

Module Development Based on PBL (Problem Based Learning) on Environmental and Ecosystem Change Materials For Student of Class X SMAN 1 Singkarak

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Abstract - Education is a conscious and planned effort to make the learning atmosphere and learning process so that active students develop their potential to have knowledge, intelligence and skills. Based on the problems obtained in the field the teacher only teaches with textbooks and has not been able to develop teaching materials. This study aims to produce environmental pollution modules based on PBL (Problem Based Learning). PBL (Problem Based Learning) is a learning model that requires students to be able to solve problems, motivate students and improve students' thinking skills.

This type of research is development using the Plomp model. The Plomp development model consists of three stages of development, namely: the initial investigation phase, the development phase and the prototype phase and the assessment phase. The data collection instrument used is the instrument for validating student worksheets. PBL-based Biology Module (Problem Based Learning) is validated by 3 experts and 1 teacher. The results showed that the aspects of content, presentation, language, grammatical scores 84.00%, 82.57%, 87.27 and 79.19% with very valid categories. It can be concluded that the Biology module based on PBL (Problem Based Learning) gets a very valid category so that it is suitable for use during the learning process and is expected to improve student learning outcomes.

Keywords - Modules, PBL, (Problem Based Learning).

I. INTRODUCTION

Education is a conscious and planned effort to make the learning atmosphere and learning process so that active students develop their potential to have knowledge, intelligence, personality, morals and skills. Education plays an important role in the process of improving the quality of human resources. The quality of human resources will usually be able to create change and face the challenges of an ever changing era. According to Mulyasa (2006) "Learning is essentially a process of interaction between students and their environment so that behavior changes occur towards a better direction". The learning process can be said to be good if the process can generate effective learning activities that are students actively involved. To create effective learning activities, it requires teacher creativity skills in preparing

learning plans, one of which is in the selection of learning resources and approaches to be used.

Biology is one part of science learning related to how to find out and understand about nature systematically and not only mastery of a collection of knowledge in the form of facts, concepts, or principles, but is a process of discovery. Biology learning as a part of science learning is a vehicle to improve students' knowledge, skills, attitudes, values, faith and responsibilities as citizens to the community and nation. The impact of students is expected to be able to balance the challenges in the future and become a quality resource (Sadiman, 2010:2).

The main material of environmental pollution in the 2013 curriculum on Biology subjects in class X 2nd semester

requires students to know the various objectives of human activities, various effects of human activities, examine the influence of pollutants on certain organisms, deduce the influence of pollutants on organism's life, explain the effects of various pollutants on the environment, and knowing the handling of waste by recycling. This material is very interesting because it relates to the environment around us.

The amount of material and presented in long paragraph formats causes students to be lazy to read and tend to memorize the material without understanding it. This results in a learning process that is less effective. Therefore, to overcome this, an appropriate learning media is needed. With the existence of learning media it is expected that the presentation of learning material is clearer and not verbalistic. Material can be presented with a series of events that are simplified or enriched so that learning activities are not a boring description of students. This is in accordance with the opinion of Sadiman, et al (2012: 17) that learning media is useful for clarifying the presentation of messages so that they are not too verbalistic

Based on the results of interviews with several teachers and students at SMAN 1 Singkarak on April 6, 2018, information was obtained that the material for environmental pollution and ecosystems included material that was quite difficult for students to understand. The difficulty of students in understanding the material will affect the learning outcomes. Based on the daily test scores obtained from biology teachers it is known that the level of completeness of students is still low. The percentage of students who achieved minimum completeness criteria was still less than 50%. The minimum completeness criteria for biology learning set at SMA 1 Singkarak is 80. The percentage of students' mastery learning in circulation and coordination material can be seen in Table 1.

Table 1. Percentage of Learning Completeness of Students in SMA N 1 Singkarak Academic Year 2018/2019.

| Number | Material | Percentage (%) | |
|--------|----------------------|----------------|----------|
| | | Pass | Not pass |
| 1 | Environmental change | 36,67 | 63,67 |
| 2 | Ecosystem | 43,66 | 56,66 |

Source: Class X Biology Gradebook

Based on the above problems, a teacher is required to have the ability to create or develop teaching materials that are in accordance with the characteristics and needs of students, these teaching materials are all materials (both tool

information and text) that are systematically arranged which displays a complete figure of competence which will be mastered by students and used in the learning process with the aim of planning and reviewing the implementation of learning. Meanwhile, the existence of teaching materials has a number of functions in the learning process.

The learning module must be validated so that the learning module developed is feasible to use. According to (Subiyanto, 1993) validity means something that is acceptable or valid that has been in accordance with the expected truth so that it can be accepted in a certain criterion. Whereas according to (Arikunto, 2012), a data generated from a product is said to be valid, it can be said that the product has provided a description of the purpose of development correctly and in accordance with the reality and the real situation.

Based on the problems above, a study on modules based on PBL (Problem Based Learning) is conducted. In the matter of environmental pollution for class X students of SMAN 1 Singkarak.

II. LITERATURE REVIEW

A. Validity

Validity is defined as the extent to which an instrument measures what is intended to be measured. Validity requires that the instrument be reliable (Kimberlin and Winterstein, 2008). Messick (1989) defines validity as an integrated evaluative assessment to the extent that empirical evidence and theoretical reasons support the adequacy and appropriateness of conclusions and actions based on test scores or measurement methods.

Validity comes from English, namely the word validity which means validity or truth. In the context of measuring instruments or assessment instruments, validity means the extent to which accuracy or accuracy of measuring instruments in carrying out their measuring functions. Validity testing can be done by doing several methods. The component of validity according to (Ministry of National Education, 2008) regarding the development of teaching materials in general "criteria assessed by experts includes components of content feasibility, linguistic components, presentation components, and graphic components". The component feasibility test is a test of the validity of a content or material from a teaching material. As stated by (Ministry of National Education, 2008) which states that "the component of content feasibility includes: conformity with Core Competencies, Basic Competencies, conformity with

children's development, conformity with the needs of teaching materials, truth in the substance of learning materials, benefits for additional insight, conformity with values moral, and social values ". This Ministry of National Education statement shows that the validity of a teaching material seen from the content of the material or its content must be in accordance with several analyzes such as analysis of Core Competencies and Basic Competencies, needs, substance truths, benefits, moral values and social values.

Language components include readability, clarity of information, conformity with the rules of good and correct Indonesian and effective and efficient use of language (clear and concise). Components of presentation include: Clarity of objectives (indicators) to be achieved, Order of presentation, Giving motivation, attractiveness, Interaction (giving stimulus and respond), Completeness of information. While Graphic Components include: Use of fonts; Type and size, Lay out or layout, Illustration, image, photo, and display design.

B. Teaching materials (Modules)

Teaching materials are all forms of material in the form of a systematically arranged set of materials that are used to help teachers / instructors in carrying out learning activities and allow students to study (Directorate of High School Development, 2010). Based on the technology used, teaching materials can be grouped into four categories, namely printed teaching materials, including hand outs, books, modules, posters, brochures, student worksheets, wallcharts, photos, or drawings, and leaflets. The function of teaching materials can be divided into two types, namely functions for educators and for students.

Modules are "a complete unit that stands alone and consists of a series of learning activities arranged to help students achieve a number of objectives specifically and clearly formulated" (Darwyan, 2010).

The objectives of learning modules are as follows: 1) students can learn according to their own ways. 2) students have the opportunity to learn according to their own pace. 3) students can choose the topic of interest, because students do not have the same pattern of interest to achieve the same goal. 4) students are given the opportunity to get to know the advantages through a remedial program (Sabiri, 2010).

In the development of a learning module must be considered the components that make it up. These components include: teacher guidelines, student work sheets,

worksheets, key worksheets, test sheets, and test sheet keys (Syarifudin, 2010).

C. PBL Model (Problem Based Learning)

PBL model (Problem Based Learning) is a learning model that can motivate, challenge, and be fun for students as a result of the learning process by understanding or solving a problem (Norman and Schmidt, 2000). Learning by using the PBL model requires students to solve authentic problems so that they are able to build their own knowledge, develop inquiry, improve thinking skills, develop independence, and be confident (Trianto, 2014:64). This model trains students to think critically and analytically in finding and using appropriate learning resources (Amir, 2010:21).

III. RESEARCH METHODS

This type of research is development using the Plomp model. The Plomp development model consists of three stages of development, namely: the initial investigation phase, the development phase and the prototype phase and the assessment phase. The data collection instrument used was a validation sheet to measure the feasibility / validity of the product developed Validation of this guided inquiry-based student worksheet was conducted by 3 (three) expert teams according to their respective fields and studies and 1 teacher. The test results are then used for revisions so that the student worksheets really meet the user's needs.

The data collected from this study is the result of validating PBL-based Biology learning modules. Module feasibility data in the form of Likert 1-4 scale with the following provisions:

- a. Strongly Agree : score 4
- b. Agree : score 3
- c. Disagree : score 2
- d. Strongly Disagree : score 1

Then, the results of the scoring are tabulated and the percentage is searched using the formula:

$$\text{Value of Validity} = \frac{\text{obtained score}}{\text{Maximum score}} \times 100\%$$

Based on the value of the validity obtained, the assessment criteria for the validity of PBL based learning modules are determined with provisions such as on Table 2.

Tabel 2. Validity Level Determination Criteria

| Range (%) | Category |
|-----------|--------------|
| 0-20 | Very invalid |
| 21-40 | Invalid |
| 41-60 | Valid enough |
| 61-80 | Valid |
| 81-100 | Very Valid |

Modified by (Riduwan, 2009)

IV. RESULTS

4.1 Results

The results of the validity of worksheet based problem based learning on biological material can be seen as follows:

4.1.1 Didactic aspects

Module development refers to the 2013 curriculum that is tailored to core competencies and basic competency. furthermore, indicators and learning objectives based on basic competency will be derived. The design and development of each activity in the Student Worksheet is adjusted to the learning objectives.

4.1.2 Construction aspects

The module developed is in accordance with the correct Indonesian language rules so that it is easily understood by students. student worksheets are also equipped with instructions for use, so that students are able to follow learning with direction. In addition, this module contains a worksheet that contains PBL (Problem Based Learning) based learning steps recommended by the 2013 curriculum.

4.1.3 Technical aspects

Cover in the module is equipped with an identity such as title, curriculum used, development base, image. The identity of the author, the identity of the student and the user that is appropriate for the module. The color on the cover is a combination of blue and green. The font used is Comis Tempus San with a size of 14-28. For the images contained in the worksheet, it is made proportional, clearly visible, complemented by captions and source images. The intended margin is left 3, top 3, right 3, and bottom 3. The results of module validation from experts / experts are in table 3 below.

Table 2. Results of module Validation developed

| Number | Assessment Aspect | Mean | Category |
|--------|-------------------|-------|------------|
| 1. | Content Aspects | 84,00 | very valid |
| 2. | Presentation | 82,57 | very valid |

| | Aspect | | |
|----|------------------|-------|------------|
| 3. | Language aspects | 87,27 | very valid |
| 4. | Integrity aspect | 79,19 | very valid |
| | | 83,57 | very valid |

Tabel 3. The practical results of the module developed.

| Number | Indicator | Average | Category |
|--------|---------------------|---------|----------------|
| 1. | Convenience aspects | 92,83% | Very practical |
| 2. | Presentation Aspect | 81,24% | Very practical |
| 3. | Time Aspect | 85,00% | Very practical |
| | Mean | 86,35% | Very practical |

Table 4. Results of module effectiveness

| Number | Indicator | Average | Category |
|--------|--------------------|---------|-----------|
| 1. | Cognitive domain | 85,64% | Effective |
| 2. | Affective domain | 84,24% | Effective |
| 3. | Psychomotor domain | 86,16% | Effective |

V. DISCUSSION

The validity of PBL-based Biology learning modules is assessed by experts / experts. The assessed aspects of validity consist of four aspects, namely aspects of construct, content, language, and graphics. The validator involved in this validation process is Dr. Darmansyah, ST, M.Pd as a technology expert, Dr. Abdurrahman, M.Pd as a linguist, Mr Aidhya Irhas Putra M.Si as a biologist, Asmi, S.Pd as material validator from SMAN 1 Singkarak. Evaluation of validity carried out by experts as a whole obtains a value with a very valid category.

Assessment of the construct aspects is obtained by a very valid module. Very valid categories obtained from expert judgment because the module developed presents clear indicators and learning objectives. Activities in the module are presented by adjusting the activities carried out with the subject matter. Activities in modules are presented systematically and in accordance with the PBL phase. As stated by Trianda L (2018) that valid teaching materials are developed if they have clear indicators and learning objectives.

Assessment of the content aspects obtained by the PBL-based Biology learning module is very valid. Very valid categories obtained from expert judgment because PBL-based Biology learning modules are developed in accordance with basic competencies and core competencies contained in the 2013 Curriculum. Learning objectives are also described based on the indicators that have been made. The module contains a list of questions related to the material concept. List of questions in the phase section develops and presents the results of work tailored to the learning objectives to be achieved by students. The list of questions that exist will focus students on the objectives to be achieved from the activities carried out. In accordance with what Aufa said (2018), the content aspect in module development can be said to be valid if it is in accordance with core competencies and basic competencies.

The next aspect is the graphic / technical aspects that obtain valid categories from experts. In accordance with what Prastowo (2011) said is a valid category of expert judgment because the module has images and writing on the cover that already reflects the contents. Images in the module can also convey messages effectively, the description of the image is in accordance with the image presented in the module. Then, the color combination used in the module is quite contrasting and sharp and does not interfere with the students' focus while reading the module attraction for students. Type and font size used are also appropriate. theoretical concepts.

The next aspect which gets a very valid category is the language. Module is considered very valid in terms of language by experts because the module is designed to use the correct Indonesian language even though in some parts there are errors in the selection of inappropriate words, the use of punctuation in some modules parts still have errors where there are inappropriate uses of punctuation. The language used has been adjusted to the language level of high school students of class X so that students easily understand the contents of the module. Modules also use simple and clear sentence structures and sentence structures used in

accordance with EYD, according to the level of student understanding, simple, clear and unambiguous, making it easier for students to understand the learning activities in the module, as well as communicative. Hamdani (2011: 224) states that the thing that needs to be considered in the preparation of modules is accuracy in composing sentences so that the modules are arranged communicatively and are easy to use as study guides for students. This is also confirmed by Prastowo (2011: 106) that the module is basically a teaching material that is arranged systematically in a language that is easily understood by students, according to their level of knowledge and age.

Based on table 1 above, we can draw a comparison of the results of module validation from each aspect assessed.

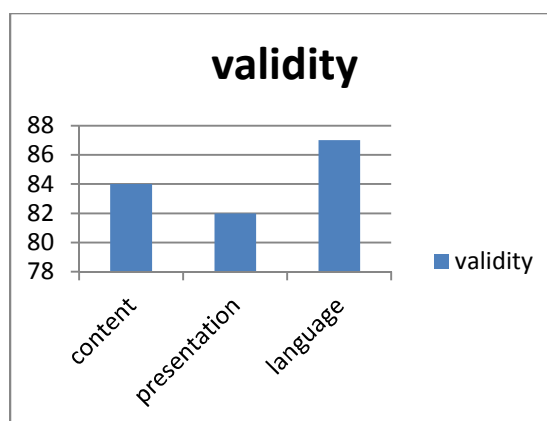


Figure 1. Results of module validation from each aspect of the assessment

Overall, PBL-based biology learning modules developed have very valid criteria, with aspects of the contents of 84.00%, presentation aspects 82.57%, language aspects 87.27% and aspects of graphics 79.19%.

Practical test aims to see the practicality of problem based learning biology modules used in the learning process that takes place in the actual conditions. Based on table 2, the practical results of each aspect of the assessment can be described.

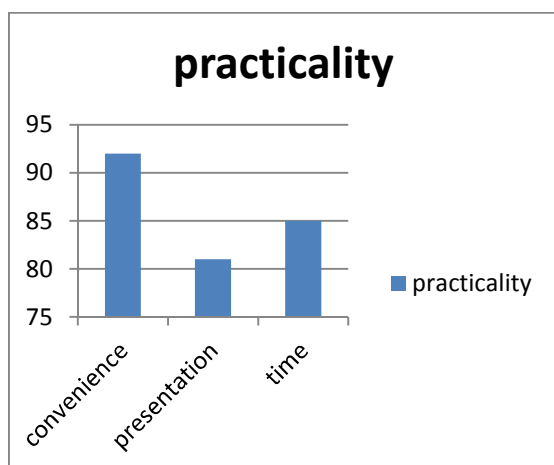


Figure 2. Module practical results from each aspect

Overall, PBL-based biology learning modules developed have practical Sanga criteria, with ease aspects of 92.83%, presentation aspects of 81.24%, and time aspects of 85.00%.

The effectiveness test is carried out to assess whether the module developed is effectively used in the learning process.

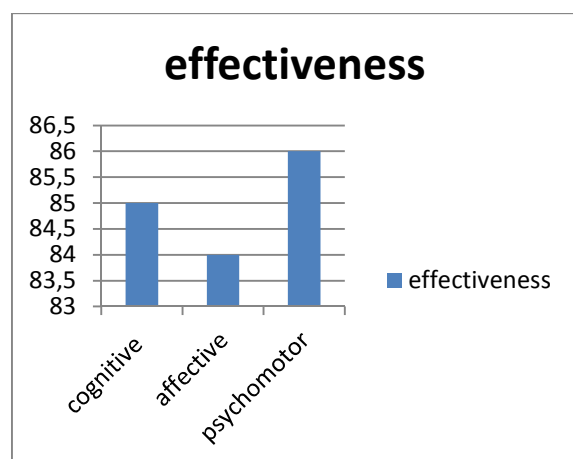


Figure 3. Results of module effectiveness

Overall, PBL-based biology learning modules developed have effective criteria, with 85.64% cognitive domain values, 84.24% affective domains, and psychomotor domains 86.15%.

VI. CONCLUSION

Based on the results of research and discussion it can be concluded that PBL-based biology learning modules developed have validi criteria in terms of didactic, construct / content aspects. While the technical aspects have very valid criteria. So that PBL-based biology learning modules can be used during the learning process as teaching materials that

help teachers and students to understand the material, help in achieving learning goals so as to improve student learning outcomes.

REFERENCES

- [1] Agustin, Y. 2018. Practicality of Development of Question Biology Science Based on Scientific Literacy on the Organism Classification and the Material and it's Changes Classification and Energyin Life for Junior High School Students of Class VII Semester I. *International Journals of Sciences and High Technologies(IJPSAT)*. Vol.6 No. 2 January 2018, pp. 595-600
- [2] Arikunto. S. 2007. *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.
- [3] Aufa, 2018. Validity of Biology's Students' Worksheet Equipped by Pictorial of Concept Map for Students of Class VIII at Junior High School. *International Journals of Sciences and High Technologies (IJPSAT)*. ISSN: 2509-0119. Vol. 6 No. 2.
- [4] Depdiknas. 2008. *Panduan Pengembangan Bahan Ajar*. Jakarta: Direktorat Pembinaan SMA
- [5] Gardner, H. 2011. *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Book. Introduction to second paper edition (tenth-anniversary edition).
- [6] Hamzah, Faiz. 2015. Studi Pengembangan Modul Pembelajaran IPA Berbasis Integrasi Islam – Sains Pada Pokok Bahasan Sistem Reproduksi Kelas IX Madrasah Tsanawiyah. *Jurnal Pendidikan Islam* Volume 1 , Nomor 1.
- [7] Herlily. 2018. Application Of Model Learning Guided Discovery With Scientifik Approach TO Enhance Learning Competency Science Seventh Grade Students.*International Journal of Progressive Sciences and Technologies (IJPSAT)*. ISSN: 2509-0119. Vol. 6 No. 2.
- [8] Kimberlin, C. L. dan Almut G. Winterstein, A.G. 2008. Validity and reliability of measurement instruments used in research. *Am J Health-Syst Pharm—Vol 65 Dec 1*.
- [9] Messick, S. (1989). *Validity*. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13-103). New "York: Macmillan.
- [10] Norman, G.R., dan Schmidt, H.G. 2000. Effectiveness of PBL Curricula: Theory, Practice and Paper Darts. *Medical Education*, 34, 721-728.
- [11] Plomp, T dan Nieveen, N. 2013. *Educational Design Research*. Netherlands: SLO.

- [12] Prastowo, A. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif: Menciptakan Metode Pembelajaran yang Menarik dan Menyenangkan*. Yogyakarta: Diva Press.
- [13] Pratiwi, M.Y, 2018. Validity of Students Worksheet Based Guided Inquiry with Diagram V on the Ecosystem Material and the Environment Influences for X Grade of Senior High School Students. *International Journal of Progressive Sciences and Technologies (IJPSAT)*. ISSN: 2509-0119 Vol. 6 No. 2 January 2018, pp. 589-594
- [14] Putri, D dan Mitarlis. 2015. Pengembangan Lembar Kerja Siswa Berbasis *Mind Mapping* pada materi laju reaksi untuk melatih Keterampilan berfikir kreatif Siswa Kelas XI SMA. *UNESA Journal of Chemical Education ISSN: 2252-9454 Vol. 4 , No.2 , pp. 340-348*.
- [15] Riduwan. 2009. *Belajar Mudah Penelitian Untuk Guru-Karyawan Dan Peneliti Pemula*. Bandung: Alfabeta.
- [16] Sabiri, Ahmad. 2010. *Strategi Belajar Mengajar & Micro Teaching*. Ciputat: Quntum Teaching.
- [17] Subiyanto, I. 1993. *Seri Diklat "Metode Penelitian*. Universitas Gunadarma.
- [18] Sudjana, Nana. 2004. *Dasar-dasar Proses Belajar Mengajar*. Bandung :Sinar Baru Algensido Offset.
- [19] Syah, Darwyan, Syarifudin, Supardi. 2009. *Strategi Belajar Mengajar*. Jakarta: Diamedit Media.
- [20] Triananda, L (2018). Validity of Students Work Sheet Problem Based Learning Equipped With Crossword Puzzles on Ecosystem and Environmental Changes for Senior High School. *International Journal of Progressive Sciences and Technologies (IJPSAT)*. ISSN: 2509-0119. Vol. 6 No. 2
- [21] Trianto. 2011. *MenDesain Model Pembelajaran Inovatif Progresif*. Edisi Ke-4. Jakarta: Kencana.