The using of handbook PBL oriented in introductory and laboratory techniques course

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Abstract. Development of handbook Problem Based Learning (PBL) oriented in the introduction and laboratory techniques course have been done and obtain very valid results. Therefore, this research is continued in practical test phase. The purpose of this research is to develop the handbook in associated to problem-based learning approach in introductory and laboratory techniques course at practical stage. This research is a development research. The research models and procedures use 4-D (four-D models) development model consisting of 4 stages: define, design, develop, and disseminate. The research data of handbook is obtained from the questionnaire of practicability. Practicality data obtained from the questionnaire by 2 lecturers and 69 students. The result of practicality assessment by the lecturer was 90% (very practical), and the result of the students practicality assessment was 76% (practical). It can be concluded that the result of PBL-oriented handbook practice in introductory and laboratory technique, obtaining very practical value from lecturer and practical from student.

1. Introduction

The introduction and laboratory techniques course have been facilitated with laboratory activities. Course introduction and laboratory techniques are equipped with practicum activities practical activities are accompanied by handbook that is designed by the lecturer team of the course. The design of the handbook is tailored to the material that has been taught during class lecture meetings. The handbook that has been designed by the introductory and laboratory techniques team oriented problem-based learning approach. Problem Based Learning (PBL) is a pedagogical approach that encourages those who take part in its processes to act both as supportive change agents working in collaboration with colleagues, and also as individuals to use their creativity in finding solutions to practical problems [1]. PBL is an instructional technique by which students learn through facilitated problem solving [2]. This approach is chosen because it can help students to think creatively, actively and directly involved in finding knowledge. In the process of learning in the PBL stage classes can be done in a way identifying facts, generate hypothesis, identify learning issues/knowledge deficiencies, applying new knowledge, evaluation [3].

There are many topics of laboratory activities have developed in the handbook include laboratory safety and action, prevention, laboratory equipment, measuring instruments, optical instruments, acid-base synthesis indicators, acid-base acid indicators, acidity determinations, standard solutions,
concentrations, solutions, dilutions, and preservation. Thus all the PBL stages contained in the handbook in introductory and laboratory techniques course involve students to find problems and solve problems with the results of data collection through practical activities and theories that have been found. In PBL, the problem, as the focus of the learning, is typically an ill-structured, complex one, with no clear ‘right answer’ [4].

Handbook oriented-PBL has been validated by material experts laboratory techniques lecture, media experts, and learning strategies as it also looks at how the validity handbook oriented PBL. The result of validation handbook is very valid. After doing the stages of validity, the author collecting data of practicality handbook in practice activities by lecturers and students. For the authors to conduct research with the aim of seeing practicality introductory and laboratory techniques handbook.

The research about the handbook with PBL has been done by Baharon with the title “Development of a Problem Based Learning in Concrete Technology Laboratory Work” [5]. Result is the handling of lab work using PBL method can reduce the problem encountered in traditional way such as free riders and lack of understanding on the relationship between individual lab works with the problem to be solved. So also with research Unal and Ozdemir with the title “A physics laboratory course designed using problem-based learning for prospective physics teachers” [6], the conclusion that participants need to conduct more problem-based laboratory activities for improving their competency on science process skills. The purpose of this study is to see the practicality handbook PBL-oriented in introduction and laboratory techniques course from lecturers and students.

2. Method
This research is a development research using 4D model. Through four stages of development that is define, design, develop and disseminate. The study was conducted in the develop stage that is seeing the results of practicality handbook developed by lecturers and students. Samples in this study are those who are following the introduction and techniques laboratory class, semester 2017/2018 on biology education at STKIP PGRI Sumatera Barat. There are 69 students, and 2 lecturers of introduction and laboratory techniques subject.

The research uses a questionnaire as instrument for data collection. The instrument to collect data with four choices of answers that very agree, agree, less agree and disagree. Questionnaire modified [7] with the observed aspects of ease of use, the time required in execution, easy to interpret, and having the same equivalence so that it can be used as a substitute or variation. This practicality analysis was treated using modified formulas from [8].

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\text{The score of practically} = \frac{\text{Average scor}}{\text{Maximum scor}} \times 100\%
\]

Evaluation of practicability uses criteria [9] and that are modified to be

- 86 – 100% = very practical
- 76 – 85% = practical
- 60 – 75% = quite practical
- 55 – 59% = less practical
- 0-54% = not practical

3. Result and discussion
The results of lecturer and student practice research shows that practical handbook of PBL oriented in introduction and laboratory technique is very practical and practical for lecturers and students. The results of the practicality of lecturers and students can be seen in figure 1. It is shows that the practical handbook result by lecturer and student from the aspect of ease of use shows the difference between 9.26%. This difference indicates that practical use of handbook is used by lecturers rather than students. The use of handbook by lecturers simplifies practical activities, facilitates student guidance in practical, makes active practical activities, enables students to be motivated in developing creativity and activities, and develops students’ scientific attitude abilities in group collaboration activities.
The material in the handbook has been developed at the stage of validity, PBL making students creative and active such as the layout and layout of the laboratory, measuring instruments and optical instruments. In laboratory materials, students are required to explain the characteristics of the science laboratory, distinguish utilities and laboratory equipment and explain the functions of laboratory parts. In this material, presented the problems in the form of laboratories that are suitable for use in laboratory activities and which are not suitable for use in practicum activities. Then the students review how their laboratory conditions to discuss and compare the problem. The results of their laboratory review can be seen in Figure 2.

Figure 1. Practical handbook by lecturers and students.

Figure 2. Student observation on laboratory conditions.

Base on figure 2, the students see the laboratory conditions on their campus. Thus in a group of students discussed how laboratory conditions are feasible to use for lab work. Likewise with materials measuring tools and optical tools that discuss using measuring cups, measuring drop pipette, technical
scales, and analytical scales and operate magnifier, mechanical microscope, electrical microscope, and binocular microscope. In this material presented the problem of discourse that discusses the measuring instrument and optical tool wrongly used by students in the determination of the size and invention of objects with the microscope. This presented discourse can challenge students to develop their scientific abilities in finding solutions to the given problems. So in the use of handbook, helping students to form a scientific attitude in finding knowledge in a more structured, creative, active and enhance the sense of cooperation in groups. The educational philosophy behind PBL aims to build self-directed learners, to develop positive team behavior, as well as to develop and nurture critical thinking skills among the student [10]. According to students practically practical use of handbook because of the ease of use, the handbook used are thicker and heavier and make students difficult to store and carry the handbook everywhere.

Aspects of time required in the implementation of practical activities when the use of PBL-oriented handbook, get the difference in the results of student and lecturer practice is 10.33%, but the assessment of lecturer and student practicality is still very practical and practical category. Practical this handbook according to lecturers and students because the use of the PBL-oriented handbook is not time and helps students and lecturers in the utilization of time when the lab that is in accordance with the stages of PBL given. The longest use of time occurs when students and lecturers conduct practice activities in stages to guide independent investigation or group investigation. Here, students do practice activities and read the theoretical basis and make the discussion and conclusion of the results of activities that have been done. Practical activities conducted by students in a single meeting there are several activities. For example, on practical activities on the material of optical equipment, the degree of acidity and solution. Practical activities on the material up to three and four activities in one meeting. For optical tool materials that discuss activities on how to use the magnifier, mechanical microscope, electrical microscope and binocular microscope. The time required for practice activities is usually very large, using the required time laboratory handbook become more controlled because students feel helped by the PBL steps contained in the handbook.

Time management also focuses on the PBL stages of the presentation of the outcome of the problem, the whole group presents a solution of the discussion of the issues they have discussed. If there is a response from other groups it will be discussed together in the discussion. The solution of the problem will be concluded to determine the most appropriate solution in discussing the problems presented in the student orientation in response to the problem in the handbook. Presentation of problem results for PBL assessment purposes, groups pull together their knowledge and prepare a final solution to the problem [11]. But overall the time division in the PBL stage can be well controlled and students can carry out the PBL stages well. Equitable participation of all students in PBL teams would ensure that all students are able to benefit appropriately from the rich benefits of PBL experiences [12].

Aspects of ease in interpreting the results of lecturer and student practicacy are at a practical and highly practical level. As a result of analysis of percentage distance data obtained by students and lecturer that is 16.67%. Interpretation of handbook in lab activities in the laboratory is not so difficult to do by lecturers and students. This can be seen because lecturers and students find it helpful in the use of this handbook while working in the laboratory in discovering their knowledge.

The aspect of having the same equivalent that is in the category quite practical for students and very practical for lecturers with a percentage range of 20.83%. Quite practically equivalent to the teaching materials of the students because in the handbook of the material presented, only the essence relating to the material discussed. In contrast to the opinion of lecturers, the judges are very practical because the material presented is supported by the theoretical studies asked at the stage of independent and group investigations. In addition, the material developed is adapted to the introductory course curriculum and laboratory techniques. The lecturer assumes that in this section, the material available in the handbook can be added to the PBL stage of the investigation and define the problem and organize the students to learn, this is why the material equivalence of the handbook can be the same as other teaching materials such as books and modules. Because the handbook includes one of the teaching materials and teaching materials is a systematic, written and unwritten set of material that creates an atmosphere that allows
students to learn [13]. So as to help the students master the basic competencies to be taught [14]. The handbook developed also adapted the curriculum, the basic details of the curriculum are presented in the form of learning objectives so that the material equivalent of the handbook is in accordance with other teaching materials. Some principles of teaching materials or learning materials include the principle of relevance, consistency, and adequacy that will support the achievement of the competencies that are learned [15].

According to the results of the overall practical, the use of handbook oriented problem-based learning introductory course and laboratory techniques according to the lecturer is very practical and practical students. This indicates the use of handbook can help lecturers and students in practice activities that begins with problem-solving. Because PBL to help students develop higher order thinking skills and a substantial disciplinary knowledge base by placing students in the active role of practitioners (or problem solvers) confronted with a situation (illstructured problem) that reflects the real world [16], and PBL can be used for future problem solving [17].

4. Conclusion

It can be concluded that the result of PBL oriented handbook practice in introductory and laboratory technique, obtaining very practical value from lecturer with average 90% and practical from student with average 76%. So, the using handbook PBL oriented in introductory and laboratory technique can be used practically by both lecturers and students.

Acknowledgments

Authors would like to thank the Kemenristek Dikti for funded all research and publication of the results of this research.

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