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

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**Abstract.** World recognition of a university can be obtained through collaboration of higher education tridharma activities or by submitting an assessment by an international accreditation agency.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 Output 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 Engieneering, Medan State University. This research involved 7 higher education institutions, both public and private. The results showed that based on the completeness of the Semester Study Plan elements consisting of identity, learning objectives, lecture materials, methods, learning activities, learning resources and assessments, 71.4% of respondents stated that they were very good. Based on the alignment of course learning outcomes with study program graduates' learning outcomes, there were 51.1% of respondents answered good. Then, 57.1% of respondents stated or rated very good the description of Courses Learning Outcomes in Semester Lesson Plan could be measured. The alignment of Courses Learning Outcomes with the material is also considered good (57.1%). The alignment of Courses Learning Outcomes with the learning model used is also considered very good with score of 57.1%. Respondents also rate very good (57.1%) towards Courses Learning Outcomes which has a Higher Order Thinking Skill (HOTS). This semester lesson plan is also considered good by the respondents regarding the suitability of the estimated time allocation with the activities carried out. In the use of the semester lesson plan language, it was considered very good by the respondents (57.1%).

# Backgorund

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.

Medan State University 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 Output 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 Medan State University.

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.

*Output 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:

a. 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.

b. 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.

c. 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.

d. 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.

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 OBE implementation steps are as follows:

a. Planning

In the planning phase, it is necessary to adjust the Vision, Mission, and Values ​​which are the achievement targets at the University level to reduce the profile of study program graduates accompanied by performance indicators and curriculum mapping. Then the lecturer prepares Semester Lesson Plan according to the profile of the study program graduates whose substance includes Courses Learning Outcomes syllabus description, learning methods, IT support. and scoring system.

Furthermore, it is necessary to carry out an external assessment of the scope of the substance to obtain feedback from external parties.

b. Implementation

At the implementation stage, pay attention to several things, namely learning methods, learning materials, diversity of learning resources, and facilities.

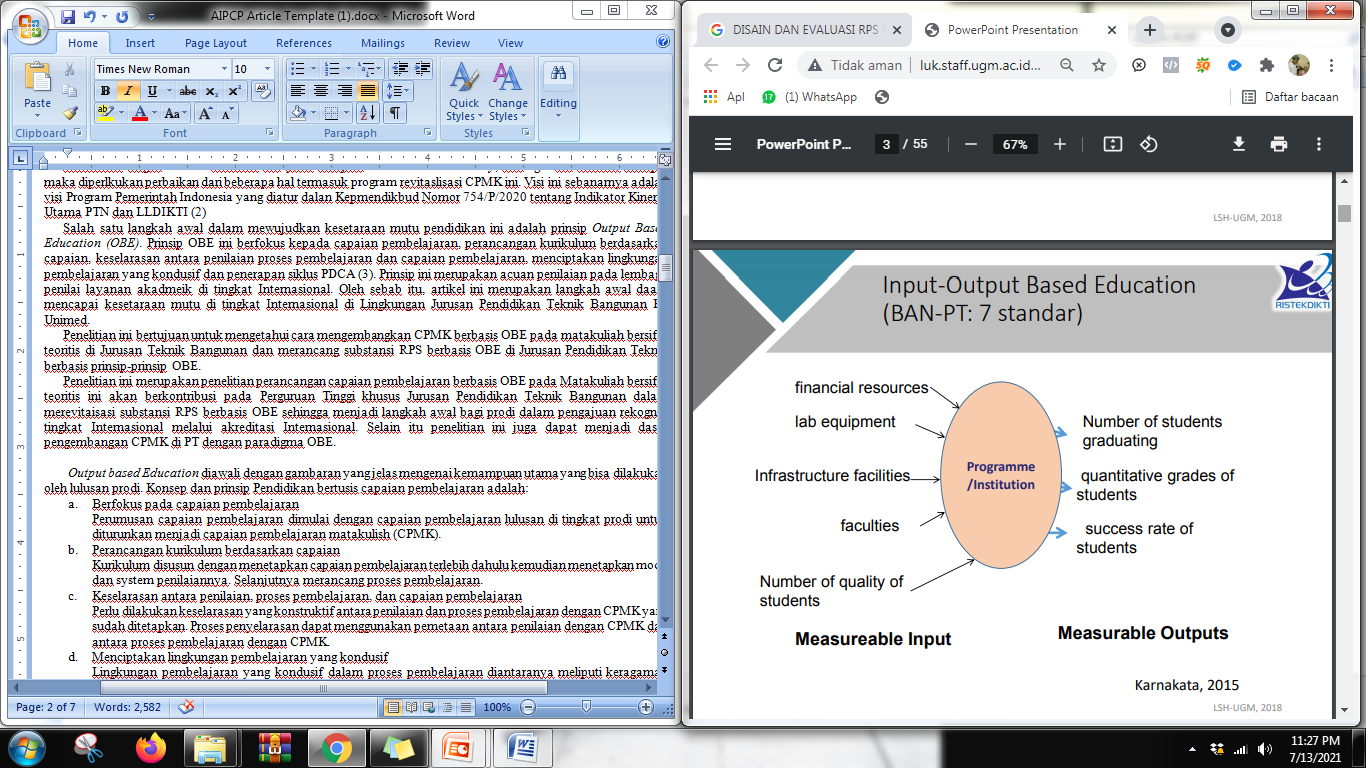
c. Monitoring and Evaluation

Monitoring and evaluation activities are carried out on a scheduled and frequent basis. The Monev uses a good instrument to evaluate the suitability of the designed plan with the implementation.

d. Sustainable development

Furthermore, based on the results of monev, it is hoped that development will occur for the direction of goodness through recommendations from money results.

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].

## RESEARCH METHODOLOGY

The research was conducted in the even semester of 2020/2021 on theoretical subjects in the field of building engineering. This research is research and development using the *four-d* model developed by Thiagarajan and Semmel [5]. 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.

In this step, it is necessary to explore the importance of designing OBE based on Courses Learning Outcomes in theoretical courses in the department of building engineering education, to explore the scope of substance at the university level, study programs to Semester Lesson Plan.

**Design**

In this step, the design of the Semester Lesson Plan based on OBE, then the design of the instrument for assessing the level of feasibility of the substance of the Semester Lesson Plan that was established

**Development**

In this step, development activities are carried out using the expert judgment method to obtain feedback from the results of the OBE principles

**Implementation**

At this stage a trial is carried out after the Semester Lesson Plan developed is valid or feasible. This trial with pre test and post test

**Evaluation**

This step is carried out after obtaining the results of the validity and effectiveness of the research so that corrections can be made to the lack of the product than resulted valid and effective product.

**Figure 2.** Flow Chart Development of Semester Lesson Plan

**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:

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= (The total number of students who answered correctly)

(The total number of students)

To find the value of Mt :

To find the value of SDt :

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

**Tabel 1.** Score Interpretation of Validation

|  |  |  |
| --- | --- | --- |
| Interval | Category | Explanation |
| 3,5 < V < 4,0 | Very Worthy | Can be continued without revision |
| 2,9 < V < 3,4 | Worthy | Can be continued with revision |
| 3,5 < V < 4,0 | Less Worthy | Can be continued with many revisions |
| 2,9 < V < 3,4 | Not Feasible | Can not be continued |

**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 ( 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 languaged used short and clear |

In the year of development, it was carried out using the Expert Judgment (Table 3) method to obtain from the principle 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.

**Tabel 3.** Expert Assessment

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Aspects | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Mean | Result |
| 1 | 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 |
| 2 | Clarity of Semester Learning Plan writing (numbering, type, and font size) | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4.71 | Very Good |
| 3 | Courses Learning Outcomes with the achievement of study of graduates of the Study Program ( Study Program) | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 4.43 | Very Good |
| 4 | Course Learning Outcomes description at Course Learning Outcomes can be measured or observed | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 4.57 | Very Good |
| 5 | Course Learning Outcomes alignment with learning material. | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4.43 | Very Good |
| 6 | Course Learning Outcomes alignment with models/learning methods used. | 5 | 5 | 4 | 5 | 5 | 4 | 3 | 4.43 | Very Good |
| 7 | Course Learning Outcomes alignment with the form of assessment and evaluation | 4 | 5 | 5 | 5 | 5 | 4 | 3 | 4.43 | Very Good |
| 8 | Course Learning Outcomes has a high-level thinking taxonomy | 5 | 5 | 4 | 4 | 5 | 5 | 3 | 4.43 | Very Good |
| 9 | Conformity for estimates of time allocation with activities carried out | 4 | 5 | 4 | 5 | 3 | 5 | 4 | 4.29 | Very Good |
| 10 | 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 |
| 11 | The language used does not cause a double understanding | 5 | 5 | 4 | 5 | 5 | 4 | 3 | 4.43 | Very Good |
| 12 | The languaged used short and clear | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 4.57 | Very Good |

From table 3, it is known on average the team of experts assesses both the assessment instrument of OBE-based Semester Learning Plan. The average value criteria of the aspects above are as follows:

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).

**Table 4.** Validity Test

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

At the evaluation stage, Course Learning Outcomes OBE 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] :

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.

1. 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.

1. 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.
2. 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.

e. 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 parstipatory 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 |
| * Focus on Learning Materials * Curriculum Design based on Learning Materials | * Focus on learning outcomes * Outcome based curriculum design |
| * Course Learning Outcomes and Process sometimes don't align | * Alignment of CPMK and Learning Process |
| * Not based on Learning Environment/Academic Atmosphere * Not PDCA cycle but still focused on learning materiall. | * Creating a conducive learning environment * Application of the P-D-C-A . cycle |

# CONCLUSION

Based on the results and discussion, it can be concluded that the Outcome Base Education-based 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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