Approach and engineering assessment of automotive vocational engineering

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Abstract. This study aims to identify approaches and assessment techniques that are appropriate for vocational courses in Automotive Engineering. This research is a quantitative research with survey method. The respondents of this study were 150 alumni of the Faculty of Engineering Universitas Negeri Yogyakarta who had worked in the automotive field. Data were collected through a questionnaire, then analyzed with descriptive analysis techniques. The results showed that the most widely considered appropriate, namely, 1) assessment approach: assessment for learning (theoretical & practical courses); 3) attitude assessment techniques: observation techniques by lecturers; 4) knowledge assessment techniques: written test; 5) skills assessment techniques: assessment of practice.

1. Introduction
The learning and assessment process is important in higher education operations to produce quality graduates. The learning process that is applied needs to be adjusted to the needs of the world of work both the model applied and the substance of the material. Especially in the automotive field, technology is developing rapidly so that the material presented needs to be developed regularly to reduce disparities with the world of work.

There are four main things that need to be mastered by students in the 21st century, namely Creativity, Critical Thinking, Communication, and Collaboration [1]. Therefore, both the learning model and the assessment approaches and techniques used must be appropriate. The learning activities in the educational institutions should be able to facilitate students to have these abilities. In addition approaches and assessment techniques used must be able to ensure the abilities of students in accordance with the needs of the workforce.

Assessment in the learning process is essential. Assessment in learning in accordance with current conditions according to the OECD viz “tests should evaluate the student’s deeper conceptual understanding, the extent to which their knowledge is integrated, coherent, and contextualized – instead of focusing on the memorization of facts” [2]. Where the assessment carried out must be able to evaluate students' deeper conceptual understanding, the extent to which their knowledge is integrated, coherent, and contextualized - not just focusing on memorizing facts. Joughin, G. convey the function of assessment includes, 1) supporting the learning process; 2) assessing student achievement in relation to course requirements; 3) maintain professional or disciplinary standards that are being prepared by students [3].

There are three types of learning assessment approaches, namely assessment of learning, assessment for learning, assessment as learning [4]. The assessment of learning approach is carried out
after the learning process is complete. The completed learning process does not always occur at the end of the semester or at the end of the student completing all education in tertiary institutions. Lecturers conduct assessments intended to provide recognition of the achievement of learning outcomes after the learning / lecture process is complete. An example of this form of assessment approach is the Midterm Examination (UTS), End of Semester Examination (UAS), and various other forms of summative assessment.

The assessment for learning approach is carried out during the learning process. With assessment for learning lecturers can provide feedback on student learning processes, monitor progress, and determine the progress of their learning. An example of this form of assessment approach is formative assessment, for example assignments, presentations, projects, including quizzes. Assessment for learning is identical to formative assessment where the assessment is designed to give teachers and learners important information about learning needs, help students assess their progress towards learning objectives, and guide teachers to vary their teaching according to their needs and goals [2]. Where this assessment emphasizes not only to test the ability of students but to help them assess their own learning progress. Besides the characteristics of assessment for learning that is providing feedback on assessment to students [5].

The assessment as learning assessment approach has a function similar to assessment for learning, which functions as formative and is carried out throughout the learning process. The difference, assessment as learning actively involves students in the assessment activities. Students are given the experience to learn to assess themselves. In addition, students can also be involved in formulating assessment procedures, criteria, or rubrics / assessment guidelines so that they know exactly what needs to be done in order to obtain maximum learning outcomes. An example of this approach to assessment is self-assessment and peer-to-peer evaluation.

The domains of competence are divided into three namely affective (attitude), cognitive (knowledge), and psychomotor (skills). The techniques used to carry out these three competency domains differ from one another. Where attitude assessment can be done in three ways namely, 1) Observation of lecturers; 2) Self-assessment; 3) Assessment between friends. The assessment of the knowledge domain follows Bloom’s revised Taxonomy by Lorin Anderson and David Krathwohl where the knowledge domain is a combination of knowledge dimensions classified into factual, conceptual, procedural, and metacognitive dimensions of cognitive processes that are hierarchically arranged starting from remembering (remembering), understanding (understanding), applying (applying), analyzing (analyzing), assessing (evaluating), and creating (creating). The domain of knowledge assessment techniques consist of, 1) Written test; 2) Oral test; 3) Assignment [6].

Skills assessment is an assessment conducted to measure the ability of students to apply knowledge in carrying out certain tasks in various contexts in accordance with indicators of competency achievement. Skills assessment can be done with a variety of techniques, including assessment of practice, product assessment, project appraisal, and portfolio assessment. Three recurring emphases in the literature on assessment for enhancing learning are (a) clarity in illuminating standards that may articulate the gap between what was achieved and what can be gained, (b) the importance of assessment design in prompting and sustaining students’ desired learning, and (c) giving students feedback that enables them to improve their learning [7].

2. Methods

This research is a quantitative research with survey method. It was conducted from February 2019 to June 2019. The alumni and users of graduates of the Automotive Engineering Education Department Universitas Negeri Yogyakarta were targeted as the participants of the study.

The research data collection technique used a questionnaire. The questionnaire distribution and return mechanism is implemented manually and utilizes Google forms. This is done because most of the graduates who have worked in the field are spread throughout Indonesia so as to facilitate the use of information technology. Data analysis technique used is descriptive analysis technique (percentage) to facilitate the presentation and interpretation of research data obtained.
3. Results and Discussion

3.1. Approach to Assessment of Theory Courses

Assessment in the lecture process has three approaches, namely assessment as learning, assessment for learning and assessment of learning. Based on the results of the study, the average theory of respondents focused on the assessment approach to learning and assessment of learning. The assessment for learning assessment approach focuses on the assessment carried out during the learning process. With assessment for learning lecturers can provide feedback on student learning processes, monitor progress, and determine the progress of their learning. As an example of this form of assessment such as assignments, presentations, projects, including quizzes. This assessment approach is considered effective to improve student learning achievement because the assessment is carried out continuously with various methods. This is in line with Wiliam, D., who states that assessment for learning is one type of assessment that is effective for improving student achievement [8].

Assessment approach to assessment of learning means the assessment carried out to assess the results or learning outcomes obtained by students during the lecture process. Lecturers conduct assessments intended to provide recognition of the achievement of learning outcomes after the learning / lecture process is complete.

The assessment for learning assessment approach is considered the most appropriate for courses in the fields of engine, chassis, electricity, body, design, and motorcycle, while the assessment of learning approach is considered most appropriate for courses in the basic fields of automotive, heavy equipment, vehicle diagnosis, and regulation and management.

Table 1. Approach assessment in theory courses

| No | Field Theory Courses                | Assessment Approach (%) |
|----|------------------------------------|-------------------------|
|    |                                    | Assessment as Learning  | Assessment for Learning | Assessment of Learning |
| 1  | Field of Basic Automotive           | 29                      | 53                      | 66                      |
| 2  | Field of Engine                    | 26                      | 60                      | 56                      |
| 3  | Field of Chassis                   | 22                      | 61                      | 60                      |
| 4  | Field of Electricity               | 21                      | 65                      | 57                      |
| 5  | Field of Body                      | 24                      | 67                      | 54                      |
| 6  | Field of Design                    | 21                      | 71                      | 57                      |
| 7  | Motorcycle Sector                  | 28                      | 62                      | 50                      |
| 8  | Heavy Equipment                    | 19                      | 55                      | 67                      |
| 9  | Field of Vehicle Diagnosis         | 23                      | 55                      | 62                      |
| 10 | Regulation and Management          | 28                      | 59                      | 64                      |
|    | Average                            | 24                      | 61                      | 59                      |

3.2. Approach to Practical Course Assessment

Based on the results of the study, for practice courses the type of assessment approach that is most appropriate for all fields of practice courses is the type of assessment for learning approach. Where this valuation approach emphasizes the assessment process. This is very rational because in practical learning the learning process time is longer than theoretical courses, where to determine whether a student is competent or not requires a comprehensive assessment during the lecture process. This is reinforced statement from Jones, C.A. where the provision of feedback in assessment can effectively provide knowledge to students to find out how to improve their performance. Where the type of assessment approach that can accommodate the existence of feedback from the assessment results is the assessment for learning assessment approach [5].
3.3. Course Assessment Techniques

There are 3 domains of competency assessed in each learning process or lecture, namely affective, cognitive and psychomotor. The most considered appropriate technique for evaluating students’ affective or attitudes is observation assessment techniques by lecturers, when compared to self-assessment techniques by students and peer-to-peer assessments. The reason is the objectivity of the assessment, where the assessment is done directly through observation is considered the most objective, although this will require extra work and carefulness of the lecturer to recognize each student being taught.

When viewed from the cognitive assessment technique (knowledge), based on the results of research the most considered appropriate technique is the written test assessment technique when compared with the two other assessment techniques namely oral tests and assignments. The written test is the easiest test to do when compared to the oral test, oral test requires a long time, especially if the number of students supported by lecturers is very large. In terms of objectivity, written tests are considered better than assignments. Where the assessment technique with the assignment, allows the existence of higher fraud factors because to ensure that the work is done purely by students is difficult to maintain.

When viewed from psychomotor assessment techniques (skills), based on the results of research techniques that are most considered suitable for all subject areas are practical assessment techniques. This type of assessment is done by looking directly at the competencies being tested.

Table 2. Assessment approaches in practice courses

| No | Field of Practice Courses         | Assessment Approach (%) |                     |                     |                     |                     |
|----|-----------------------------------|-------------------------|---------------------|---------------------|---------------------|---------------------|
|    |                                   | Assessment as Learning  | Assessment for Learning | Assessment of Learning |
| 1  | Field of Basic Automotive         | 22                      | 70                  | 45                  |
| 2  | Field of Engine                  | 24                      | 67                  | 45                  |
| 3  | Field of Chassis                 | 19                      | 63                  | 52                  |
| 4  | Field of Electricity             | 26                      | 64                  | 45                  |
| 5  | Field of Body                    | 25                      | 64                  | 43                  |
| 6  | Field of Design                  | 29                      | 69                  | 45                  |
| 7  | Motorcycle Sector                | 33                      | 55                  | 48                  |
| 8  | Heavy Equipment                  | 27                      | 63                  | 46                  |
| 9  | Field of Vehicle Diagnosis       | 38                      | 63                  | 45                  |
| Average |                               | 27                      | 64                  | 46                  |

Table 3. Theory and practice course assessment techniques

| No | Field of Subject                        | Attitude Assessment Techniques (%) | Knowledge Assessment Techniques (%) | Skill Assessment Techniques (%) |
|----|----------------------------------------|------------------------------------|------------------------------------|---------------------------------|
|    |                                        | Lecturer Observation Self Assessment Peer Assessment Written Test Oral Test Assignment of Practice Portraits Product Rating Project Appraisal Portfolio Assessment |
| 1  | Field of Basic Automotive              | 46 11 13 88 42 53 83 31 24 18 |
| 2  | Field of Engine                        | 44 10 9 80 38 47 77 22 22 18 |
| 3  | Field of Chassis                       | 50 10 10 87 42 50 94 19 17 17 |
| 4  | Field of Electricity                  | 45 8 9 84 40 47 83 27 22 16 |
| 5  | Field of Body                         | 44 10 11 76 33 49 80 45 32 14 |
| 6  | Field of Design                       | 46 10 10 71 23 54 69 46 32 20 |
| 7  | Motorcycle Sector                     | 42 10 12 80 39 44 75 34 30 17 |
| 8  | Heavy Equipment                       | 46 8 10 83 38 50 78 20 24 17 |
| 9  | Field of Vehicle Diagnosis            | 46 10 12 77 39 47 84 27 24 17 |
| 10 | Regulation and Management             | 42 13 10 85 42 61 27 0 5 30 |
| Average |                                   | 45 10 10 81 38 50 75 27 23 18 |
4. Conclusion

Based on the results of research and discussion, the following conclusions can be drawn, 1) the assessment approach that is considered most appropriate is the assessment for learning for both theoretical and practical courses; 2) the attitude assessment technique that is considered appropriate is the observation technique by the lecturer; 3) knowledge assessment techniques that are considered suitable are written tests; 4) the skills assessment technique that is considered appropriate is the practice assessment.

Suggestions based on the results of this study are the selection of approaches and assessment techniques in learning must be adjusted to the learning outcomes and profiles of graduates who have been determined, so that the scores achieved can illustrate the suitability of graduates' competencies with the occupational fields to be cultivated.

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