

FEASIBILITY TEST OF HEREDITY CIRCLE (CROSS) PRACTICUM GUIDE ON INHERITANCE MATERIALS FOR INQUIRY-BASED STUDENTS IN CLASS XII

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Abstract

This study aims to develop and analyze content feasibility, presentation feasibility, language feasibility in practicum guides in the application of heredity circles using the 4-D model. The method used is development (Development Research). The research was designed with ADDIE's design development model (Analysis, Design, Development, Implementation and Evaluation). The data used are qualitative and quantitative data. Quantitative data was obtained from questionnaires and tests while qualitative data came from criticism and suggestions for the guide product by validating the material and student responses. The evaluation aspect at the 1st validation stage obtained an average result of 53.38% and increased in the 2nd stage validation by 8.78% to 62.16% where the criteria that were in the good enough category changed to be good. Based on the research results obtained, it can be concluded that the feasibility test of the Lingkaran Hereditas (LINTAS) practicum guide on inheritance material for inquiry-based class XII students can be declared feasible, valid, and effective for use in schools both in terms of content, presentation, to language used.

Keywords: Heredity, Genetics, Practical guide, Inquiry.

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INTRODUCTION

Education is an important aspect of human life. Education always experiences changes and modifications that always keep up with the times so that it can develop in a better direction. Many aspects of change have occurred in education such as the implementation of learning in the field, the quality of education, facilities and infrastructure, and other supporting aspects. The current developments have led to developments in science, especially in the molecular field, one of which is the development of genetics. The current learning encourages students to be able to be independent both in the form of abilities and skills, students are expected to be able to think in theory and practice directly in the field (Asmani, 2016).

Many students have the perception that in heredity learning it is very difficult to learn because it has material that is abstract and confusing (Kristiani, Ristanto, & Lisanti, 2020). This can happen because the teacher does not fully or thoroughly explain the genetic material using the lecture method, so students are not yet able to construct and connect between the concepts of heredity as a whole (Miharja, Hindun, & Fauzi, 2019; Abimbola). Practicum activities can accommodate students' mastery in minds on & hand on (Muhajir, 2015). So that one of the efforts to maximize the ability of students is to do practicum in the laboratory. To carry out practicum activities, adequate tools, materials and facilities are needed, but in real life there are still many schools in Indonesia that have inadequate facilities. This is what underlies the research by modifying practical learning and testing the feasibility of the Heredity Circle practicum guide on material inheritance properties using simple tools. Practicum activities have a very important role in learning because they can carry out 3 aspects of learning assessment simultaneously, namely cognitive, affective, and psychomotor. By covering these three criteria, it is hoped that students will be able to balance both in abilities and skills so that the realized learning process goes better (Hamidah, 2014).

The proper implementation of practicum activities is based on practicum guidelines that are systematic and effective (Nurussaniah & Nurhayati, 2016). The practicum guide is a practicum implementation guide which contains procedures for preparation, implementation, data analysis and reporting to expedite or provide material and information assistance as a guide for students in carrying out practicum activities. The practicum guide is a facility for students to be able to work in a directed and continuous manner. The use of learning media makes it easier for students to understand biology subject matter. The media used must be varied, fun, attract attention, and provide new learning experiences so that students can easily understand or capture the essence of the lesson (Primasari, 2014).

According to Zulaiha, et al. (2014) there are still many discrepancies in student worksheets such as there are no indicators, there is no practicum title of what to do, the worksheet is blurry, so it is not interesting,

the observation column is small, so it is not free to write down the observations, the worksheet has not been characterized as a book-based science process skill. One solution that helps improve students' understanding is to develop practicum guides that can make it easier for students to understand heredity material. Guide to heredity practicum on inheritance material developed based on guided inquiry. Practicum activities in the form of direct application of calculations in case study questions aim to increase understanding of the concept of heredity learning. With practicum activities, students can understand heredity material in inheritance.

Guided inquiry learning is used in the development of guidelines so that practicum activities can be student centered. The use of a guided inquiry-based approach is expected to help students discover independently learning concepts, especially ma. According to Sukma et al. (2016) the guided inquiry learning model is a learning model with independent discovery of concepts by students so that their role is more dominant. According to Yuliani et al. (2017) guided inquiry syntax includes orientation, formulating problems, proposing hypotheses, collecting data, testing hypotheses, and formulating conclusions. The advantages of the guided inquiry model are that the lecturer or teacher does not let go of learning activities carried out by students independently, so that students who think slowly or have low intelligence are still able to participate in learning activities.

RESEARCH METHOD

The method used is Research and Development (Tjeerd Plomp & Nienke Nieveen, 2013) using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluate) developed by Dick and Carry (1996) (Endang Mulyatiningsih, 2012: 200). The first stage of the ADDIE model is to do the analysis. In the analysis stage, material and needs analysis is carried out. Furthermore, the design stage begins with drafting a practicum guide. At the development or development stage, what is being developed here is to develop new teaching materials based on science process skills. After developing the practicum guidebook, the researcher then carried out the experiments contained in the practicum guide himself. The last stage is the evaluation stage. At this stage, material expert validation is carried out, namely the biology teacher concerned teaching the subject and students' responses to the product (practicum guide). The object of this study were students of class XII IPA at one of the public high schools in Bekasi. The data used are qualitative and quantitative data. Quantitative data were obtained from questionnaires and tests, while qualitative data came from criticism and suggestions for guide products by material validation and student responses. The validation process for the practicum guide product was carried out by 2 experts, namely a high school biology teacher. The material validation stage is said to be good if it includes several assessment indicators. Assessment indicators on media validation include aspects of assessing material feasibility, presentation feasibility, and linguistic feasibility. The instrument uses a modification of the development of Muljono (2007), namely the cover design of the guide and the design of the contents of the practicum guide. Material validation assessment indicators include several aspects and research indicators. Assessment aspects are presented in Table 1.

Table 1. Material Validation Assessment Indicators

Aspect	Indicator
Content Eligibility	Material Coverage
	Material Accuracy
	Sophisticated and Contextual
	Skill Dimension
Eligibility of Presentation	Serving Technique
	Presentation Support
	Presentation Completeness
Language Eligibility	Communicative
	Compatibility with Language Rules

Source: Modification (Muljono, 2007)

Practical guidelines that have been validated are tested on small groups and large groups. Small group trials involved 15 students while large group trials involved 30 students. The product trial instrument is a questionnaire sheet using a Likert scale (Sugiyono, 2018) with a score category scale 1-5, namely: 5 (very good), 4 (good), 3 (good enough), 2 (not good), and 1 (very not good). Assessment indicators include interest in the guide, sequence, the level of ease of understanding the contents of the guide and the language used according to the Enhanced Spelling. The criteria for evaluating guide products are presented in Table 2. The data is converted in percentage form using the following formula:

$$\text{Validity} = \text{Total score obtained} / \text{total maximum score} \times 100\%$$

Table 2. Media Eligibility Criteria

Skor Presentase (%)	Klasifikasi Validasi
80 - 100	Very Good (VG)
60 - 80	Good (G)
40 - 60	Good Enough (GE)
20 - 40	Not Good (NG)
0 - 20	Very Bad (VB)

Source: (Ridian and Akdon, 2020)

RESEARCH RESULT AND DISCUSSION

Analysis Phase

The material analysis is obtained by determining what material is needed to be presented in the practicum guide. While the needs analysis was carried out through distributing questionnaires to 38 students, where the results of the questionnaire showed as many as 68.2% of students stated that the material for deviations from Mendel's Law was difficult to understand and also boring because the explanations were confusing and practicum was rarely carried out on this material so it was necessary development is carried out by making a practicum guide regarding the material to make it easier for students to understand the practicum being carried out.

Design Stage

This design consists of an introductory section, a content section, and a closing section which includes several content sections (Table 3).

Table 3. Practicum Guide Design

Part	Component
Introduction	Front cover
	Student group identity sheet
Content	Practicum goals
	Brief matter
	Practical tools and materials
	Practical steps
	Table of results of crossing experiments
	Discussion
Closing	Conclusion
	Postpracticum questions

Source: (Isrika, et.al., 2022) with modifications.

The Canva application was used to create this practical guide. This Mendelian law practicum guide is based on inquiry and is based on an effective practicum guide. Good practicum guidelines must contain several important elements, including practicum titles, objectives, basic theory, tools and materials, work procedures, and evaluation. This is in line with the statement of Budiarti & Oka (2014) that the guide consists of several sections, including titles, tools and resources, work steps, and questions that will measure students' understanding. Figures 1 and 2 show some of the results of the practicum guide designs that have been made.

Development Stage

The teaching materials developed here are the media used in high school practicum on heredity material. At this stage the guidebook has developed the content, presentation, language used so that the guidebook is easier to understand and implement. The practicum guidebook has been designed to attract students' interest to be more motivated to carry out the practicum, the observation sheet is also to make it easier for students to process data and at each step of doing the practicum it is made more detailed so that students can follow the guide properly and correctly.

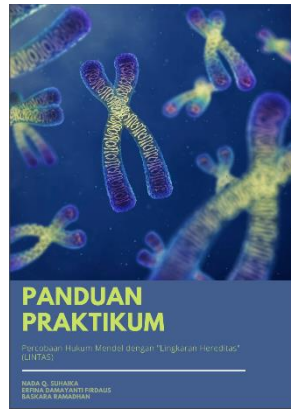


Figure 1. Practicum Guide Cover

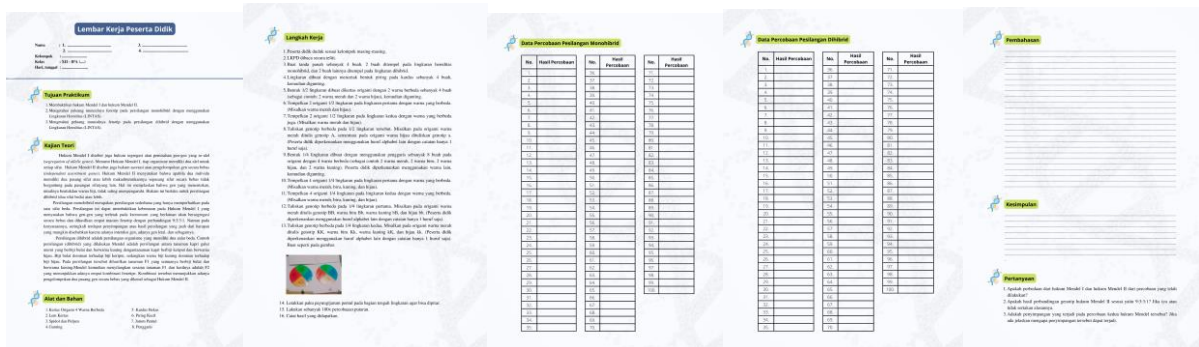


Figure 2. Contents of the Practicum Guide

Implementation Stage

This is intended so that researchers feel for themselves whether the practicum guidebook can be applied in schools. Furthermore, the guidebook was tested in school practicum. If the guidebook has been implemented in schools, then the evaluation stage is carried out by the material expert validator's assessment.

Evaluation Stage

Material Expert Validator Assessment

Validation needs to be done so that the practicum guide can be feasible to use. Material validation was carried out twice. The aspects assessed in material validation are content feasibility, presentation feasibility, and language feasibility. The results of the material validation are presented in Table 4.

Table 4. The results of the Feasibility Assessment of Practicum Guidance Materials

Stage Validation	Assessment Aspects			Average (%)	Criteria
	Content Eligibility (%)	Adequacy of Presentation (%)	Language Eligibility (%)		
I	53.66	65	41.5	53.38	GE
II	60.15	70.33	56	62.16	G

Based on the expert's assessment of the material, there are several improvements to the practicum guide, namely the completeness of the material presented with the need for additional literature and there are still several sentences that must be corrected, such as in the work steps section. The material validator gives suggestions that it is necessary to improve the writing of material where it is necessary to include reference sources at the end of the sentence in the elaboration of the material, add even more complete material, and need to look for sentences in simpler and easier work steps (effective sentences). According to Listika et al. (2019) effective sentences have the characteristics of equivalence and unity, alignment of forms, emphasis in sentences, frugality in using the word variety in sentence structure. The material validator suggests that

effective sentences are needed in the practicum work steps so as not to confuse students either or lead to assumptions when students read them. The material expert suggested that the contents of the practicum guide should be added to the implementation of the steps of the inquiry method in easy-to-understand language that is related to the practicum to be carried out, namely proving Mendel's law.

The evaluation aspect at the 1st validation stage obtained an average result of 53.38% and increased in the 2nd stage validation by 8.78% to 62.16% where the criteria that were in the good enough category changed to be good. The presentation feasibility aspect consists of techniques, supports, and presentation completeness. Based on the assessment of material experts, the practicum guide product produced includes several indicators including introduction, content, and closing. The validator appreciates the concluding section which provides questions that can provoke the way of thinking of students where the existence of these questions further demonstrates an inquiry-based practicum guide. However, the Validator provides suggestions for continuing to improve the effectiveness of writing sentences. The validator also provides suggestions for adding images that are in accordance with Mendel's Law material in the practicum guides that are made. Sentences used must be simple, short, clear, and communicative, and there are relevant images that can represent the material.

The next aspect of assessment is language assessment. Communication cues and linguistic compliance make up the language appropriateness features. The language chosen should be easily understood or communicative. Meanwhile, the matter of conformity is in line with grammar rules, which are assessed from the accuracy of constructing effective sentences and referring to good and correct Indonesian language rules. The ideal practicum guide according to Sari et al. (2018), not confusing in a sentence editor. Additional evidence for language appropriateness includes the following: communicative, dialogical, and interactive qualities; simplicity; consistency; good suitability of Indonesian language rules; and the use of terms and symbols or symbols that are in accordance with scientific and technological advances.

After the practicum guide has been declared feasible by the validator, it will proceed to the trial phase, for class XII IPA students at a high school in Bekasi. The trial was carried out first using a small group consisting of 15 students and a large group consisting of 38 students. Testing of practicum guide product trials is carried out by distributing student response questionnaires using the Google form. The aim is to obtain suggestions and input on the perfection of the guidelines that have been developed. The results of the small group trials obtained a percentage of 70.34% including the "Good" category. Suggestions for students to make the product better, namely clarifying work steps, clarifying sentences such as using uppercase and lowercase letters to represent genotypes to be written on the Heredity Circle, and adding an example picture of the Heredity Circle to be made. Furthermore, large group trials obtained 74.5% in the "Good" category. This is supported by the opinion of Akbar (2013) that learning media can be said to be feasible if the respondent's results are obtained above 70%. Learning tools developed are said to be of high quality if they meet three criteria, namely validity, practicality, and effectiveness. A learning device is said to be valid if there is a consistent correlation between each component that is developed with the features of the learning model used; it is also said to be practical if it is easy to use and implement; and is said to be effective if the learning objectives can be achieved by using the developed learning tools (Fatmawati, 2016).

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the research results obtained, it can be concluded that the feasibility test of the Heredity Circle practicum guide (LINTAS) on inheritance material for inquiry-based class XII students can be declared feasible, valid, and effective for use in schools both in terms of content, presentation, to language used.

With the improvement of practicum guidelines, an increase in the percentage of each stage of the assessment was obtained. The results of product trials carried out by small groups of students and large groups of students showed the "good" category indicating that the practicum guide was feasible to use. The implication of developing this practicum guide is that students gain new knowledge where when Mendel does the crossing, the results listed in the books are not obtained, including 1:2:1 or 9:3:3:1, but random results are obtained, and multiple trials are needed. - times to get close to these numbers. The use of this inquiry-based practicum guide helps students to find more independent material concepts and think more critically.

B. Suggestion

Based on the research conducted, the researchers suggest the following.

1. The application of this practicum guide has stages of a guided inquiry approach where in its implementation it is hoped that students will better integrate the knowledge gained during practicum activities in other subjects.

2. Teachers are advised to be more intensive in guiding students in carrying out practicum activities, because the application of guided inquiry syntax requires a fairly high level of accuracy and understanding in its implementation.
3. To other researchers, so that they can develop practicum guides with a more varied learning approach.

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