Sys Rev Pharm 2020;11(12):585-592
A multifaceted review journal in the field of pharmacy

Needs Analysis of Gasoline Engine Learning Based on Competency Problem Based Learning (CPBL)

[1]Bahrul Amin, [2]Jalius Jama, [3]Syahril, [4]Asrul Huda

1, 2, 3, 4, Universitas Negeri Padang
Email: [1]bahrul5513@gmail.com, [2]jaliusjama@yahoo.com, [3]syahril@ft.unp.ac.id, [4]asrulhuda@gmail.com

ABSTRACT

This research is based on a preliminary study and a need analysis conducted on the eye of a gasoline engine. It is found that learning is not optimal. This is due to the inappropriate learning model and strategy and the very rapid development of automotive technology. This study aims to develop a Competency Problem Based Learning (MP-CPBL) Learning. Research and developmental / R & D methods are included in the "need to do" research category, namely research whose results will be used to assist the implementation of work so that if the work is assisted by-products produced from R&D, it will be more productive, effective and efficient. Hence the R&D research and development method. Research and development (R&D) methods are included in the combination research method sequential model. This research produces a Competency Problem Based Learning (MP-CPBL) learning model with 9 syntaxes: a) Introduction and review b) Problem Identification c) Understanding Problems d) Collecting and sharing information e) Planning Training f) Developing training Materials g) Implementing training h) Presenting the results of the training i) evaluating the results of the training. The resulting model analysis met the criteria for practicality with the student's current condition score only 63.16 (mean = 3.16) or still in the sufficient category. Meanwhile, the current condition desired by students is 84.49 (mean = 4.22), so that the gap between the current condition and the expected condition according to students is 21.33 (mean = 1.07). While the conditions expected to reach the number 65.57 (mean = 3.28) or still in the sufficient category. Meanwhile, the expected condition that students want is 86.47 (mean = 4.32), so the gap between the current condition and the expected condition according to students is 20.90 (mean = 1.05).

Keywords: CPBL, need analysis, Learning Model, Gasoline Engine.

Correspondence:
Bahrul Amin
Universitas Negeri Padang
Email: [1]bahrul5513@gmail.com

INTRODUCTION

Vocational education as part of the national education system plays a very strategic role in the creation of a skilled and character workforce. From various studies, the opportunity to have a high and sustainable economic growth from a country will be even greater if supported by human resources. The educational problem faced by the Indonesian nation is the low quality of education at every type and level of education. Referring to the student ability survey released by the Program for International Student Assessment (PISA), in December 2019 in Paris, Indonesia was ranked 72nd out of 77 countries. Education is the key to improving Indonesia's human development and overcoming the above problems. Based on data on unemployment figures as of August 2019, the open unemployment rate was recorded at 7.05 million people. This figure has increased by 500 thousand people when compared to August 2018 of 7 million people. Furthermore, BPS data for 2019 recorded that the open unemployment rate according to education was dominated by vocational high schools of 10.24%, followed by senior high schools of 7.92%, Diplomas 5.99%, and Undergraduates 6.02%. (Based on data from the Central Statistics Agency, 2019).

In the pre-observational research conducted at the Diploma III Study Program of Automotive Engineering, Faculty of Engineering, Padang State University, it is known that learning gasoline engine courses still uses conventional methods, namely the lecture method and guided practice. Learning outcomes using conventional methods are:

Table 1. Student Learning Outcomes Using Conventional Methods

No	Semester	Group 1 values	Group 2 values
1	January – June 2016	38,09 %	61,91 %
2	January – June 2017	56,75 %	43,25 %
3	Januare – June 2018	28,67 %	71,33 %
Average		41,17 %	58,83 %

Based on this data, it can be seen that the percentage of group two is greater than the percentage of group one, this means that student learning outcomes with grades from B - to E are greater, meaning that student learning outcomes are low.

Based on the above conditions, in the January - June 2019 semester, researchers are trying to make improvements to the learning outcomes of students taking the Gasoline Engine course through changes to the learning model used. This change was made from the conventional method to the Problem Based Learning (PBL) model. Based on the reference, the PBL model used is the PBL model developed by Torp and Sage (2002) with 8 steps. The reason this Torp & Sage model was chosen for use, is because based on existing references that this model is the latest PBL model, suitable for adult education, suitable for learning outside the medical and medical fields.

The comparison of the percentage of scores for students who take the Gasoline Motor course with conventional methods and PBL is as shown in the table below:

Table 2. Comparison of Student Learning Outcomes Using Conventional Methods and PBL Models

No	Semester	Conventional method value	PBL Model values
1	Acquired Value B to A	41,17 %	72,2 %
2	Acquired Value B- to E	58,83 %	27,8 %
Number of differences		**-17,66 %**	**44,4 %**

Based on the table above, using the conventional method there was a decrease of -17.66%. This shows that student learning outcomes are still low, while using the PBL learning model there is an increase of 44.4%, which means that there is an increase in student learning outcomes taking the gasoline engine course.

Some of the factors identified as the cause of gaps in learning between actual conditions and optimal conditions that should occur are: 1) In learning activities that are still centered on teaching staff as information presenters, 2) Teaching staff have not been able to actively involve students in learning and increase motivation Students in the learning process so that the student's interest in understanding the learning given is higher, 3) Learning models that are too centered on teaching staff fail to train key skills such as thinking skills, problem-solving and communication skills, (Mossuto, 2009 and Delisle, 1997; Muhammad et al., 2019; Munir et al., 2019; Noorollahi et al., 2019).

On the problem of learning Gasoline Engine, the authors developed MP-CPBL in the Gasoline Motor course, so that the authors examined the Learning Needs Analysis of the CPBL-Based Gasoline Motor in the Diploma III Automotive Engineering Study Program, Automotive Engineering Department, Faculty of Engineering, State University of Padang.

LITERATURE REVIEW

Definition of Learn and Learning process

Hergenhahn and Olson (2010: 2) cite the American Heritage Dictionary, which defines learning as "to gain knowledge, comprehension, or mastery through experience or study". The meaning is that learning is an attempt to gain knowledge, understanding, or mastery through experience or study.

By making modifications to the theory put forward by Kimble, (Hergenhahn and Olson, 2010) states:

Learning is a relatively permanent change in behavior or potential behavior that comes from experience and cannot be attributed to a temporary body state such as a condition caused by illness, fatigue, or drugs.

Judging from the theory stated above, it can be seen that the learning process occurs because of the experience that comes from the learner's interaction with the situations and conditions in their environment. The interaction that is meant here is an interaction that is directed or directed towards achieving goals. These interactions occur continuously, meaning that the interactions that are happening now are based on previous experiences, and so on.

Learning Models

In simple terms, a model is defined as an object or concept that is used to present something. Something real and converted to a more comprehensive form (Meyer, 1985: 2). The learning model is a plan or a pattern that is used as a guide in planning something. Nurhayati (2000) defines the learning model as a conceptual framework that describes systematic procedures in coordinating learning experiences to achieve specific learning goals, and serves as a guide for designers and learners in planning and carrying out teaching and learning activities. Meanwhile, Joice & Weil (2003) defines a learning model as a pattern that is used as a guide in planning classroom learning or learning in a tutorial setting and to determine learning tools including books, films, computers, curricula and others. . Furthermore, Joyce & Weil (2003) stated that each learning model directs us into designing learning to help students in such a way that learning objectives are achieved.

Learning models can be classified based on their learning objectives, syntax, (sequence pattern), and the nature of the learning environment (Asrul Huda, 2019; Noreen et al., 2019; Normalini et al., 2019). An example of classification based on objectives is direct learning, a good learning model to help students learn basic skills such as basic multiplication tables or for any topic related to tool use. However, this is not suitable when used to teach high-level mathematical concepts (Kardi and Nur, 2009; Ramakrishnan et al., 2020; Shabbir et al., 2019).

The syntax (sequence pattern) of a learning model is a pattern that describes the sequence of the overall flow of stages which are generally accompanied by a series of learning activities (Eggen & Kauchak, 2012; Shabbir et al., 2020). The syntax (sequence pattern) of a particular learning model clearly shows what activities a lecturer or student must do. The syntax (sequence pattern) of various learning models ends with the stage of closing the lesson, which includes activities to summarize the main points of the lessons carried out by students under the guidance of the lecturer.

Problem Based Learning (PBL)

Problem Based Learning (PBL) has been known since the era of Plato and Socrates, which asked students to assess, look for new information and ideas and discuss them during learning activities (Bouhuijs et al., 1993: 43 and Mossuto, 2009). Barrow (1980) stated that the idea of

PBL was introduced by Socrates (469-399 BC) in which believed that learning through one's efforts was a correct way of learning. PBL then entered mainstream education in the 1960s at the School of Medicine at McMaster University in Ontario Canada, introducing it into the medical curriculum (Neville, 1999). This was followed by Maastricht University, Netherlands in 1974 (Spencer & Jordan, 1999). Later PBL has expanded throughout North America and around the world (Albanase & Mitchell, 1993).

Learning outcome types : Analysis

The analysis is an attempt to select integrity into elements or parts so that the hierarchy and/or structure are clear. An analysis is a complex skill, which takes advantage of the skills of the three previous types. With analysis, it is hoped that someone will have a comprehensive understanding and be able to sort integrity into parts that remain integrated, for some things understanding the process, for other things understanding how it works, for another understanding the systematics. If someone has developed their

analytical skills, they will be able to apply them to new situations creatively (Uno, 2012).

DEVELOPMENT METHODS

Development model

Research and developmental / R & D methods are included in the "need to do" research category, namely research whose results will be used to assist the implementation of work so that if the work is assisted by-products produced from R&D, it will be more productive, effective and efficient. Hence the R&D research and development method. Research and development (R&D) methods are included in the combination research method sequential model.

Borg and Gall (1983: 772), define development research as follows:

"Educational research and development (R&D) is a process used to develop and validate educational products. The steps of this process are usualy reffered to as R&D cycle, which consist of studying research findings pertinent to the product to be developed, developing the products based on these findings, field testing it in the setting where it will be used eventually, and revising it to correct the deficiencies found in the filed-testing stage.

According to Sugiyono (2013: 530), research and development are "to be able to produce certain products used research that is needs analysis and to test the effectiveness of these products so that they can function in the wider community, it is necessary to research to test the effectiveness of these products".

Development procedure

In carrying out development research, a research component is needed which forms a conceptual framework for R&D (Asrul Huda, 2020). The components in R&D that must be present are: 1). Potential and Problems, 2). Data Collection, 3). Product Design, 4). Design Validation, 5). Design Revision, 6). Product Trials, 7). Product Revision, 8). Trial Use, 9). Product Revisions and 10). Mass Production. The components above are clearer, seen in Figure 1 below:

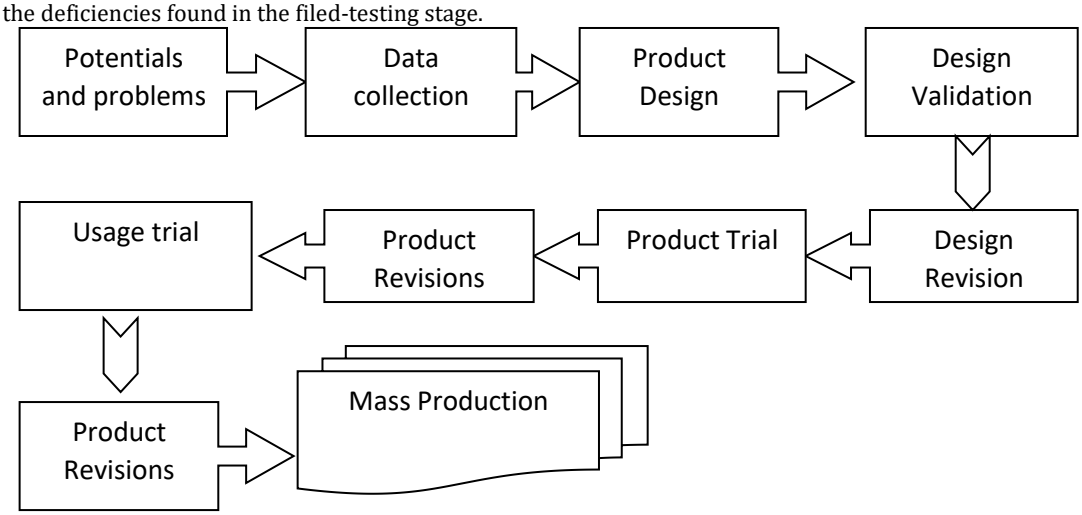

Figure 1. Development Research Procedure

Overall research procedures for the development of the Vocational School Teacher Candidate Student selection model by taking the following steps:

1. Potential and Problem
   Research can start from a potential or problem. Potential is everything that when utilized will have added value. In this step, it is done by formulating the problem to be studied, namely by carrying out a needs analysis for the problem of learning gasoline engines in automotive engineering vocational education.
2. Information Gathering
   After the potential and problems can be shown factually and up to date, then it is necessary to collect various information that can be used as material for planning certain products that are expected to overcome these problems. Here, a separate research method is needed. What method will be used for research depends on the problem and the accuracy of the objectives to be achieved.
3. Product Design
   The products produced in Research and Development research are various. In the field of technology, the orientation of technology products that can be utilized for human life is a product of quality, energy saving, attractive, low price, lightweight, ergonomic, and has multiple benefits.
   Arrange the initial form of the model and the tools needed in model development. There are several forms of supporting tools needed in this development, including manuals for the application of models, media for supporting devices, data collection tools, and several instruments needed in developing the model. At this stage, the validation process will be carried out on the model design and the required instruments. Validation is carried out by several experts who are experts in their fields. The initial form of the learning model for the gasoline engine course in the existing Automotive Engineering Vocational Education.
4. Design Validation
   Design validation is an activation process to assess whether the product design, in this case, the MP-CPBL in the gasoline engine course in Automotive Engineering Vocational Education will be more effective than the old one or not. At this stage, the MP-CPBL has been modified and undergoes changes by the validation process either FGD or panel of

experts, the next process is to carry out limited trials, in implementing this limited trial involves 6-12 respondents, the purpose of the trial is to minimize errors or deficiencies that may occur before the trial on a large scale.

5. Design Reparation
   Revise the learning model of the findings on the limited test. The finding of errors or things that are less than perfect at the previous stage must be revised and corrected, through a process of analysis and evaluation. This revision stage will further strengthen the results tested on a limited test so that a MP-CPBL is obtained.
6. Product testing
   Revisions were carried out in the previous process, then carried out field tests on a large scale. The trial was carried out by conducting experiments.
7. Product Revision
   MP-CPBL after the experimental process will be reviewed again. Weaknesses and unfavorable findings, in this process, are followed up by making improvements to the model being developed.
8. Trial use
   The results of improvements after the experimental process or large-scale test were then implemented on a large regional scale. At this stage, the process of observing or observing students is carried out using a questionnaire instrument and measuring the responses of students and lecturers to the implementation of MP-CPBL that has been developed by the instruments that have been made. This process is to determine the practicality of the modified MP-CPBL.
9. Product Revision
   Make a final revision of the learning model. Based on the results of the implementation on a wide scale and seeing the results of student performance as well as student and lecturer perceptions of the model developed, then a final revision is made to further refine the model developed.
10. Mass Product Manufacturing
    Report the findings in the form of seminar presentations. This stage is the final stage, which is carried out in developing learning models, by reporting the results of research through scientific forums with seminars or scientific journal publications.

ANALYSIS AND RESULTS

Analysis of developing MP-CPBL is given to Diploma III students in the 2018 academic year Automotive Engineering Study Program

The following are the results of the analysis research conducted:

1. Data Description Analysis Achievement of competency between current conditions and expected conditions in the gasoline engine course
   The analysis of needs assessment for students as a petrol engine test in this study was carried out by distributing a needs analysis questionnaire to 30 students of the Diploma III program of Automotive Engineering, Padang State University. The questionnaire consists of two parts. The first part is analyzing the current condition of the gasoline engine while the second is the condition of the students' expectations in the gasoline engine course. The data description can be seen in Table 1 below:

Table 3 Data Description Analysis of Achievement of competency between current conditions and expected conditions in the gasoline engine course.

Gasoline Engine Competencies	Average Current Condition	X%	Average Expectation Conditions	Y%	Delta Mean
1. I can read the technical drawings in the practical job sheet.	3,47	69,33	4,50	90,00	20,67
2. I can select tools according to the job sheet provided.	3,37	67,33	4,53	90,67	23,33
3. I can use measuring instruments with high accuracy.	3,30	66,00	4,33	86,67	20,67
4. I can calibrate the measuring instrument that will be used for work	3,27	65,33	4,33	86,67	21,33
5. I use safety equipment in every practicum	3,23	64,67	4,60	92,00	27,33
6. I can maintain and maintain tools (maintenance tools) according to the SOP.	3,07	61,33	4,43	88,67	27,33
7. I can explain the basic concept of a petrol engine and its application in motorized vehicles correctly	2,93	58,67	3,97	79,33	20,67
8. I can disassemble and inspect and measure the main components of the gasoline engine in the right way	3,00	60,00	4,27	85,33	25,33
9. I can analyze the results of the inspection and measurement of the main components of the gasoline engine in the right way.	3,20	64,00	4,20	84,00	20,00
10. I can properly disassemble, inspect and repair the carburetor system	3,03	60,67	4,20	84,00	23,33
11. I was able to correct the problem with the carburetor Fuel system in the right way	3,37	67,33	4,13	82,67	15,33
12. I can properly disassemble and inspect the	2,83	56,67	4,17	83,33	26,67

fuel injection system components.					
13. I can perform maintenance on the fuel injection system the right way.	3,20	64,00	4,17	83,33	19,33
14. I can properly disassemble and check the ignition system components of the gasoline engine.	3,17	63,33	4,23	84,67	21,33
15. I can properly maintain the ignition system of the gasoline engine.	3,30	66,00	4,20	84,00	18,00
16. I can properly inspect and maintain the gasoline engine lubrication system.	3,03	60,67	4,20	84,00	23,33
17. I can properly inspect and maintain the gasoline motor cooling system	3,40	68,00	4,30	86,00	18,00
18. I can maintain the gasoline motor intake system in the right way.	3,00	60,00	4,20	84,00	24,00
19. I can perform maintenance on the gasoline motor exhaust system in the right way	3,27	65,33	4,13	82,67	17,33
20. I was able to perform the gasoline engine performance test using the Dyno test in the right way	3,23	64,67	4,13	82,67	18,00
21. I was able to test the exhaust emission of a gasoline engine in the right way.	3,07	61,33	4,10	82,00	20,67
22. I was able to diagnose the condition of the machine using a stethoscope in the right way	3,20	64,00	4,03	80,67	16,67
23. I can explain the procedure for tuning up a gasoline engine according to the standard procedure for a gasoline engine.	3,30	66,00	4,10	82,00	16,00
24. I can perform repairs and maintenance of all components and systems according to standard gasoline motor tune-up procedures properly.	3,10	62,00	4,17	83,33	21,33
25. I can use the special service tools (SST) used to tune up the gasoline engine in the right way	3,37	67,33	4,27	85,33	18,00
26. I can report the tuning results of the engine in the right way	2,90	58,00	4,17	83,33	25,33
27. I was able to analyze the process of increasing the power of the gasoline motor in the right way.	2,87	57,33	4,13	82,67	25,33
28. I can make engine modifications to increase the volumetric efficiency of the gasoline engine in the right way.	2,77	55,33	3,97	79,33	24,00
29. I was able to check and measure the cylinder bore in the right way	3,10	62,00	4,13	82,67	20,67
30. There are up to date teaching materials available in the form of textbooks (reference).	3,40	68,00	4,43	88,67	20,67

Table 4. The Learning Process of Vocational Education Diploma III in Automotive Engineering

Gasoline Engine Competencies	Average Current Condition	X%	Average Expectation Conditions	Y%	Delta Mean
31. Up to date teaching materials are available in the form of lecture modules.	3,33	66,67	4,30	86,00	19,33
32. There are up to date teaching materials available in the form of a Job Sheet / Lab Sheet.	3,47	69,33	4,33	86,67	17,33
33. The learning process takes place using a short theory.	3,17	63,33	4,30	86,00	22,67
34. The learning process takes place using the demonstration method.	2,93	58,67	4,13	82,67	24,00
35. The learning process is carried out using multimedia.	3,13	62,67	4,30	86,00	23,33
36. Learning takes place with strategies	3,33	66,67	4,40	88,00	21,33

that please students.					
37. Ongoing learning can motivate students.	3,30	66,00	4,40	88,00	22,00
38. Lecturers evaluate the learning process.	3,33	66,67	4,40	88,00	21,33
39. Lecturers evaluate the learning outcomes that have been implemented.	3,30	66,00	4,27	85,33	19,33
40. Lecturers present learning in the form of individual assignments in the form of project assignments.	3,03	60,67	4,17	83,33	22,67
41. Lecturers present learning in the form of group assignments	3,60	72,00	4,37	87,33	15,33
42. I present problem-solving actions in the form of practical assignments in an automotive workshop	3,10	62,00	4,40	88,00	26,00
43. I show high initiative in practical work in automotive workshops	3,50	70,00	4,37	87,33	17,33
44. I demonstrated good interpersonal relationships in practice in automotive workshops	3,60	72,00	4,43	88,67	16,67
45. I demonstrate good communication ethics in practice in automotive workshops	3,37	67,33	4,30	86,00	18,67
46. I show high activity and enthusiasm in practicing at the automotive workshop	3,30	66,00	4,27	85,33	19,33
47. I demonstrate full attendance and high discipline in practice in automotive workshops	3,30	66,00	4,27	85,33	19,33
48. I show an honest attitude and critical thinking in practice in automotive workshops	3,33	66,67	4,30	86,00	19,33
49. I show a responsible attitude and cooperation in practice at the automotive workshop	3,00	60,00	4,40	88,00	28,00
50. There are up to date learning facilities available at automotive workshops	3,13	62,67	4,37	87,33	24,67

Based on the table above, it can be ascertained that of the 50 competencies that are given the impact of the current gap level and the expected average delta Mean is 25.00

Gasoline Engine Learning Competencies

1. **Student Competence between Current Conditions and Expectations According to Student Opinions.**
   Based on the results of the analysis of the current condition data and it is expected that it has been done, it is hoped that the level of competency attainment of the Vocational Diploma III student of Automotive Engineering based on the student's opinion has only reached 63.16 (mean = 3.16) or still in the sufficient category While the expected condition that the student wants is 84.49 (mean = 4.22), so that the gap in the level of competency attainment between the current condition and the expected condition according to the student is 21.33 (mean = 1.07).

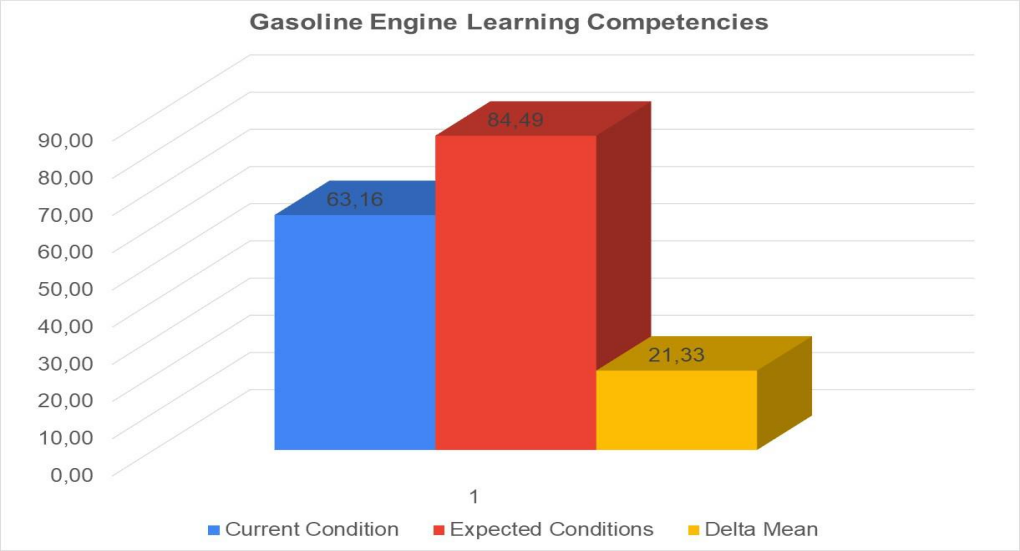

Figure 2. Competency Achievements According to Student Opinions

2. Student Competence Between Current Conditions and Expectations According to Student Opinions

Furthermore, the level of competency attainment of Vocational Diploma III Students in Automotive Engineering is based on the student's opinion on the expected condition of reaching 65.57 (mean = 3.28) or still in the sufficient category. As shown in table 2 below. Meanwhile, the expected condition that the student wants is 86.47 (mean = 4.32), so that the gap in the level of competency achievement between the current condition and the expected condition according to the student is 20.90 (mean = 1.05).

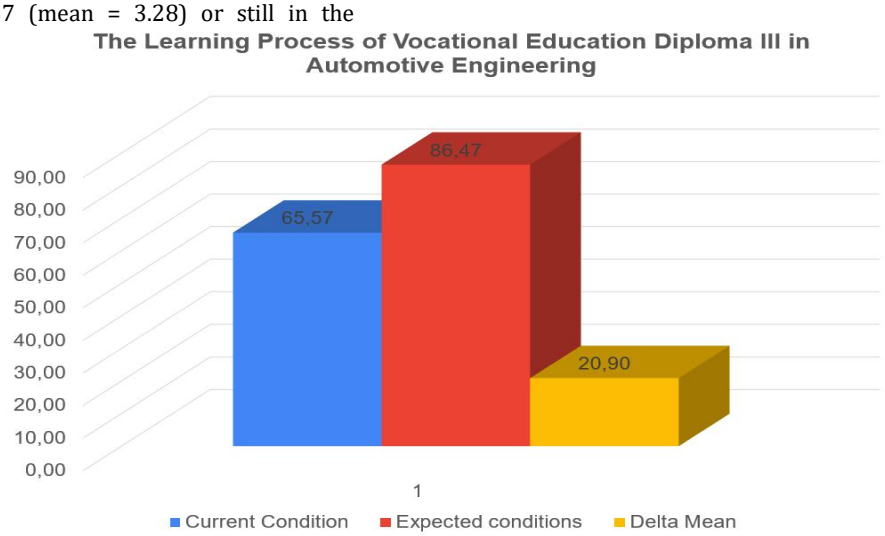

Figure 3. Competency Achievements According to Student Opinions

CONCLUSION

The conclusions of this study are as follows:

1) Development of Competency Problem Based Learning (CPBL) Learning Model is needed to improve the skills of Diploma III Automotive Engineering students at the Padang State University.
2) This research will produce a Competency Problem Based Learning (CPBL) Learning Model with the following syntax: a) Introduction and review b) Problem Identification c) Understanding Problems d) Collecting and sharing information e) Planning Training f) Developing training materials g) Implementing Training h) Presenting the results of the training i) evaluating the results of the training
3) Based on the results of research on the Analysis of Learning Needs for Gasoline Engine Based on CPBL, the results show that the practice process using Competency Problem Based Learning (CPBL) for D3 Students of the Automotive Engineering Study Program is needed to be implemented to improve professional expertise.

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