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# The Development of Teaching Material for Automotive Electrical and Electronics Laboratorium Based on Automotive-SKKNI to Improve the Achievement of Standar Competencies of Polytechnic Students

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**Abstract.** The development research aims to produce draft teaching materials of otomotive electrical and elektronic practice in the form of an integrated jobsheet that can improve the achievement of competency standars in mechanical engineering majors. Development held for two years. The first year perform a requirement of analysis of the competency standards contained in the SKKNI otomotive field based Kep.116 /Men/ VII/2004 , KKNI and SNPT based curriculum in mechanical engineering majors in 2017[4]. Automotive electrical and electronic practice grouped into 2 (two) types of jobsheet that is conventional ignition system and the elctronic ignition jobsheet system , where both types of jobsheet are arranged in one standard of competence. The model refers to the material development of the model of Dick and Carey (2004). The results of the questionnaire responses of experts, students, and faculty were analyzed descriptively, the result is the average age of students is 20-22 years. Outstanding characteristics are more students tend to like work that is experimental. (Sunarto, 2004). Means of laboratory learning approaches and strategies of training is one of the most appropriate learning system applied in practice otomotive electrical and electronic in mechanical engineering majors.Characteristics of students majoring in mechanical engineering force in 2016/2017 to practice learning otomotive electrical and electronic views of: 1) the attitude of the average student score of 114 (positive), 2) the interest of students the average score of 75 (high), 3) student motivation average score of 75 (high), and 4) the level of students' understanding of the concept of otomotive electrical and electronic practices an average score of 3.6 (medium), and 5) most of the suggestions students 79,41% suggest the practice of teaching materials need to be developed , enhanced with more series of system drawings and short explanations to make it more easily understood and to understand.

## 1. Introduction

Polytechnic is a professional institute of higher education oriented to the needs of industry and ready-made resilience of learners become members of the community who have professional skills in their respective fields. In order to produce the workforce and professional, it is necessary to process the preparation of infrastructure and learning activities in Polytechnic not only focused on the activity of developing cognitive ability only, also student's own competence. However, the facilities and infrastructure associated with the development of these factors are ignored. This can be seen from textbooks or other teaching materials on special practice lessons for learning at the Polytechnic. The learning practices that are the main ingredients to equip student hard work also require more intensive practice learning. The course subjects that practice teaching materials are still not classified as the practice of Electricity and Electronics.

Based on the preliminary survey of the research team, it concludes that there are two main issues in practical learning: l) the absence of innovative practice learning modules, practical lecture materials as

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outlined in the lesson plan (RPP) and Jobsheet less relevant to the Indonesian National Work Competency Standards (SKKNI) automotive field [6] and 2) practice teaching method with lecture (conventional) still become habit of teaching team. Based on the background explanation above, the main problem of this development research is how is the draft form of teaching materials in the form of an integrated jobsheet based on SKKNI in automotive field for electrical engineering and automotive electronics courses that can improve the achievement of competence in students majoring in mechanical engineering of Polytechnic.

## 2. Research Methods

### *2.1 Types and Research Design*

This research material development study using the model of Dick & Carey (2004) and designed to take place in two years. A summary of key activities, subjects and products to be achieved within two years can be briefly described in the following Table 1.

**Table 1.**Expected Summary of Activity and Product Within Two Years

| Step | Main Activities | Subject | Product |
|---|---|---|---|
| I -2017 | Jobheet development<br>1. Setting course and course materials<br>2. Conduct a needs analysis (need assessment)<br>3. Establish SK, KD and learning outcome indicators<br>4.Designing the developer of teaching materials and instructions for their use<br>5. Drafting (prototype) jobsheet and instructions for its use | 1. College student<br>2. Lecturer/ instructor | Draft teaching materials or an integrated jobsheet has not been validated |
| II-2018 | Jobheet testing<br>1. Conduct expert test<br>2. Analyzes and revisions I<br>3. Conduct individual testing<br>4. Analysis and revisions II<br>5. Conduct group test small<br>6. Analysis and revision III<br>7. Conduct a class test<br>8. Analysis and revision IV<br>9. Dissemination | 1. Field experts Studies<br>2. Technologist Learning<br>3. Assessment expert<br>4. College student<br>5. Lecturer/ Instructor | Practical teaching materials In the form of an integrated jobsheet that has been Validated |

### *2.2 Population and Sample*

The population of the study were students and lecturers of mechanical engineering, where the students were 140 people and 63 lecturers at the State Polytechnic of Bali. Samples were taken as many as 71 students distributed in three classes, namely engineering courses of classes IVA, IVB and IVC IV Semester IV classes in 2017, and 7 lecturers special lecturer at Lab.Otomotif. In detail the state of the population is presented in the following Table 2.

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**Table 2. Sample Population of Research Preparing the Practice of Practice Materials in the Form of Integrated Jobheet at Bali State Polytechnic**

| No | Study Program | Number of Classes | Number of people |
|---|---|---|---|
| 1. | Student majoring mechanical engineering (Smt IV) | 3 | 71 |
| 2. | Lecturer/Instructor of Mechanical Engineering at Lab.Otomotif | - | 7 |
| | Amount | 3 | 78 |

*2.3 Data Analysis*

Data collected from questionnaires from expert responses, students, and lecturers were analyzed descriptively. The feasibility and criteria for product revision are as follows.

**Feasibility Level and Product Revision Criteria**

| Scorecoards (%) | Eligibility |
|---|---|
| 82,3 – 95,0 | Very worth it |
| 69,7 – 82,3 | Well worth it |
| 44,3 – 69,7 | Quite decent |
| 31,7 – 44,3 | Less feasible, needs to be revised |
| 19,0 – 31,7 | Very unfeasible, it needs to be revised |

(Depdiknas BNSP,2008)

## 3. Results and Discussion

The teaching material development model refers to the development model of Dick & Carey (2004) through 3 (three) steps of development, namely: 1) the determination of the course and the material includes needs analysis, 2) drafting the worksheet, and 3) review and trial. The first and second steps are run in the 1st year, while the third step will be implemented in the 2nd year.

The description of the material determination and the results of the needs analysis can be described in the following sections.

*3.1 Competence Required in Electrical Practice Lessons and Automotive Electronics*

In the development of materials teaching materials electrical engineering and automotive electronics are packaged in 2 (two) integrated jobsheet. Each Jobsheet will be packaged in the format: 1) description of contents (objectives, prerequisites, instructions for use of the worksheet, competency standards), 2) content framework (introduction sheet, information sheet, instruction sheet, seft check sheet, evaluation sheet), 3) competence test. Competence maps in electrical engineering practice and automotive electronics are shown as follows.

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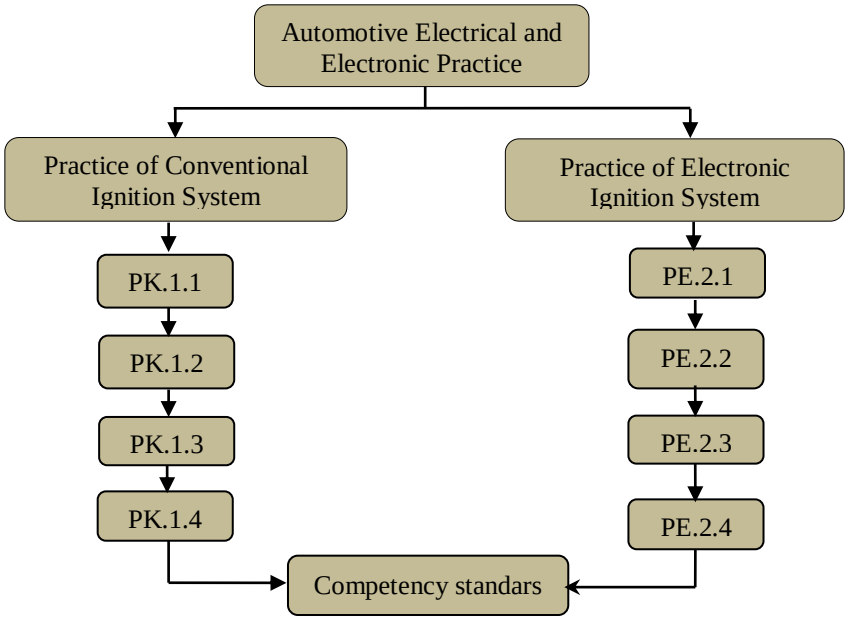
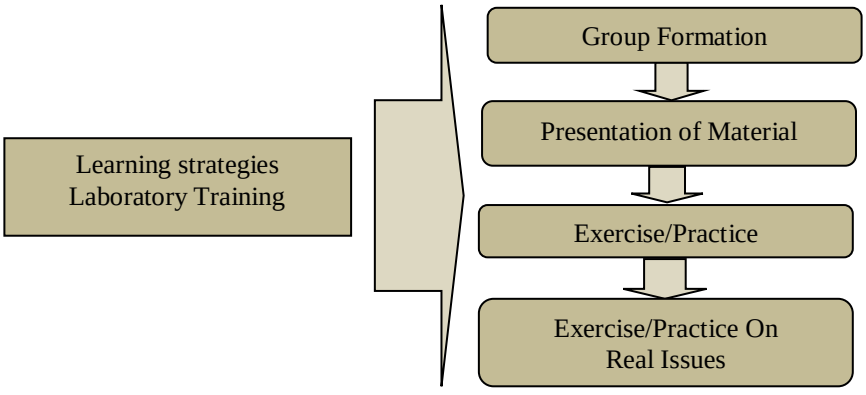



PK 1.1 Able to explain the concept of conventional ignition system practice automotive
PK 1.2 Able to release and re-assemble ignition system with coil ignition (Conventional Coil Ignation) as well as that put forward safety and health work.
PK 1.3 Able to identify, measure, adjust and improve the ignition system according to the specified standard.
PK 1.4 Able to produce reports of experimental results of automotive conventional ignition practice
PE 2.1 Able to explain the concept of electronic ignition system practice (inductive) including the IGF cable function between distributor and ECU.
PE 2.2 Able to remove and reassemble and examine key components that promote safety and health.
PE 2.3 Able to identify, measure and inspect major components and adjust the components of the ignition system according to the specified standard
PE 2.4 Able to produce reports of experimental results of automobile automotive ignition system practice.

One approach and learning strategy that can be used is learning laboratory training because it oriented constructivism learning theory with schematic steps can be described as follows [7].




In terms of the opportunity given by the lecturers to the students to explore / experiment in the learning process, show all the lecturers apply the approach and learning strategy laboratory training is

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seen from the results of the lecturer/instructor questionnaire that approach and learning strategy laboratory training implementation is ranked 1 (One) which means that the frequency of application is most often used by lecturers / instructors in the learning process of electrical and automotive electronics practice. Based on the results of the questionnaire can also be explained that the level of students' understanding of the concept and content of electrical engineering and electronics automotive that has been implemented previously shows the average score: 3.63 (medium) with the minimum score is: 2 and maximum: 5 while the percentage is very good: 5, 88% (4 people), good: 52.94% (36 people), medium: 36.76% (25 people) and less: 4.41% (3 people). The data indicates that there is still a need for improved improvements in preparation, practice learning and assessment processes, through reform of approaches and learning strategies and development of teaching materials in the form of an integrated jobsheet.

According to a Wena quote (2009) which states that learning objectives can be categorized into three domains, namely (1) cognitive domain, (2) affective domain, and (3) psychomotor domain. However, in this study, the focus of the study is the attitude domain (affective), interest and motivation of students in electrical engineering and automotive electronics in which there are several levels of knowledge, understanding, application, analysis, and evaluation. The description can be explained like the following sections.

*1. Domain of Learners Attitudes to the Learning of Electrical Practice and Automotive Electronics*

Based on the results of the students' assessment through questionnaires about the characteristics of the students, especially in the attitude (affective) of the students toward the practice of electricity and electronics automotive that has been implemented previously shows the average score: 114 (medium), while 18 students (26.47%) Very positive attitude statement and 50 students (73,53%) positive, and no student giving statement of neutral and negative attitude (0%). This statement of attitude means that there is still a need to improve again because, the attitude domain (affective) is a change from the learning process. So learning is not memorizing and not remembering, learning is one of the processes marked by a change in a person, the change can be shown in various forms such as changing his knowledge, his understanding, his attitude and his behavior, his skills, his abilities and abilities, his reactions, Acceptance and other aspects that exist in each individual[3].

*2. Domain Interest Learners to the Learning of Electrical Practice and Automotive Electronics*

So it can be said that interest in learning is a tendency that leads students to the fields that he likes without any compulsion from anyone to improve the quality in terms of knowledge, skills, values, attitudes, interests, appreciation, logic thinking, communication, and creativity[3]. Based on the results of questionnaires about the characteristics of students majoring in mechanical engineering of the Bali State Polytechnic to the interest of learning in electrical engineering and automotive electronics showed the average score of 75 included in the high category. While 17 students (25.00%) stated that their interest is very high, 51 students (75.00%) have high interest, and no students expressed their interest. With the number of 17 students (25.00%) stated that their interest is very high towards the study of electrical and automotive electronics practice, it means that the number of students is still low category, moreover there are no students who stated interest, and 51 students (75.00%) who Expressed high interest is still very necessary to do improvements again, One way that can be done is by the development of practical teaching materials that follow the principles of selection of teaching materials in the form of integrated jobsheet namely; Principles of relevance, consistency and adequacy[6].

*3. Domain Motivation Learners Against Learning Electrical Practice and Automotive Electronics*

Motivation is something that moves a person or a group to do or not do something [5]. High learning motivation is reflected by the non-breaking persistence to achieve success despite being confronted by difficulties. Related to the questionnaire about the characteristics of the students of engineering majors of the State Polytechnic of Bali to the motivation to learn in electrical practice and automotive electronics showed the average score of 75 included in the high category. Where 20 students (29,41%)

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have very high motivation, 48 students (70,59%) high motivation and no student (0%) motivation is. This means that there is still a need to increase efforts to motivate students' domains in the practice of electricity and automotive electronics, since approximately 30% of the number of highly motivated practitioners, as well as to newly motivated students is almost 71% Students who have no moderate motivation (0%) means that their motivation is still very low in the practice of electricity and automotive electronics. One of the efforts that can be done to develop the motivation domain of learners besides by developing teaching materials in the form of integrated worksheet is by extrinsic effort, among others: 1) giving praise, 2) giving advice, 3) giving motivation spirit, 4) gift inforcement , 5) punishment funishment and, 6) imitate someone who has sucsses[1]. It is expected that with the increase of motivation to study practice is very high, then the level of success and learning achievement of learners in the practice of electricity and automotive electronics become better.

## 4. Conclusion

1. Automotive electrical and electronics practices are grouped into 2 (two) types of practical job that are conventional ignition system practice and electronic ignition system practice where both types of job practice are arranged in 1 (one) competency standard with 8 (eight) basic competence With 8 (eight) indicators of learning outcomes.
2. Characteristics of students majoring in mechanical engineering year 2016/2017 1) 85.29% mostly aged between 20-21 years, 2) student attitudes toward practical learning mostly 73.53% stated positive, 26.47% very positive 3) student interest 25% very high, 75% high, 4) student motivation 29.41% stated very high, 70.59% high, no students who have moderate and low motivation, and 5) level of understanding of students to the concept of electrical and electronics practice automotive: 5.88% states very good , 52.94% good, 36.76% moderate, and 4.41% less, while 6) student suggestion mostly 79.41% suggesting practice material (jobsheet) needs to be developed / refined with more drawings of system set and brief explanation to make it easier to understand and understandable.
3. The most frequent learning approach and strategy used in automotive electrical and electronics practice is laboratory training.
4. Draft teaching materials in the form of integrated worksheet material developed based on a combination of competence standards contained in the curriculum based on the Indonesian National Qualification Framework (KKNI) of Mechanical Engineering Department of Bali State Polytechnic and KEP.116 / MEN / VII / 2004 on National Work Competency Standards Indonesia (SKKNI) in the field of light vehicle automotive.

## 5. Acknowledgments

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