

Level of Practicality and Effectiveness of Practicum Guidelines in The Molecular Genetics Course for Students of Biology Undergraduate Study Programs

Aulya Novira
Oslan Jumadi
Alimuddin Ali
Hartono

Introduction

Practicum is a teaching method that provides opportunities for students to be actively involved in a practicum, of course, consisting of experimental steps to conduct tests aimed at obtaining results in the form of facts. With the practicum students can develop skills and thinking abilities. Practicum activities can run and achieve learning competencies if equipped with practicum tools along with the right practicum guide. The problem obtained by researchers when conducting observations at the Department of Biology FMIPA Makassar State University for molecular genetics courses is that students have not been able to carry out molecular genetics practicum, especially those related to DNA isolation. This is because there is no practicum guide for the topic of molecular genetics. The result is that students have not been able to prove the concepts they have obtained directly in the laboratory, so their mastery of the concept of molecular genetics is still lacking. The existence of practicum activities is very important in learning molecular genetics because it can help improve student skills in both science and education. In line with Abu, et al. (2019) that one of the skills that must be possessed by undergraduate biology graduates is expertise in practicum activities. Practical activities are actually carried out as an effort to provide real experience to students in implementing theoretical studies and to prove existing theories. One solution to the learning problem is the need to develop a practicum guide in the Molecular Genetics course. According to Murti et al, (2014) the practicum method is generally specifically designed so that students can develop learning activities, obtain facts from the concepts they learn, develop basic skills in conducting experiments, the ability to solve problems with a scientific approach, increase understanding of the subject matter, develop basic skills in making observations, communicate the results of observations orally or in writing and can facilitate the reconstruction of concepts or build concepts so that lecturers play a role in strengthening

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Abstract. *This type of research is Research and Development (R&D) which aims to determine the level of practicality, and effectiveness of guided inquiry-based molecular genetics guides. The research design uses the ADDIE development model, namely Analyze, Design, Develop, Implement, and Evaluate. The subjects of this research were Lecturers of Biology Department of Makassar State University, and Students. The instrument to test the validity uses a questionnaire sheet validated by an expert validator, to test the practicality of giving a student response questionnaire, lecturer response, and product implementation sheet, and test the effectiveness of multiple choice questions to test student learning outcomes. The data from this study showed that the development of this practicum guide was categorized as practical because the data obtained were in the interval $4 \leq IO \leq 5$. The effectiveness test used T-Test analysis (Paired Sample Test). From the data analysis, it is obtained that the use of molecular genetics practicum guides is effective in increasing knowledge related to DNA isolation, PCR, and electrophoresis material in practicum activities after being given molecular genetics guides. It can be seen that the significance of $p = 0.000 < 0.01$, meaning that the results obtained are very significant, it can be concluded that the developed guide shows effective on improving student cognitive learning outcomes.*

Keywords: *practicum guide, molecular genetics, guided inquiry, practicality test, effectiveness test*

Aulya Novira
Universitas Negeri Makassar
Indonesia

Oslan Jumadi
Universitas Negeri Makassar
Indonesia

Alimuddin Ali
Universitas Negeri Makassar
Indonesia

Hartono
Universitas Negeri Makassar
Indonesia

and correcting erroneous concepts, while according to Lestari (2014) Practical guidance is an important media that is needed in practicum activities in order to help students achieve learning completeness, foster habits of scientific work, and provide feedback to lecturers in developing learning designs that are more varied and meaningful.

The problem obtained by researchers when conducting observations at the Department of Biology FMIPA Makassar State University for molecular genetics courses is that students have not been able to carry out molecular genetics practicum, especially those related to DNA isolation. This is because there is no practicum guide for the topic of molecular genetics. The result is that students have not been able to prove the concepts they have obtained directly in the laboratory, so their mastery of the concept of molecular genetics is still lacking.

This study aims to produce a practicum guide in molecular genetics courses for undergraduate biology students who meet the criteria of practicality and effectiveness. With the development of the molecular genetics practicum guide, it is hoped that students will get material that is in accordance with competency standards and can optimize the potential and skills of biology education students who will later become educators in Formal Education Institutions. Based on the above background, it is considered very important to conduct research on the development of a practicum guide for biotechnology courses for undergraduate Biology students.

Research Methods

The type of research used is Research and Development (R&D) which refers to the ADDIE development model which consists of five stages, namely Analysis, Design, Development, Implementation and Evaluation. Data collection techniques in this study include validity analysis through expert validator assessment using a practicum guide validation sheet. The data analysis refers to Hobri (2010).

Table. 1 Determination of Interval Level of Practicality

Practicability Interval	Description
$1 \leq IO < 2$	Not practical
$2 \leq IO < 3$	Less practical
$3 \leq IO < 4$	Moderately practical
$4 \leq IO < 5$	Practical
$IO = 1,5$	Very practical

(Source: Hobri, 2010)

To test the effectiveness of the molecular genetics practicum guide using T-Test (Paired sample t-test) with a significance level of 0.01 or 1% was used to test the hypothesis. Data analysis using the SPSS 24.0 for Windows program. Before the data were analyzed with the Paired sample t-test test, the prerequisite tests were first carried out, namely the normality test and the homogeneity test. Normality test used Shapiro-Wilk test. The homogeneity test used Levene's Test of Equality of Error Variance.

Results And Discussion

The results of the practicality and effectiveness tests of the implementation of research on the development of guided inquiry-based practicum guides in the Molecular Genetics course for undergraduate Biology Study Program Students, FMIPA UNM will be explained as follows.

1. Implementation Stage

Guiding products and instruments that have been validated will then be implemented in the trial class. Implementation was carried out by giving research instruments to 2 biology lecturers as prospective users of the practicum guide that had been developed, 2 observers who filled out the product implementation questionnaire sheet, 10 students who tested the developed guide. The practicality test that has been carried out by giving the product implementation observation sheet, lecturer response questionnaire and student response questionnaire is obtained in the practical category. The data can be seen in the appendix pp 157-158.

Furthermore, the effectiveness test of student learning outcomes by giving an evaluation test of learning outcomes aims to determine how effective the use of guided inquiry-based practicum guides is in the process of practicum activities. This evaluation test was carried out after the practicum activities were completed. This test uses prerequisite tests, namely normality test and homogeneity test and T-Test (Paired Samples Test).

a. Normality test

Normality test is used to determine whether the data obtained comes from a normally distributed population or not. The normality test used is the Shapiro Wilk test. Normality test results can be seen below.

Table 2. Shapiro Wilk Analysis Results

Group	Significance	Conclusion
Pretest	0,376	Normally distributed data
Posttest	0,261	Normally distributed data

Data testing uses the Shapiro Wilk test with the test criteria, namely: the research sample is normally distributed if the significance value is $\alpha > 0.05$. The sample is not normally distributed if the significance $\alpha < 0.05$. Based on the table above, the pretest significance value is 0.376 and the posttest significance value is 0.261, which means that it is greater than 0.05, so it is concluded that the research sample is normally distributed.

a. Homogeneity Test

Homogeneity test to determine whether the data are of the same or different variance. The homogeneity test used is Levene's Test for Equality of Variance. The homogeneity test criterion is that the data is said to be homogeneous if the significance value $\alpha > 0.05$ and vice versa if the significance value $\alpha < 0.05$ then the data is not homogeneous. Homogeneity test results can be seen in the following table.

Table 3. Results of Levene's Test for Equality of Variance

Group	Significance	Conclusion
Data pretest dan posttest	0,463	Homogeneous

Based on the table above, the significance value is $0.463 > 0.05$. So it can be concluded that the pre and post test data are homogeneous or have the same variance.

b. Hypothesis Test

After the data meets the prerequisites, namely that the data is normally distributed and has the same or homogeneous variance, the next hypothesis test is carried out. Hypothesis testing used is T-Test (Paired Samples Test) on SPSS used to determine whether there is a difference in student learning outcomes before and after using molecular genetics guides. This hypothesis test is intended to determine whether the difference is significant or not.

Based on the learning outcomes data obtained, it shows that the use of molecular genetics practicum guides is effective in increasing knowledge related to DNA isolation, PCR, and electrophoresis material in practicum activities after being given molecular genetics guides. It can be seen in the table that the significance result of $p = 0.000 < 0.01$, means that the results obtained are very significant, so it can be concluded that the guide developed shows effective on improving student cognitive learning outcomes.

2. Evaluation Stage

The evaluation stage is a stage carried out to provide value to the guide that has been developed. At this stage, data analysis was carried out on the validity, practicality, and effectiveness of the developed practicum guide. The results of the data analysis show that the guide developed has met the requirements. Based on the accumulation of each aspect of the assessment, the validity value of the guide is 4.75 which is in the "Very Valid" category.

Lecturer response to the practicum guide shows 4.47 or is in the interval $4 \leq IO \leq 5$ so it is categorized as practical while the student response to the guide shows a value of 4.50 or is in the interval $4 \leq IO \leq 5$ so that the developed guide meets practical criteria.

Based on the learning outcomes data obtained, it shows that the use of molecular genetics practicum guides is effective in increasing knowledge related to DNA isolation, PCR, and electrophoresis material in practicum activities after being given molecular genetics guides. It can be seen in the table that the significance result of $p=0.000 < 0.01$, means that the results obtained are very significant, it can be concluded that the guide developed shows effective on cognitive learning outcomes, so it can be used in practicum activities.

Eliza & Myori (2017) suggest that effectiveness is something that has an influence or effect that brings results from an effort or action. The effectiveness criteria refer to (1) students' mastery of the material taught, (2) improving student learning outcomes with significant differences in initial understanding and understanding after learning. If these criteria have been met, the product developed can be said to be effective. Referring to several opinions of experts, the media developed must meet the criteria of valid, practical and effective. Valid is measured based on the opinions of experts. Practical is measured on ease of use by lecturers and students as users. Effective is seen from students' mastery of the material taught.

Syamsu (2017) argues that the high value of student post tests is also inseparable from the use of Guided Inquiry in the practicum guide. Learning with the Guided Inquiry approach can bring students directly involved in practicum experiment activities. This direct experience is what makes student activity effective in the practicum. According to Rustaman (2005) the ability of guided inquiry can affect the development of student knowledge. Accustoming students to learn through scientific process activities, in addition to being able to train detailed scientific skills and systematic work, can also shape students' thinking patterns scientifically. Thus, the development of guided inquiry can have implications for the development of students' thinking skills (high order of thinking). With the training of guided inquiry in students when doing practicum activities, student activities will be very effective.

Data on student learning outcomes were obtained through the administration of a learning outcomes test conducted at the last meeting (posttest). The test was given in the form of multiple choice questions as many as 25 questions with 5 answer keys. This analysis is used to determine students' mastery of concepts after conducting practicum activities using guided inquiry-based molecular genetics practicum guides. According to Sukardi (2008), a test is a systematic procedure for individuals who are tested represented by a set of stimuli for their answers that can be shown in numbers so that an individual's level of understanding of the tested variable is obtained. Based on the data on student cognitive learning outcomes obtained,

it can be concluded that cognitive learning outcomes have increased from before using the practicum guide and after using the practicum guide. This means that the guided inquiry-based molecular genetics practicum guide has a positive effect on student learning outcomes. The results of Arsih's research (2010) also showed that classical learning completeness by using guided inquiry-oriented learning tools can improve student learning outcomes. This shows that the guided inquiry in the developed practicum guide is able to train students' scientific thinking skills, this is in accordance with the opinion of Rahayu (2011) which states that learning requires active learning involvement. The application of the guided inquiry approach, causes students not to passively receive and memorize information provided by lecturers, but try to find concepts through direct experience instead of just hearing and receiving concepts from what is conveyed by lecturers.

Conclusion

Based on the results of research and development of molecular genetics practicum guides in undergraduate Biology students FMIPA UNM it can be concluded that. The development of molecular genetics practicum guides in undergraduate Biology students FMIPA UNM developed is practical. The development of molecular genetics practicum guides in undergraduate Biology students FMIPA UNM developed is effective.

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<i>Aulya Novira</i>	Graduate student of Makassar State University, Makassar, Indonesia E-mail: aulyanovira1@gmail.com
<i>Oslan Jumadi</i>	Prof., S.Si., M.Phil., Ph.D. Lecturer of Biology Department FMIPA Makassar State University, Makassar, Indonesia E-mail: oslanj@unm.ac.id
<i>Alimuddin Ali</i>	Dr., S.Si, M.Si. Lecturer of Biology Department FMIPA Makassar State University Makassar, Indonesia E-mail: muddin_69@unm.ac.id
<i>Hartono</i>	S.Si., S.Pd., M. Biotech., Ph.D. Lecturer of Biology Department FMIPA Makassar State University, Makassar, Indonesia E-mail: hartono@unm.ac.id