

Need Analysis for Development of Learning Module with Problem Based Learning Model Based on Polya's Problem Solving to Improve Problem Solving Ability of Students

Nadya Mahardika¹, Djusmaini Djamah², Hamdi Rifai²

¹Student of Magister Degree Program of Physics Education, Universitas Negeri Padang
Jl. Prof. Dr. Hamka Air Tawar Barat Padang-25131, Indonesia

²Lecturer of Magister Degree Program of Physics Education, Universitas Negeri Padang
Jl. Prof. Dr. Hamka Air Tawar Barat Padang-25131, Indonesia



Abstract - Need analysis is the first step in the Plomp development model that needs to be done before developing a product. Aspects that have been analyzed are curriculum (passing competency standards, content, process, assessment) and characteristics of students. The purpose of this study was to find interventions that could be used to improve the problem-solving skills of students. The type of research that has been used is qualitative research with descriptive method. The subjects of the study were students of class X Senior High School No 4 Padang. Data that has been used in this research is primary data obtained by using the instrument in the form of questionnaire which is compiled based on indicators of need analysis. The result of passing competency standards analysis shows that the average acquisition of knowledge competence of students is 66.07 which are in the less category. The result of learning process analysis shows two aspects that are still in the less category, that is learning model analysis 69,05 and analysis of learning source 68,75. The results of the assessment analysis with an average of 91.18 are in very good category. Results of analysis of the characteristics of students on the aspects of problem-solving skills are in the less category, that is 69.22. Needs analysis indicates that intervention can be used to improve problem-solving skill of students is learning module with problem based learning model based on Polya's problem solving.

Keywords - Need Analysis, Learning Module, Problem Based Learning, Polya's Problem Solving.

I. INTRODUCTION

Education can be defined as humanization or humanizing effort, which is an effort to help human beings to exist in accordance with their human dignity. Education is the main pillar for the complete organization of human beings. According to Ki Hajar Dewantara, humans can be formed through education and human maintenance efforts, in order to develop the offspring of a nation so as to grow with healthy physical and mind through the world of education. The purpose of national education is to create an atmosphere of learning and learning process so that students are actively

developing their potential to become human beings who believe and piety to God Almighty, have a noble character, healthy, knowledgeable, capable, creative, independent, and become citizens of a democratic and responsible[1]. The purpose of education will be realized by improving the quality of education.

The government has made various efforts to improve the quality of education, one of which is to revise the Curriculum KTSP into Curriculum 2013. Students in the Curriculum 2013 are required to actively and independently in initiating information, able to work together in groups, able to interact

with teachers and other students, and develop problem solving skill. Polya argues that problem solving is an action to find a way out of the problem and achieve goals that can not be achieved immediately [2].

Polya describes that there are four steps to solve the problem, i.e: 1) Understand the problem, students understand the problems through reading and observing. students are expected to understand the problem conditions that include identifying problems, analyzing problems, and translating information that is known and asked on the question; 2) Dividing plan, students design a plan to solve the problem by finding the relationship between the data found with the unknown part of the problem. This designing activity is important because when the students are able to make a connection of the known data and unknown data then the students can solve the problem based on the knowledge they have obtained previously; 3) Carrying out the plan, using a plan that has been made to solve the problem. This step is important to examine whether students understand a problem well or not; 4) Looking back, examining the results that are the solution of the problem and making conclusions from the answers given. Problem-solving skill are related to the knowledge, understanding and skills that individuals have had before. Problem-solving skills are important for the future because with the practice of finding solutions to a problem and carefully assessing information allows individuals to solve problems in the future [3]. One of the subjects that requires problem-solving skill in the solution is Physics.

Physics means natural science, the science that studies about nature. Physics is an experimental science that is used to discover patterns and principles that connect natural phenomena. The purpose of learning physics is to master the concepts of Physics and able to use scientific methods based on scientific attitude to solve problems so as to realize the greatness of God Almighty, thus Physics can habituate students' thinking ability that is useful in problem solving.

Physics subject is very important, therefore it is required an effective learning activities for the expected learning objectives can be achieved. Minister of Education and Culture Regulation No. 22 of 2016 describes some of the principles of learning that are used in the Curriculum 2013 [4]. First, students who initially in the learning process are told to students to find out. This emphasizes that in the Curriculum 2013 students are required to be active in the learning process. According to the National Research Council students who are active in Physics lessons are actively hands and mind[5]. Students who are actively thinking are those who can connect newly acquired knowledge with the initial knowledge they had

before[6]. The Government in the Curriculum 2013 expects students to have the ability to construct their own mind and feel comfortable with the experience they get.

Secondly, teachers as the only source of learning become resource-based learning sources. Conventional education as implemented in Education Unit Level Curriculum creates a paradigm that teachers are the only source of learning, while in Curriculum 2013 teachers have a broader role, that is to become learning facilitators and managers of learning resources for students. Learning resources are everything that can help students to achieve learning objectives. Learning resources are not limited to textbooks only, learning materials are also one source of learning. There are several types of printed materials, such as books, modules, student worksheets, brochures, etc. Teachers as managers of learning resources should be able to develop learning resources that can improve student problem solving skills[7]. One learning resource that can accommodate student problem-solving skills in the learning process is the module. The module has a self-instruction component that allows students to learn independently [8].

Third, the textual approach to the process as a reinforcement of the use of a scientific approach. Through a scientific approach, students are expected to actively find knowledge, gain spiritual skills and attitudes, as well as social attitudes. Students are expected to develop their skills holistically. It is stated in the core competencies of Curriculum 2013. Learning process should use the model and learning methods that can create quality Physics learning and improve student learning motivation[4]. The formation of an active student is determined by the way the teacher teaches in the classroom. The learning process is related to the learning model used by the teacher, one of the instructional models recommended in the Curriculum 2013 is the Problem Based Learning model.

Needs analysis is done in Senior High School No 4 in Padang by interviewing teachers and giving questionnaires to teachers and students. Needs analysis and context analysis should be done before designing a product[9]. Product needs analysis is the first step that must be taken in developing the product. Needs analysis is grouped into curriculum analysis, student analysis and concept analysis. Curriculum analysis is aimed to know the achievement of educational goals in accordance with Core Competence and Basic Competence [10]. Conceptual analysis is the identification of materials that will be taught and arranged systematically and linking a material with relevant material. The curriculum analysis is conducted to see the gap in the implementation of learning

activities with expected learning in the curriculum of 2013. Curriculum components are divided into objective components, content components and program / material structure, media / infrastructure components, learning strategy components, learning process and evaluation / evaluation component. So, based on that opinion aspect to be analyzed in this research is Curriculum (passing competency standard, content / material, process / learning activity, assessment) and characteristic of student. The passing competency standard is a qualification of graduate competency that includes the attitude, knowledge, and skills of students that must be fulfilled or achieved from an educational unit at the primary and secondary level[4].

Learning materials occupy a very important position of the entire curriculum and must be well prepared for the implementation of learning to achieve goals. According to the Curriculum and Learning Development Team the curriculum content covers all aspects both related to the subject matter and student activities. Component content / material is the learning material that is programmed to achieve the goals.

Learning activities are a series of activities undertaken by students in achieving certain learning outcomes. Learning activities is a process of interaction in certain conditions involving students, teachers and the environment. Government Regulation No. 19/2005 on National Education Standards authorizes learning activities in educational units to be interactive, inspirational, fun, challenging and motivating students to participate actively.

Learning activities include preliminary activities, core activities and closing activities. There are some things that need to be considered in carrying out learning activities, i.e: learning approaches, methods used, stages in learning, and place of implementation of learning. Component learning activities that need to be considered by teachers in choosing and determining the media, the source of learning methods, strategies, approaches that is used[12].

Assessment analysis is very important to be done to know the achievement of student competence include attitude, knowledge and skill. Assessment analysis is the achievement of student learning outcomes that can provide an overview of the learning process. Assessment results can be used to identify students' strengths and weaknesses, monitor progress in learning, provide input in improving learning programs in the classroom and detect student needs. Assessment can be grouped into summative and formative assessments. Summative assessment is done at the end of the learning process in an effort to determine the ability or competence of

students, while formative assessment conducted to assess the progress of students in learning process to improve learning[13]. Assessment consists of three stages, i.e: planning, implementation, and reporting.

Student analysis is performed to collect data about students. This data will have an impact to make a decision of the product to be made. Everyone is born with different characters, the difference is a gift to be grateful for. However, it would be a problem if it could not be managed properly. The characteristics of students is the quality of individual students consisting of interests, attitudes, motivation to learn, learning styles, thinking skills, and initial ability [14]. Characteristics of students, initial ability, learning styles and plural intelligence. General characteristics include an overview of age, sex, level, and cultural and social and socioeconomic factors. Initial abilities refer to students' knowledge, skills and attitudes. While learning styles are grouped into auditory, visual and kinesthetic. Analytical instrument of the characteristics of the students developed based on the explanation of expert opinions above include the initial ability, interest, motivation, learning style, and problem-solving skills which are used to see the characteristics of the characteristics used as a reference in improving the learning process for the better.

Implementation of learning activities should be supported by appropriate learning models. All learning models can be used because there is no better learning model than others. However, in order to achieve the maximum learning objectives, it is necessary to select the learning model according to the characteristics of the learning objectives to be achieved, the learning materials, the students, and the ability of the teachers to manage the learning materials [4]. Analysis of learning materials needs to be done to determine the learning model to be used. The learning model is adapted to the categories of factual, conceptual, and procedural knowledge. Based on the analysis, the learning model that is used is Problem Based Learning.

Problem Based Learning (PBL) is a learning based on constructivist theory of learning by presenting authentic problems to students, so that students can construct their own knowledge and learn independently to solve a problem. Implementation of PBL model is expected to provide more skill for students than just memorizing learning materials. The PBL model can train students in problem solving, group discussion, communication, and information processing during the learning process. PBL model can help improve students problem solving skills[16]. One of the problems found in the field is the ability to solve student problems that have not been

optimal. This is because teachers are not yet focused on developing student problem-solving skills based on indicators of problem-solving skills.

Problem solving is a way to determine the way out of a difficult and full of obstacles to achieve the goal. Learning using Polya solving indicators can improve students' problem-solving skills[17]. Polya's problem solving allows students to get used to work on problems that not only rely on memory, but students are expected to relate it to real situations that have been experienced. Module development in this research by using Problem Based Learning model based on Polya's Problem Solving which contains indicators that can help improve students problem solving skills.

Physics is one of the subjects that requires problem solving skills in its completion. The use of learning resources combined with the application of appropriate learning model is expected to be a solution to the problem solving ability of students who have not been optimal. The result of need analysis shows that module development with Problem Based Learning model based on Polya's Problem Solving is needed to improve students problem solving skills.

II. METHODS

This research type is qualitative research with descriptive method. Qualitative research is a research using the consideration that researchers want to see, review, and describe about what it is by understanding the meaning, social interaction, and feelings of someone based on the views of data sources not the views of researchers[18]. The descriptive method is intended to describe the existing phenomena, which take place in the present or the past[19]. Descriptive method is a method that describes a variable, symptoms, or incidence as it is without giving a control of treatment [20].

The type of data in this study is the primary data that has been obtained through the questionnaire. The data collection instrument is a tool in collecting data so that the activity becomes systematic. The research instruments that researchers use when observing are interview formats and questionnaires that contain indicators of students problem solving skills.

The data analysis technique that has been used is Likert scale. According to Riduwan (2008: 12) Likert scale can be used to measure opinions or perceptions of a person or group of people about social events or symptoms. The calculation of the value of each indicator using the formula:

$$\text{Value of achievement} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%$$

Category achievement can be seen in Table 1.

Table 1. Table Category Achievement.

Interval	Category
90 <VG ≤ 100	Very Good (VG)
80 <G ≤ 90	Good (G)
70 <F ≤ 80	Fair (F)
≤ 70	Less (L)

Source: Ministry of Education and Culture (2014)

III. RESULT AND DISCUSSION

The result of this research is data percentage of need analysis will be used in module development with Problem Based Learning model based on Polya's Problem Solving to improve students problem solving skills. The result of passing competency standard analysis in Senior High School No 4 Padang shows that graduate competency achievement is not good in all aspects. The average acquisition of attitudinal competence is 87.50, knowledge competence 66.07, skill competence 81.25. The graph of passing competency standard analysis can be seen in Figure 1.

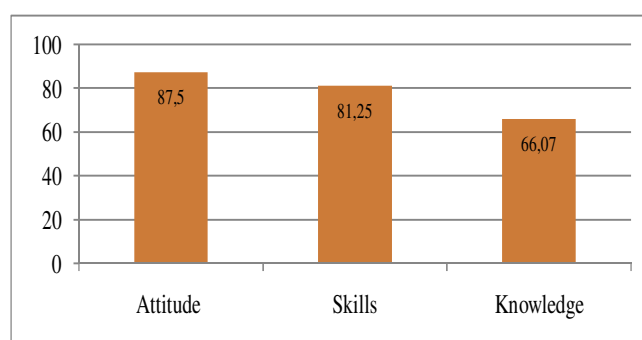


Fig 1. Graph of Passing Competency Standard Analysis

Aspects that have been analyzed in the learning activities are preliminary activities, core activities, and closing activities. The results of the preliminary activity analysis were 100, core activity analysis including applying 87.50 learning approach, 69.05 learning method and model analysis, 82.50 learning media analysis, 68.75 learning source analysis, and closing activity analysis 100. Graph analysis of learning activities can be seen in Figure 2.

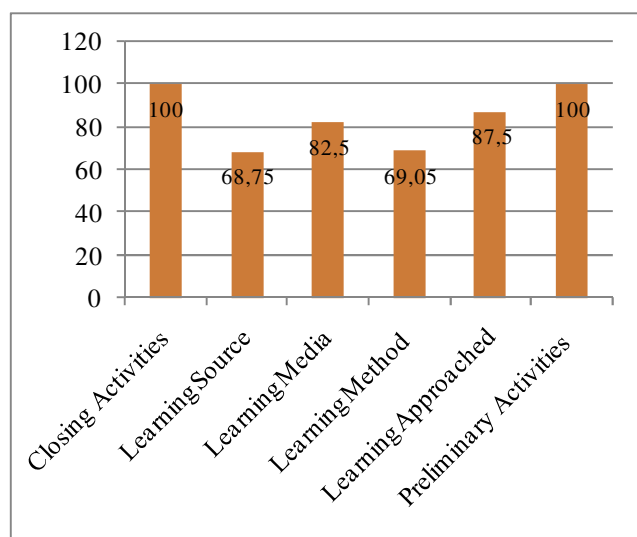


Fig 2. Graphic of Learning Activity Analysis

The result of the assessment analysis at the planning stage is 92,50, the implementation stage 81,04, and the reporting stage 100. The result of the analysis shows that the assessment activity has been done well. Graph analysis analysis can be seen in Figure 3.

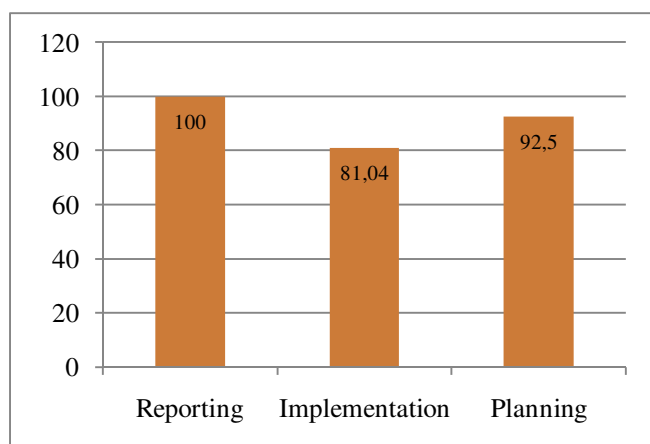


Fig 3. Graph analysis of assessment activities

Analysis of student characteristics includes analysis of initial ability, interest, motivation, learning style, and problem solving skills. The result of initial ability analysis is attitude competence 80,36, knowledge competence 65,17, skill competence 77,64. The results of the analysis indicate the need to increase the students' competence in the knowledge aspect. The result of interest analysis is 80,28. The result of motivation analysis is 80,14. The result of learning styles analysis consisted of visual learning style with value 79,38, auditory learning style 64,17, and kinesthetic learning style 55,56. The analysis results show students with visual learning

style more dominant, so that in developing the module need to be equipped with images and use of color which vary as marker of main message from presentation of material. The average result of students problem solving skills is 69.22. Each student problem solving indicator is in the less category. Figures 4 and 5 are graphical analysis of learning styles and problem-solving abilities of students.

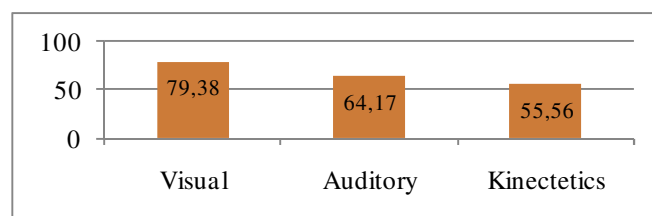


Fig 4. Graphic Analysis of Learning Styles of Students

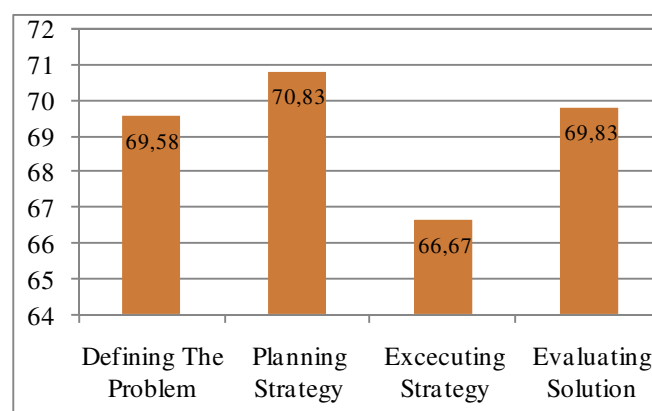


Fig 5. Graphic Analyst Ability Problem Solving Students

The analysis performed is part of the preliminary research in the development of module with Problem Based Learning model based on Polya's Problem Solving to improve students problem solving abilities. The result of passing competency standard analysis in High School No 4 Padang shows that graduate competency achievement is not good in all aspects. The average acquisition of attitudinal competence is 87.50, knowledge competence 66.07, skill competence 81.25. The result of passing competency standard analysis shows that students' competence is not maximal yet.

The results of analysis on knowledge competence is the lowest compared to the others. This relates to students' knowledge of the concepts of Physics and problem solving related to the Physics lesson. The aspects that are analyzed in the learning activities are the preliminary activities, core activities, and closing activities. Preliminary activity analysis results 100, core activity analysis including applying 87.50 learning approach, method analysis and learning model 69.05, learning media analysis 82.50, and analysis of learning

resources 68.75, and closing activity analysis 100. Based on data obtained, some aspects of the learning activities have been running well, but the use of learning resources and application of methods and learning models is still not optimal.

Learning resources which are used in school one of them is learning materials in the form of modules. The module is made by the physics teacher. The current module does not meet the standards expected in the Curriculum 2013 which emphasizes scientific learning. The current module focuses only on descriptive descriptions of learning materials and training questions, so that students are less able to learn independently to construct their own knowledge in the learning process. Students in the Curriculum 2013 are expected to apply scientific work in the learning process in order to improve students problem solving skills.

Based on the characteristics of Curriculum 2013, the type of instructional learning material that should be prepared is a constructivist learning material. Learning materials that can be used as a learning resource in the classroom can also train students' independence in building their own concepts. For that required source of learning that support it. Teachers in preparing modules need to pay attention to the ideal module structure. The structure of the module according to the Ministry of National Education (2008) contains an opening section (title, table of contents, information map, list of competency objectives, preliminary tests), core parts (introduction, material relationships, material descriptions, assignments, summaries) cover (glossary, final test, index). In the preparation of modules also need to note the suitability of the contents of the module with passing competency standards, core competencies, basic competencies, material adequacy, and scientific approach. In fact, the modules that are used in schools are not in accordance with the ideal module structure according to the Ministry of National Education.

Assessment is the process of collecting and processing information to measure the achievement of student learning outcomes. Assessment on Curriculum 2013 is divided into three stages, ie planning, implementation, and reporting. Evaluation activities which are done well will produce valid data as a picture of the outcome of the learning process. The result of the assessment analysis at the planning stage is 92.50, the implementation stage 81.04, and the reporting stage 100. The result of the analysis shows that the assessment activity has been done well.

Analysis of student characteristics includes analysis of initial ability, interest, motivation, learning styles, and

problem solving skills. The result of initial ability analysis is attitude competence 80.36, knowledge competence 65.17, skill competence 77.64. The results of the analysis indicate the need to increase the students' competence in the knowledge aspect. The result of interest analysis is 80.28. The result of motivation analysis is 80.14. The result of learning style analysis consisted of visual learning style with value 79.38, auditory learning style 64.17, and kinesthetic learning style 55.56. The analysis results show students with visual learning style more dominant, so that in developed module need to be equipped with images and use of color which vary as marker of main message from presentation of material. Learning resources that are used in the learning process should be tailored to the characteristics of students.

The result of student problem solving skills analysis at identifying problem stage shows value 69.83. The stage of recognizing the problem is the stage where the student must read and understand the problem verbally, be able to identify problems by identifying problems on the matter, write down the known quantity, understand and determine the factors related to the problem, create a picture or notation that matches the problem as well able to compile data from problem. The result of percentage recognizing the problem is in the less category. The second stage is to plan a strategy with an average of 70.83. The planning phase of the strategy is concerned with determining the relationship between the known data and the unknown and whether the student has seen the condition before. Students in this stage are expected to be able to identify the concepts, principles, rules, formulas and physics's law of the problem. The design stage is important because when the students are able to make the relationship of known and unknown data then the student can apply the knowledge that has been obtained before. The results of the analysis at this stage are in the less category. The third stage is to apply the strategy with an average of 66.67. Students at this stage are able to determine the exact mathematical equations, and able to solve the problem. Students must be able to form a more standard systematically in the sense of formulas which are used as formulas according to the question on the problem to lead to the plan of the solution. The last stage is to evaluate the solution, ie check the truth of the results obtained and conclude the answer of the problem with an average of 69.58 are in the category less. At this stage students are expected to be able to evaluate a given solution by re-examining answers, checking the solutions, working with different solutions.

IV. CONCLUSION

The results of research and discussion show that some aspects of needs analysis is running well, but there are still

aspects that have not been optimal. The result of the analysis shows that there are still some improvement in some aspects, namely learning model, learning resource, and problem solving ability of students. Therefore, the authors designed the module with problem based learning model based on polya's problem solving as the solution of the problem in school.

REFERENCES

- [1] Aka E Ğ, Guven E, & Aydogdu M 2010 *Journal of Turkish Science Education* 13-24
- [2] Anwar I 2010 *Pengembangan Bahan Ajar* (Bandung: Direktori UPI)
- [3] Arikunto S 2009 *Dasar-Dasar Evaluasi Pendidikan* (Jakarta: Bumi aksara)
- [4] Daryanto 2013 *Menyusun Modul: Bahan Ajar untuk Persiapan Guru dalam Mengajar* (Yogyakarta: Gava Media)
- [5] Direktorat Pembinaan SMA 2010 *Juknis Pengembangan Bahan Ajar SMA* (Jakarta: Depdiknas)
- [6] G.Polya. 1973. *How to Solve It*. New York: Princenton University Press
- [7] Undang-Undang RI No. 20 tahun 2003 *Tentang Sistem Pendidikan Nasional* (Jakarta: Departemen Pendidikan Nasional)
- [8] Mims C 2003 *A Middle School Computer Technologies Journal* V 6 Issue 1 Winter 2003 ISSN 10979778.
- [9] National Research Council 1996 *National Science Education Standard* (Washington DC: National Academy Press)
- [10] Nuralam 2009 *Jurnal Edukasi* V V no. 1
- [11] Rangkuti A N 2015 *IOSR Journal of Research & Method in Education* 5(5): 13-16
- [12] Raval H 2014 *International Journal of Educational Development* (Elsevier)
- [13] Permendiknas No. 22 tahun 2016 *tentang Standar Proses* (Jakarta : Kementrian Pendidikan dan Kebudayaan)
- [14] Riduwan 2009 *Variabel-variabel Penelitian* (Bandung: Alfabet)
- [15] Sani RA 2013 *Inovasi Pembelajaran* (Jakarta: Bumi Aksara)
- [16] Sugiyono 2010 *Metode Penelitian Kualitatif, Kuantitatif dan R&D* (Bandung : Alfabeta)
- [17] Sukmadinata N S 2011 *Metode Penelitian Pendidikan* (Bandung : Remaja Rosdakarya)
- [18] Steiner G 2009 *Journal of Business and Management* 15 (1) 5-33