. In this study, the stages carried out were only the Analysis, Design, and Development processes. The approach in this study follows the following framework figure 1.

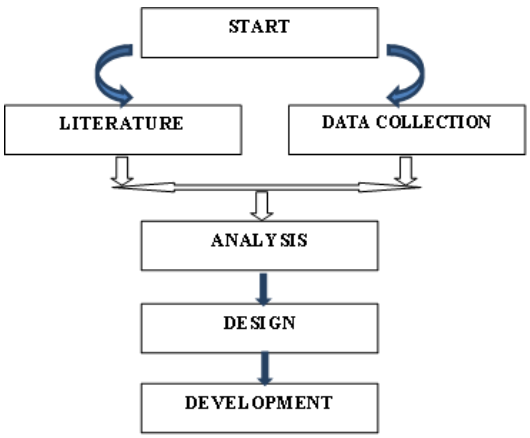

Figure 1: Research Framework

The subjects and objects in this study are teaching materials on building evaluation that has been developed in the Building Evaluation book. The instrument used to collect initial data in this development research was a questionnaire or questionnaire. Questionnaire sheets are used to collect data from the review results to determine the need for teaching materials development on Building evaluation. Furthermore, questionnaires were used to evaluate the validity and practicality of this Building Evaluation book. The method chart for development is shown in the following figure 2.

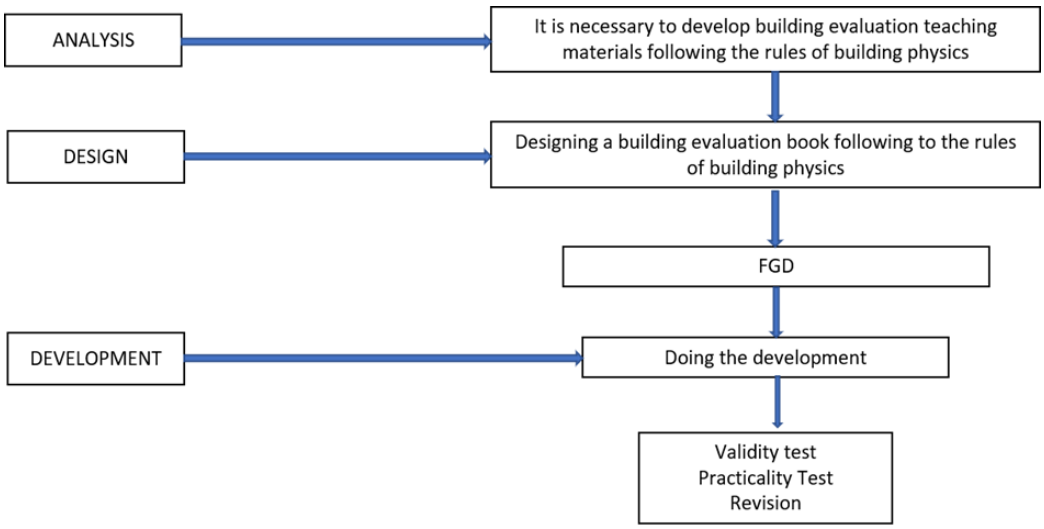

Figure 2: Development Chart Using ADDIE

3. RESULTS AND DISCUSSION

3.1 Building Comfort

Building Physics is an applied science that studies hydrothermal, acoustic, and light properties related to building components (roofs, facades, windows, partition walls, etc.), spaces, buildings, and building installations [4]Mohammad Kholid Ridwan, 2010. This definition means that the purpose of Building Physics is to answer problems related to the influence of the building environment. The building is a significant part of the environment because human activities, as users, occur in the building. All elements in the building have a role in influencing global comfort. Furthermore, [5] Frick 2006, suggested protecting the buildings and their entire surface from solar radiation. Indonesia, located in a tropical environment, receives a high intensity of sunlight which causes high temperatures in buildings if not taken seriously.

The main factors that provide comfort and endurance in humans are temperature, solar radiation, wind speed, humidity, and rainfall. Temperature plays the most significant role and other factors behind it. The human body reacts to hot or cold temperatures by maintaining a constant body temperature. The human nature reaction will be able to accommodate temperatures within a definite range while still feeling comfortable. Thermal comfort will be felt when body heat is in equilibrium with the physical environment, [6]Prasasto Satwiko, 2009. The definition of thermal comfort according to ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) is a "Condition of mind which expresses satisfaction with the thermal environment" (ASHRAE 55-74), in [4] Mohammad Kholid Ridwan, 2010. Concerning human comfort, the

primary function of the building is modifying climate so that it is suitable to human comfort standards.

For comfort, humans regulate natural air circulation, regulate temperature and humidity, control solar radiation, and use thermal insulation. Therefore, it is necessary to create areas of the building that can cause a difference in temperature and air pressure, [7]Heru Subiyantoro, 2008. Based on [8]Karyono 2013, a building is a work of architecture. Three criteria in the building as an architectural work exist: (1) the building is a work of art; (2) the building can make residents feel comfortable; and (3) the building is efficient in energy consumption. Buildings that cannot provide comfort for their occupants need renovation. Therefore, they become comfortable places to live. Buildings that cannot save energy consumption will be more expensive to operate [9]Lina Yuliastina, 2016. Building comfort can be obtained by creating continuity between buildings and their environment or by interaction with nature.

3.2 Teaching Materials Development

Teaching Material Development is a series of processes or activities to produce a learning tool based on existing development theory. There are several design models for developing learning models, one of which is the ADDIE Model. The ADDIE model is one of the learning design models developed by Reiser and Mollenda (1990) in [10]Molenda, Michael, 2015. The ADDIE model is compiled systematically using these development stages: analysis, design, development, implementation, and evaluation. Those stages are abbreviated as ADDIE.

This study uses an R&D (Research and Development) development research approach by adopting the ADDIE development model. The design for the development of this Building Evaluation book goes through a process or stages to produce a development product that refers to the three stages in the ADDIE model. The three stages are the analysis stage, the design stage, and the development stage.

(a). Analysis Stage

The stage is a preliminary stage to find potential problems and needs analysis for students when learning Building Physics. The analysis phase includes observing the need for learning activities and materials in tertiary institutions and adjusting them to standard curriculum content.

(b). Design Stage

At this stage, we are designing a product to support learning, namely designing book material for students to evaluate buildings that meet the principles of Building Physics.

(c). Development Stage

The book developed is validated based on eligibility standards by expert lecturers from the Unimed Faculty of Engineering according to the required field. This stage aims to make the book feasible for students.

4. DEVELOPMENT RESULTS

At the design stage, the Building Evaluation book went through three ways of designing steps: (1) selection of material according to student characteristics and competency requirements, (2) learning strategies, and (3) form of worksheets and evaluation. The selection of material presented in this book is as follows table 1.

Table 1: Building Evaluation book materials

Chapter	*Material*	*Sub-Chapter Materials*
1	Introduction	- Description - Student Prerequisites - Instructions for Using the Building Evaluation Book - Final Learning Objectives - Learning & Competency Achievements - Initial Ability Pretest
2	Learning Activities 1	- Building According to the Rules of Building Physics - Material Description - Task - Worksheet - Evaluation
3	Learning Activities 2	- Existing Building Evaluation Guide - Material Description - Task - Worksheet - Evaluation
4	Learning Activities 3	- Building Redesign Guide According to Building Physics Rules - Material Description - Task - Worksheet - Evaluation
5	Closing	

After making improvements and revisions based on the expert team's input, the next step is to test the validity and practicality of the contents of the Building Evaluation book. An expert team tested the validity and practicality of the book. There were five experts in their fields according to the needs of the research.

Validation tests were carried out on the contents of the Building Evaluation book. The content validity index in this study is the content validity index stated by Aiken with Aiken's V index, [11] Saifuddin Azwar 2013, mentioned that an assessment is declared valid when the criteria for an Aiken's V score is above 0.60. The assessment aspects in validating the contents of the Building Evaluation book include (a) material organizational aspects, (b) writing format aspects, (c) book content aspects, and (d) language aspects. The team of experts was involved as validators in assessing the contents of this book based on their fields of expertise depending on the needs of this research.

The analysis of the contents' validation of the Building Evaluation book shows that the average Aiken's V value is 0.8806. The Aikens' V rating range between 0.80 to 1. The validation results from the expert team for this book are = 0.8806, which means > 0.60. Thus, it can be categorized as valid.

Meanwhile, the practicality test of this Building Evaluation book is reviewed from several aspects of the assessment 1) attractiveness; (2) development process; (3) ease of use; (4) functionality and usability. Based on the practicality test conducted on the Building Evaluation book, the results were declared "Very Practical" with a P (mean) value range of 4.0 to 5.0 with a percentage of 82.86% - 100%.

5. CONCLUSION

Based on the results of the content validation, it was found that the Building Evaluation Book was declared valid and suitable for use and testing. Meanwhile, based on the practicality test results, this Building Evaluation Book was stated to be practical in its use.

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