

# Design and Validation of Lesson Plan Development in Materials Technology Courses with an Outcome-Based Education Approach

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## ABSTRACT

The realization of World Class University is included in the Indonesian government program. The first step to achieve equality in the quality of National and International Education is to adopt the existing curriculum with Outcome-based Education (OBE) principles. The OBE principle is a reference for assessing academic service appraisal institutions at the international level. Therefore, this research was conducted as the first step in achieving equality in the quality of international level in the Department of Engineering, Faculty of Engineering, Universitas Negeri Medan. This research involved 7 validator from public and private institution and practice professional. This research using 12 aspects as an indicator to assess the achievement of OBE approach are completeness of the Semester Study Plan elements, clarity of learning plan writing, courses learning outcomes achievement to study program graduates', measurable of Courses Learning Outcomes description, the alignment of Courses Learning Outcomes with the material and learning model used, the used of Higher Order Thinking Skill (HOTS), the conformity for estimates time allocation with the activities carried out, the use of the language understanding and clearness. The results showed that the lesson plan of materials technology course had reached outcome-based education approach.

**Keywords:** *Outcome-based education, Design and validation, Lesson plan, Technology course.*

## 1. INTRODUCTION

Assessment of the quality of education in a university is regulated in Ministerial Regulation Number. 3 of 2020 which is listed in the National Higher Education Standards. The current government prioritizes equalizing the quality of education in Indonesia with several other countries. The rules of the Chamber of Commerce and Industry state that the target for the absorption of graduates is national and international. The average absorption of graduates in Indonesia is only around 40%, for this reason it is necessary to equalize the quality of education in higher education, namely improving the quality of human resources, curriculum management and infrastructure [1]. Currently, the Indonesian government has prepared the The Indonesian National Qualifications Framework Independent Learning-Independent Campus

(MBKM) curriculum which aims to improve the quality and relevance of higher education graduates.

The Department of Building Engineering Education has implemented the The Indonesian National Qualifications Framework, Independent Learning-Independent Campus curriculum, but there are several obstacles related to the deepening of Courses Learning Outcomes that must be adjusted to the competency needs of the business and industrial world through link and match. This is in accordance with the results of observations which show that the determination of Courses Learning Outcomes at Semester Lesson Plan is still in the Good category although it is still necessary to revitalize courses learning outcomes in the Department of Building Engineering in order to achieve graduate competency standards.

Universitas Negeri Medan has a vision that is to become a World Class University, and in order for this vision to be achieved, several improvements are needed, including the Courses Learning Outcomes revitalization program. This vision is actually the vision of the Indonesian Government Program as regulated in Ministry of Education and Culture Number 754/P/2020 concerning Main Performance Indicators of State University and Higher Education Service Institute [2].

One of the first steps in realizing equality in the quality of education is the principle of Outcome-based education (OBE). This OBE principle focuses on learning outcomes, curriculum design based on outcomes, alignment between the assessments of the learning process and learning outcomes, creating a conducive learning environment and implementing the PDCA (Plan, Do, Check, Act) cycle [3]. This principle is a reference for assessing academic service appraisal institutions at the international level. Therefore, this article is the first step in achieving quality equality at the international level in the Department of Building Engineering Education, Faculty of Engineering, and Universitas Negeri Medan.

This study aims to find out how to develop OBE-based Course Learning Outcomes in theoretical subjects in the Department of Building Engineering and to design the substance of the OBE-based Semester Study Plan in the Department of Engineering Education based on OBE principles.

This research is a research design of OBE-based learning outcomes in theoretical subjects that will contribute to special colleges in the Department of Building Engineering Education in revitalizing the substance of the OBE-based Semester Learning Plan so that it becomes the first step for study programs in applying for recognition at the international level through international accreditation. In addition, this research can also be the basis for the development of Course Learning Outcomes in universities with the OBE paradigm. Outcome-based education begins with a clear picture of the main abilities that can be done by study program graduates. The concepts and principles of Education based on learning outcomes are:

**1.1. Focusing on learning outcomes**

The formulation of learning outcomes begins with the learning outcomes of graduates at the study program level to be reduced to learning outcomes for subjects.

**1.2. Achievement-based curriculum design**

The curriculum is prepared by determining learning outcomes first and then setting the model and assessment system. Next, design the learning process.

**1.3. Alignment between assessment, learning process, and learning achievement**

There needs to be a constructive alignment between the assessment and learning process with the established Courses Learning Outcomes. The alignment process can use a mapping between the assessment and Courses Learning Outcomes and between the learning process and Courses Learning Outcomes.

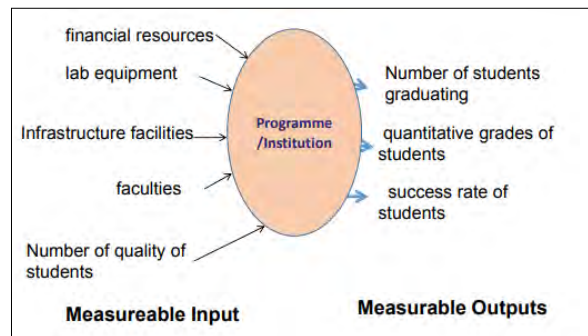
**1.4. Creating a conducive learning environment**

A conducive learning environment in the learning process includes the diversity of learning resources, materials that follow the development of knowledge and technology, as well as adequate facilities both in terms of quantity and quality.

**1.5. Application of the P-D-C-A cycle**

There is a continuous process from planning, implementation, monitoring, to development. In this case, the quality assurance agency has a role in ensuring the cycle.

The National Accreditation Board for Higher Education, figure 1 explains the concept of OBE-based Semester Lesson Plan.



**Figure 1** Semester Lesson Plan based on OBE.

In essence, OBE integrates a number of processes including curriculum design, process assessment and teaching and learning methods that focus on what students can do. OBE emphasizes that learning outcomes can be met in terms of knowledge, skills and attitudes according to social, economic and academic cultural conditions [4].

**2. METHOD**

The research was conducted in the even semester of 2020/2021 on theoretical subjects in the field of building engineering. The type of this research is research and development. According to Aminah and Candra [5] that research and development is a process or steps to develop a product or improve an existing product. The research

and development used to produce certain products and test the effectiveness of these products with the aim of producing new products through the development process [6]. There are 4 stages in the ADDIE model development research, namely the analysis, design, development, implementation, and evaluation stages. Figure 2 showed the procedure of development an OBE-based on Semester Lesson Plan.

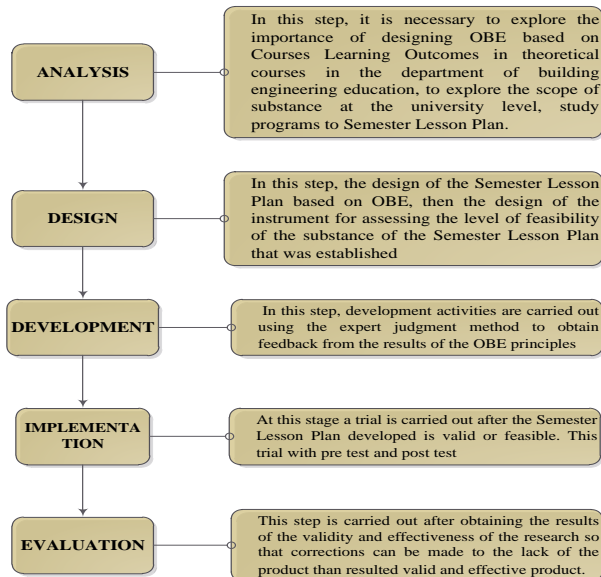


Figure 2 Flow Chart Development of Semester Lesson Plan.

### 3. VALIDITY TEST

The test that is answered to have student learning outcomes is a test that has been tested for validity. To test the validity of the test, use the formula of Biserial Point Correlation [6] with the following formula:

$$r_{pbi} = \frac{Mp - Mt}{SDt} \sqrt{\frac{p}{q}} \quad (1)$$

Information:

- Rpbi = biserial point correlation coefficient
- Mp = Mean score of the subjects that answered correctly the item that was looking for correlation
- Mt = Mean total score (Average score of all test takers)
- SDt = Standard deviation total score
- P = Proportion of Subjects who answered the item correctly
- Q = 1- p

To find the value of p:

$$P = \frac{\text{(The total number of students who answered correctly)}}{\text{(The total number of students)}} \quad (2)$$

To find the value of Mt:

$$Mt = \frac{\sum Xt}{N} \quad (3)$$

To find the value of SDt:

$$SDt = \sqrt{\frac{\sum Xt^2}{N} - \left(\frac{\sum Xt}{N}\right)^2} \quad (4)$$

Because if  $r_{count} > r_{table}$  then the instrument is valid, otherwise if  $r_{count} < r_{table}$  it means the question is invalid, then the question must be revised or not used. Table 1 showed the score interpretation of validation [7].

Table 1 Score Interpretation of Validation.

Interval	Category	Explanation
$3.5 \leq V \leq 4.0$	Very Worthy	Can be continued without revision
$2.9 \leq V \leq 3.4$	Worthy	Can be continued with revision
$3.5 \leq V \leq 4.0$	Less Worthy	Can be continued with many revisions
$2.9 \leq V \leq 3.4$	Not Feasible	Can not be continued

### 4. RESULTS AND DISCUSSION

In the analysis step, a search is carried out on the importance of designing an OBE-based Courses Learning Outcomes in a theoretical course in the Department of Building Engineering Education. Conducting exploration of the scope of substance at the university level, study program to Semester Lesson Plan. The results of analysis, this building engineering study program conducted a focus group discussion (FGD) to analyze the importance of preparing an OBE-based on Semester Lesson Plan.

In the design step of Semester Learning Plan based on OBE (Table 2), then designs an instrument for assessing the feasibility level of the Semester Learning Plan substance that is built. In this step, the building engineering study program has developed an instrument to measure the feasibility of an OBE-based on Semester Learning Plan.

Table 2 The Instruments of Design Stage.

Number	Aspects
1	Completeness of Semester Learning Plan (identity, learning objectives, material, methods, learning activities, learning resources, and assessments)
2	Clarity of Semester Learning Plan writing (numbering, type, and font size)
3	Courses Learning Outcomes with the achievement of study of graduates of the Study Program

4	Course Learning Outcomes description at Course Learning Outcomes can be measured or observed
5	Course Learning Outcomes alignment with learning material.
6	Course Learning Outcomes alignment with models/learning methods used.
7	Course Learning Outcomes alignment with the form of assessment and evaluation
8	Course Learning Outcomes has a high-level thinking taxonomy
9	Conformity for estimates of time allocation with activities carried out
10	The use of language is in accordance with a good and correct Indonesian rule
11	The language used does not cause a double understanding
12	The language used short and clear

In the year of development, it was carried out using the Expert Judgment (Table 3) method to obtain from the principal expert; this stage was carried out by distributing questionnaires to OBE experts to receive the results of the assessment. The following is the answer to experts related to Semester Learning Plan based on OBE. Based on Table 3, it is known on average the team of experts

assesses both the assessment instrument of OBE-based Semester Learning Plan.

At the implementation stage, the Semester Learning Plan trial was conducted by applying the level of validity of the instrument that was assessed by experts (Table 4).

At the evaluation stage, Course Learning Outcomes using OBE approach is evaluated against the effectiveness of assessment and validity. This OBE-based Course Learning Outcomes is considered quite good and effective because OBE has several principles as follows [8]:

#### **4.1. Focusing on learning achievements**

The formulation of learning achievements began with graduate learning achievements at the study level to be reduced to become the achievement of courses learning.

#### **4.2. Designing curriculum based on achievements**

The curriculum is arranged by setting learning achievements first then set the model and system assessment. Furthermore, design the learning process. A job between assessment, learning processes, and learning achievements.

**Table 3** Expert Assessment.

Aspects	Validator							Mean	Result
	1	2	3	4	5	6	7		
Completeness of Semester Learning Plan (identity, learning objectives, material, methods, learning activities, learning resources, and assessments)	5	5	5	4	5	4	5	4.71	Very Good
Clarity of Semester Learning Plan writing (numbering, type, and font size)	5	5	5	5	5	4	4	4.71	Very Good
Courses Learning Outcomes with the achievement of study of graduates of the Study Program	4	5	5	4	4	5	4	4.43	Very Good
Course Learning Outcomes description at Course Learning Outcomes can be measured or observed	4	5	5	4	5	5	4	4.57	Very Good
Course Learning Outcomes alignment with learning material.	4	5	5	4	5	4	4	4.43	Very Good
Course Learning Outcomes alignment with models/learning methods used.	5	5	4	5	5	4	3	4.43	Very Good
Course Learning Outcomes alignment with the form of assessment and evaluation	4	5	5	5	5	4	3	4.43	Very Good
Course Learning Outcomes has a high-level thinking taxonomy	5	5	4	4	5	5	3	4.43	Very Good
Conformity for estimates of time allocation with activities carried out	4	5	4	5	3	5	4	4.29	Very Good
The use of language is in accordance with a good and correct Indonesian rule	4	5	5	5	5	4	4	4.57	Very Good
The language used does not cause a double understanding	5	5	4	5	5	4	3	4.43	Very Good
The language used short and clear	5	5	5	5	5	4	3	4.57	Very Good

**Table 4** Validity Test.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Result
<b>1</b>	103.2857	102.238	0.519	0.763	Valid
	103.2857	94.905	0.791	0.738	Valid
<b>3</b>	103.5714	98.952	0.322	0.753	Valid
<b>4</b>	103.4286	96.952	0.516	0.746	Valid
<b>5</b>	103.5714	95.619	0.647	0.741	Valid
<b>6</b>	103.5714	89.952	0.810	0.723	Valid
<b>7</b>	103.5714	88.619	0.907	0.718	Valid
<b>8</b>	103.5714	91.952	0.669	0.731	Valid
<b>9</b>	103.7143	101.905	0.612	0.766	Valid
<b>10</b>	103.4286	94.952	0.713	0.739	Valid
<b>11</b>	103.5714	89.952	0.810	0.723	Valid
<b>12</b>	103.4286	88.619	0.907	0.718	Valid
<b>Total</b>	54.0000	25.667	1.000	.866	

### 4.3. Constructive harmony

Constructive harmony is needed between the assessment and learning process with the established Course Learning Outcomes. Alignment process can use mapping between assessments with Course Learning Outcomes and between the learning process with Course Learning Outcomes.

### 4.4. Creating a conducive learning environment

The conducive learning environment in the learning process includes the diversity of learning resources, the material that follows the development of knowledge and technology, as well as maintained facilities in terms of number and quality.

### 4.5. Application of P-D-C-A Cycle

There is a continuous process ranging from planning, implementing, monitoring, to its development. In this case the Quality Assurance Institution has a role in guaranteeing the cycle [8].

This OBE is considered very effective, because it has several advantages rather than the usual Semester Learning Plan, this result was similar to Darmalaksana [9] with the title of implementation of the RPKPS Research Methods OBE-based research methods on the SKL and the Bachelor of the Bachelor of the Hadith Sciences study program revealed the evaluation results from the OBE-based RPCS applied for 1 semester. The method of this research is qualitative through literature studies. This study concluded that the successful implementation of OBE-based RPKPS was played greater by the readiness factor of the study and the implementation of the feedback on the stages of student training results which was oriented to improve the quality of the final training results. This study recommends the preparation of the OBE-based Semester Learning

Activity Program Plan in curriculum program courses in the PTKI environment.

This is result was similar to Alimudin [10] with a strategy to develop student learning achievements through the internalization of university values by mapping the basic character of students and educational assessments, directing them to the expected learning outcomes of the graduate learning achievement derivative. Study program; providing and spiritual students; maintain good communication between students with lecturers during the learning process; and do edutainment learning methods with a clear and transparent assessment system. The research method used is a participatory study. Table 5 showed the comparison of normal Semester Lesson Plan and OBE Semester Lesson Plan.

**Table 5** Comparison of non-OBE Semester Lesson Plan and OBE Semester Lesson Plan.

Non-OBE	OBE
<ul style="list-style-type: none"> <li>• Focus on Learning Materials</li> <li>• Curriculum Design based on Learning Materials</li> <li>• Course Learning Outcomes and Process sometimes don't align</li> <li>• Not based on Learning Environment/Academic Atmosphere</li> <li>• Not PDCA cycle but still focused on learning materiall.</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on learning outcomes</li> <li>• Outcome-based curriculum design</li> <li>• Alignment of CPMK and Learning Process</li> <li>• Creating a conducive learning environment</li> <li>• Application of the P-D-C-A . cycle</li> </ul>

## 5. CONCLUSION

Based on the results and discussion, it can be concluded that the Outcome Base Education approach in Semester Lesson Plan validation is feasible to be developed because it has a very feasible validation level so that the building engineering department can implement this Semester Lesson Plan for curriculum development in the future.

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