

## Making Basic Learning Modules for Building Construction Class X Competency in Building Modeling and Information Design Skills

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### ABSTRACT

*This research was motivated by the problems faced, namely not using modules in the Basic Building Construction Basic Course on Elements of Specifications and Characteristics of Building Materials Based on Green Materials and Construction Work, as well as the competence of Class X Building Information Modeling in Building Modeling and Information Design skills. The purpose of this research is to produce products in the form of valid and practical modules. The research method used is Research & Development (R&D) and refers to the Decide, Design, Develop and Evaluate (DDD-E) development model. Based on the results of the study, the percentage of material validity test, media validity test, and practicality test was obtained at 76%, 80% and 89.38% respectively. The conclusion in this study is that the learning modules developed are valid and practical to be used in the learning process of the elements of Specifications and Characteristics of Building Materials Based on Green Materials and Construction Works, as well as Building Information Modeling class X Building Modeling and Information Design Competencies.*

**Keywords:** *Development; Module; Basic Building Construction; Building Information Modelling; Green Building.*

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### INTRODUCTION

Education is any learning experience that takes place in all environments and throughout life and education can be interpreted as teaching held in schools as formal educational institutions. The implementation of vocational education prepares students in various majors [1]. which can later meet the needs of various industries and is able to prepare students to become productive human beings, who can work in their fields of expertise after going through educational programs [2].

Secondary education consists of formal education in the form of Senior High School (SMA), Madrasah Aliyah (MA), Vocational High School (SMK) and Madrasah Aliyah Vocational (MAK) or other equivalent forms [3]. Vocational High School (SMK) is an educational institution that prioritizes graduates to be ready to enter the world of work in accordance with certain fields [4].

SMK Dhuafa Padang is a vocational education institution that organizes expertise programs including Information Design and Building Modeling (DPIB). ADPIB affairs study the planning and implementation of an infrastructure such as buildings, roads and bridges and other infrastructure [5].

DPIB expertise program, students study Basic Building Construction (DDKB) subjects for

class X. The subjects consist of eight learning elements, which include elements of Specifications and Characteristics of Building Materials Based on Environmentally Friendly Materials, Construction Work, and Building Information Modeling. The section that discusses the Specifications and Characteristics of Environmentally Friendly Building Materials and Construction Works studies global issues related to Green building and sustainable buildings, Specifications and Characteristics of Green Material-Based Building Materials, while the Building Information Modeling element discusses the understanding and history of BIM, dimensions and levels of BIM and the use of BIM in the building cycle.

Opinions of DPIB grade X students about the learning experience on the subjects of Specifications and Characteristics of Green Materials Based Building Materials and Construction Works and Building Information Modeling obtained through interviews, students are still adapting to the elements of Specifications and Characteristics of Green Materials Based Building Materials and Construction Work and Building Information Modeling, Because these two elements are new in the independent curriculum. Learning media such as books or modules also do not exist for these two elements at SMK Dhuafa Padang, so students do not have a handle on teaching materials for independent learning and there is no preparation before the learning process accompanied by a lack of references for learning.

As a result of interaction with DDKB subject teachers related to Specifications and Characteristics of Building Materials Based on Green Materials and Construction Works, as well as Building Information Modeling, these elements are new elements in the Basic Building Construction subjects. This element has only been implemented at SMK Dhuafa Padang in the 2023/2024 school year. Students also adapt to both elements of learning.

To understand building materials based on environmentally friendly materials and construction work and Building Information Modeling, learning resources or media that support the learning process are needed. Factors that are predicted to affect student learning achievement are teaching materials, learning media, student abilities, student enthusiasm and motivation, teacher abilities and learning strategies applied by teachers [6].

Learning media is one example of external factors that can be utilized to improve learning efficiency [7]. The use of learning media at the teaching orientation stage will greatly help the effectiveness of the learning process and the delivery of messages and lesson content at that time [8]. The use of learning media in the form of modules is considered to be a good idea in overcoming problems in DDKB subjects, especially in the elements of Specification and Ccharacteristic, B ahan B angunan B based on *Green M*, aterial and Pwork, Kconstruction, and *Building Information Modelling*.

A module is a structured and comprehensive form of learning media, containing a series of learning experiences that are planned and designed to assist students in achieving specific learning objectives. Top of Form Learning using modules has many benefits, learners are responsible for their own learning activities, in addition, learners can learn actively and independently using learning modules. [9]

## **METHOD**

The approach applied in this study is research and development method, also known as Research and Development (R&D) [10]. This study aims not only to create learning modules, but also to evaluate the suitability of Basic Building Construction subject modules, especially

in the aspects of Specifications and Characteristics of Green Material-Based Building Materials, Construction Works, and Building Information Modelling, within the framework of DPIB Expertise Competency. The development model applied in this study is DDD-E (Decide, Design, Develop, Evaluate) [11]. The DDD-E development model consists of three main stages, namely *Decide* (determine) which is the stage of determining program objectives and materials, *Design* (design) which is the stage of designing the program structure, and *Develop* (develop) which is the stage of producing media, there is also an *evaluation* stage carried out at each stage of development [12].

## Research Procedure

### Decide Stage

1. Setting Learning Objectives

The determination of these learning objectives has been determined in accordance with the curriculum that has been set in the Learning Objectives Flow (ATP) Class X of SMK Dhuafa Padang in the aspects of Specifications and Characteristics of Building Materials Based on Environmentally Friendly Materials and Construction Works, as well as Building Information Modeling.

2. The second stage of the researcher determines the theme of the media.

In this study, the module designed was a printed version created through the use of Microsoft Word application. This module serves as a reference guide in the learning process.

3. Developing Prerequisite Capabilities

This module is made so that students can easily use it, easy in the learning process and students are also required to learn independently.

4. Assess Resources

Based on the results of observations made, it is known that in general students do not have learning devices such as modules, books or other teaching materials used during learning. The presence of this module is expected by students to get a handle or reference in learning so as to make students more enthusiastic and interested in the lesson.

### Design Phase

1. Define outline content

This stage is the stage of determining the content of the material made, the content of the material is adjusted to the Flow of Learning Objectives in the school to be studied.

2. Create a flowchart

Making flowcharts has a purpose as a guideline in helping and compiling module creation.

3. Defining the Design Look

This design stage will also design the appearance of the module, the display to be created includes the appearance of the cover (cover), the contents of the module, and the material.

4. Create a Storyboard

Making storyboards is done by entering material into templates that have been created using the Microsoft Word application. The material entered is adjusted to the Learning Objective Flow (ATP) of the subject.

5. Creating Learning Media Validation Instruments

At this stage, researchers create learning media validation instruments to assess the modules made. This research questionnaire consists of media expert questionnaires, material expert questionnaires and practicality test questionnaires.

### **Develop Stage**

1. Validation of Learning Media Validity Questionnaire  
At this stage, researchers validate instruments that have been made at the design stage which will be assessed by questionnaire experts
2. Making Learning Media in the Form of Print Modules  
This stage is the stage of designing or creating modules that are adjusted at the design stage.

This develop stage is the stage of making modules in accordance with the Flowchart and design that has been designed before. This stage also makes various components that make up the module such as drawings needed to explain the material.

### **Evaluate Stage**

The last stage of the DDDE model is evaluate, at this stage, researchers conduct evaluations, namely:

1. Learning Media Validation
  - a. Module Revision  
This stage researchers make improvements to the module in accordance with suggestions and input from media experts and material experts.
  - b. Module Assessment  
Modules that have been improved or revised will then be assessed by media experts and material experts to see the feasibility of the modules made.
2. Media Practicality  
This stage is a test of student response to the module made, questionnaires are given to students after students use the module in the learning process.

### **Time and Place of Research**

The research was conducted in the July – December Semester of the 2023/2024 Academic Year at SMK Dhuafa Padang.

### **Research Subjects**

The research subjects used in this study are three media experts and three material experts as validators (assessors) of learning module products to be made. Then the product practicality test consisted of 26 Class X students majoring in Building Modeling and Information Design of SMK Dhuafa Padang in the July – December 2023 semester.

### **Research Instruments**

The instrument used in this study was a questionnaire. Specifically, this study will use a rating scale type questionnaire [13]. Media experts, material experts, and students will fill out research instruments in the form of questionnaires.

### **Data Analysis Techniques**

This study utilizes statistical analysis techniques because the data obtained from validators and responses are data in the form of numbers [14].

1. Validation Analysis Techniques  
The data obtained from the validation results will be analyzed using the formula:

$$V = \sum s / [n( c - 1 ) ]$$

Information:

V = Instrument Validity

$$S = r - lo$$

r = Figures provided by appraisers

lo = Lowest validity rater numbers

n = Number of Appraisers

c = Highest validity rater number

## 2. Practicality Analysis Techniques

The data generated from filling out questionnaires by students is analyzed using the formula:

$$NP = \frac{S}{SM} \times 100\%$$

Information:

NP = The Value of Practicality

S = Number of scores obtained

SM = Maximum score

## RESULTS AND DISCUSSION

### Results

This research is adjusted to the DDD-E (Decide, Design, Develop, Evaluate) development model as follows:

#### Decide

##### 1. Defining Learning Objectives

Learning objectives have been listed in the Learning Objectives Flow (ATP) of the subject DDKB Class X competence expertise DPIB SMK Dhuafa Padang.

##### 2. Determining the Theme and Scope

The application used in this study is the Microsoft Word application as an application for designing modules. The material used in this module is elements of Specifications and Characteristics of Building Materials Based on Green Materials and Construction Works: Global issues related to green building and sustainable building, specifications and characteristics of building materials based on Green materials, while elements of Building Information Modelling: Understanding and history of BIM, dimensions and levels of BIM and the use of BIM in the building cycle.

##### 3. Developing Prerequisite Capabilities

Through observations at SMK Dhuafa Padang, information was obtained that DPIB grade X students can learn independently both at school and at home using modules as learning media.

##### 4. Assess Resources

After making observations at SMK Dhuafa Padang, it is known that grade X students of DPIB SMK Dhuafa Padang do not have modules or books as learning resources both at school and at home

#### Design

##### 1. Define outline content

The content of the material is adjusted to the Flow of Learning Objectives in the school to be studied.

##### 2. Create a flowchart

This stage is carried out to describe the sequence and structure of research carried out in the form of a flowchart.

##### 3. Defining the Module View

Design the appearance or template first which will be used by designing using the Microsoft Word application.

##### 4. Create a Storyboard



Making storyboards is done by inserting material into templates that have been made using the Microsoft Word application.

**Develop**

This development process is the step of creating modules based on the workflow and design that has been prepared at the design stage.

**Evaluate**

In this phase, researchers evaluate through the process of media validation, material validation, and practical testing of the module. Data on the results of media validation testing by three media expert lecturers can be seen in Table 1.

Table 1. Media Expert Product Validation

Aspects	Material Expert			S1	S2	S3	Σs	N(C-1)	V	Category
	1	2	3							
<b>Format</b>	7	6	6	5	4	4	13	18	0,72	Valid
<b>Organization</b>	19	17	19	14	12	14	27	36	0,75	Valid
<b>Attraction</b>	20	24	20	14	18	14	46	54	0,85	Highly Valid
<b>Font Shape and Size</b>	14	12	13	10	8	9	46	54	0,85	Highly Valid
<b>Blank Space Space</b>	10	10	9	7	7	6	20	27	0,74	Valid
<b>Consistency</b>	17	17	17	12	12	12	36	45	0,80	Highly Valid
<b>Final Results</b>	87	86	84	62	61	59	188	234	0,80	Highly Valid

Based on the results of the media validation calculations that have been carried out, namely with the level of achievement of the three results obtained, an average of 80% is obtained. So it can be concluded that the resulting module product falls into the very valid category.

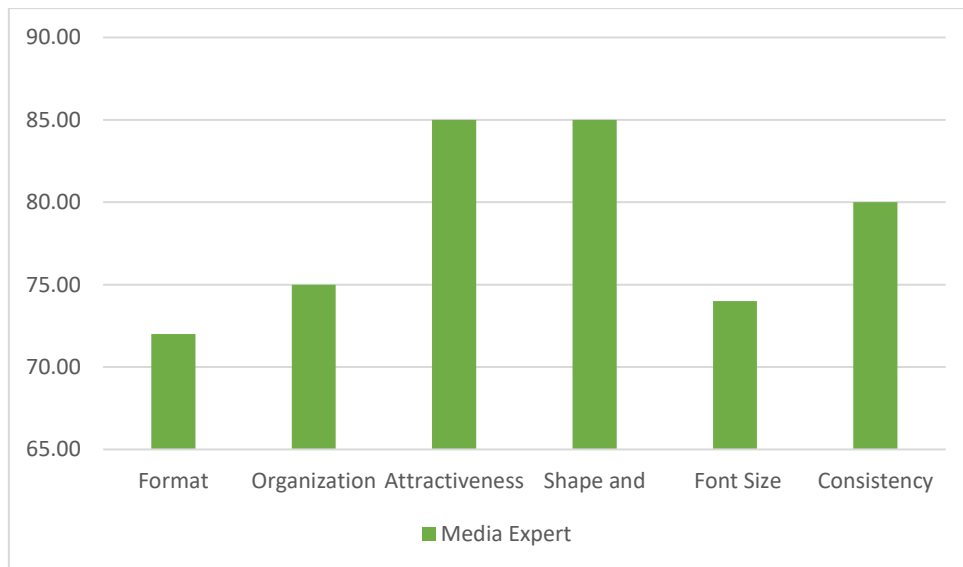


Figure 1. Validation Test Results by Media Experts

The results of material validation testing conducted by 3 DDKB subject matter experts can be seen in Table 2.

Table 2. Material Expert Product Validation

Aspects	Material Expert			S1	S2	S3	Σs	N(C-1)	V	Category
	1	2	3							
Self Instruction	26	28	26	19	21	19	59	77	0,77	Valid
Self Contained	11	12	12	8	9	9	26	33	0,79	Valid
Stand Alone	7	6	7	5	4	5	14	22	0,64	Valid
Adaptive	7	8	8	5	6	6	17	22	0,77	Valid
User Friendly	7	8	8	5	6	6	17	22	0,77	Valid
<b>Final Results</b>	<b>58</b>	<b>62</b>	<b>61</b>	<b>42</b>	<b>46</b>	<b>45</b>	<b>133</b>	<b>176</b>	<b>0,76</b>	<b>Valid</b>

Based on the results of the material validation calculations that have been carried out, namely with the level of achievement of the three material experts, the results obtained are obtained on average 76%. So it can be concluded that the resulting module product falls into the valid category.

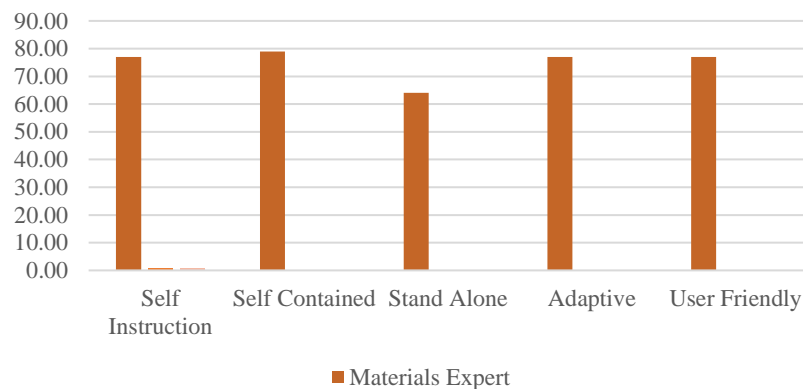


Figure 2. Validation Test Results by Material Experts

The results of the practicality test for all grade X students of Competence in Modeling Design Expertise and Building information of SMK Dhuafa Padang as many as 26 students, can be seen in Table 3.

Table 3. Product Practicality

No	Practical Aspect	S	BC	Persentse	Category
1	Display	657	728	90,25	Very Practical
2	Ease of Use	642	728	88,19	Very Practical
3	Module Expediency	839	936	89,64	Very Practical
Final Results		2138	2392	89,38	Very Practical

Based on the results of calculations that have been carried out, namely with a percentage of 89.38%, so it can be concluded that module products fall into the very practical category.

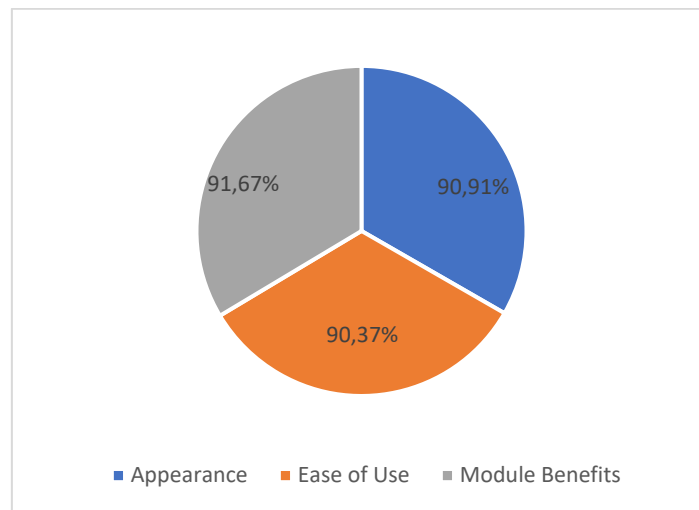


Figure 3. Practicality Results Diagram

### Discussion

The result resulting from this study is a printed module for the subject Fundamentals of Building Construction class X, focusing on the competence of Building Modeling and Information Design expertise. In this subject, two elements are taken/discussed, namely, the first element of Specifications and Characteristics of Building Materials Based on Green Materials and Construction Work, the second element Building Information Modelling. This research is adjusted to the DDD-E (Decide, Design, Develop, Evaluate) development model.

Based on the results of the entire research, it can be seen that the validity test conducted by media expert validators on the media assessment aspect obtained a value of 80% with very valid criteria, and material expert validators on the material assessment aspect obtained a value of 76% with valid criteria. Furthermore, based on the results of the practicality test, it obtained a value of 89.38% with very practical criteria.

### CONCLUSION

Based on the findings of the research results, it was concluded that the learning module Basics of Building Construction for Class X, on the Competency of Building Modeling and Information Design Expertise, proved valid and practical to be used in the learning process. These conclusions are based on evaluations conducted by media experts, material experts, and students.

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