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DEVELOPMENT OF DERMATOGLYPHIC PRACTICUM GUIDE BASED ON GUIDED INQUIRY

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ABSTRACT
This study aims to develop dermatoglyphic practicum guide based on guided inquiry and to determine students' creative thinking skills in using the practicum guide. This type of research is Research and development or R&D with the ADDIE development model. The subjects of this study were students of biology education at Jambi University who had contracted genetics courses and genetics practicum, namely students of the 2018 batch. The data analysis techniques in this study were quantitative and qualitative. The results of media validation and material validation showed an increase after revision with a media validation value of 71.60% (good) and material validation 89,05% (very good). The results of small group trials and large group trials of student perceptions of the practicum guide obtained a percentage of 84,82% % with (very good) and 89,24% for large group trials (very good). The use of practicum guides can improve students' creative thinking skills with the N-gain test score of 0.73 including the high category. Guided inquiry-based dermatoglyphic material practicum through the paired sample t-test, it is known that there is a significant effect of the use of practicum guides on students' creative thinking skills.

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1. INTRODUCTION

Practical guides are needed to help direct students in carrying out practical activities (Furqon et al., 2016). The practical guide should be arranged in a systematic and attractive so that students can learn and carry out practicum independently. The practicum guide is a practicum implementation guideline that has structural components, namely practicum titles, objectives, theoretical basis, tools and materials, and questions that lead to goals that follow the rules of scientific writing (Arifah et al., 2014).

One of the learning experiences carried out through practicum is Genetics (Fadillah & Angraini, 2018). The practicum activities are carried out with the aim of understanding the concept of genetics and overcoming difficulties in understanding material that was originally considered abstract to become more real. Practical activities train so that theory can be applied to real problems (cognitive), train in independent activity planning (affective), and train in the use of certain instruments (psychomotor) (Susantini et al., 2012). Dermatoglyphics is one of the materials found in genetics practicum.

Dermatoglyphics is a pattern of skin ridges (crista cutanea) found on the hairless skin surface found on the fingers, palms of the hands and soles of the feet (Purbasari & Sumadji, 2017; Singh et al., 2016; Smail et al., 2019). Genetic practicum of dermatoglyphic material is already contained in the practicum guide. However, dermatoglyphic material has little explanation. In the manual there is no description of the human fingerprint pattern. The fingerprint pattern only mentions three basic pattern names consisting of Whorl, Arch, and Loop while the derived pattern is not explained. In addition, the work procedure has not provided a detailed explanation of good fingerprint taking. This has an impact on student errors in determining fingerprint patterns.

Based on a preliminary study questionnaire from the statements of 31 students who had contracted the Genetics practicum, it was found that 54.8% of students had difficulty understanding dermatoglyphics. This is because of several obstacles, namely 80.6% of students feel that during the practicum the determination of their

own fingerprints is not quite right. 51.6% of students thought that the practicum guide did not explain well how to take the correct fingerprint, and 51.6% of the students felt that the dermatoglyphic practicum teaching materials were few. Therefore, a dermatoglyphic practicum guide was developed.

In addition, currently in the 21st century requires students to have various skills and be able to compete globally. 21st century learning skills consist of communication, collaboration, critical thinking, and creativity (Prihadi, 2018). The ability to think creatively is in the current education system very important to face the challenges of the development of science and technology. This is because the ability to think creatively can make students more flexible, open-minded and adaptable to the development of science and technology.

Students who are able to think creatively will give satisfaction to the surrounding environment because the actions are carried out in a fast time, give good results, and the work produced is original and unique. Creative thinking is also needed to solve problems in society (Mentari et al., 2019). However, currently Indonesia has low creative thinking skills for Indonesian students. This can be seen from the 2015 GCI (Global Creativity Index) research which shows that Indonesia is ranked 115th out of 139 countries (Florida et al., 2015). In addition to GCI, the results of the PISA research show that Indonesian students do not yet have the skills to become creative thinkers and problem solvers, and have below the average ability to carry out scientific investigations in learning (OECD, 2016).

One of the innovations that can be done to improve students' creative thinking skills in practicum is to develop a guided inquiry-based dermatoglyphic material practicum guide. Guided inquiry-based practicum guides can make students able and active in carrying out practicum independently at home (Fadillah & Angraini, 2018). Guided inquiry-based practicum guides can also help students be more active during learning, be able to improve process skills, and make students more creative in finding material concepts (Nasution, 2018). The purpose of this study was to develop a practical guide for dermatoglyphic material based on guided inquiry and to determine students' creative thinking skills in using the practicum guide.

2. RESEARCH METHOD

This research uses research and development methods. The development model used is ADDIE. ADDIE stands for the development stage process which consists of analysis, design, development, implementation, and evaluation (Molenda, 2015). The subjects of this research are Biology Education students who have contracted genetics practicum class 2018. Data analysis techniques are qualitative and quantitative. Quantitative was obtained from questionnaires and tests, while qualitative was obtained from criticism and suggestions for the developed guide.

The first stage of development is analysis (analysis). Stages of analysis are carried out with the aim of identifying the problems and needs of students to improve the quality of learning (Branch, 2010). At this stage, a needs analysis of the dermatoglyphic material is carried out, then an analysis of the material will be carried out which will be presented in the dermatoglyphic practicum guide. Then the design stage is carried out. The design phase includes the design of the practicum guide through designing the display of the guide, and the contents of the practicum guide. The practical guide for dermatoglyphic material based on guided inquiry contains practicum rules, practicum objectives, theoretical studies, tools and materials, working methods and there are post practicum questions.

After designing the guide, the development stage is continued. At this stage, product validation is carried out. Product validation aims to assess the feasibility of the product design (practical guide). Validation was carried out by several experts consisting of media experts and material experts. The assessments and suggestions from the validator experts form the basis for design revisions. The practical guide that has been validated is carried out by small group trials and large group trials (product trials). Small group trials involve 6 students while large group trials involve 16 students. The product trial aims to determine student responses to the developed practicum guide. The instrument for product validation and testing is a questionnaire which is measured using a Likert scale. Each measured indicator is given a score on a scale of 1-5, namely 5 (very good), 4 (good), 3 (good enough), 2 (not good), and 1 (very bad) (Sugiyono, 2018). The data will be converted in percentage form with the following formula:

$$\text{Validity} = \frac{\text{(Total score obtained)}}{\text{(Maximum score)}} \times 100\%$$

The next stage is implementation. This stage is a preparation for the learning environment and encourages students to use the practicum guide that has been made (Branch, 2010). The use of practical guides aims to determine whether there is an increase in creative thinking skills. The implementation process was carried out by giving description test questions to 15 students. The test design used is one group pre-test and post-test. Analysis of test data was carried out by using paired sample T-test and N-gain score. The last stage is evaluation. Evaluation aims to evaluate the suitability of the material with material competency standards. The evaluation stage is carried out by reviewing product and material designs to obtain information that supports research.

Table 1. Media Eligibility Criteria

No	Percentage Score (%)	Validation Classification	Explanation
1	80 – 100	Very Good (VG)	No need to revise
2	60 – 80	Good (G)	No need to revise
3	40 – 60	Good Enough (GE)	Need to revise
4	20 – 40	Not Good (NG)	Need to revise
5	0 – 20	Very Bad (VB)	Need to revise

3. RESULT AND DISCUSSION

Research on the development of a guided inquiry-based dermatoglyphics practicum guide is used for 5th semester students who are contracting the Genetics practicum course. The development model consists of 5 stages, namely analysis (initial investigation) of guide requirements, design stage, development stage, implementation stage, and evaluation stage. The stages of the practicum guide development process are described as follows.

Analysis Phase (Preliminary Investigation)

The analysis phase carried out is a needs analysis and material analysis. The results of the needs analysis stage based on a questionnaire distributed to 31 students who had contracted the Genetics practicum showed that 54.8% of biology education students considered that dermatoglyphic material was difficult, 35.5% was not difficult, and 9.7% was very difficult. So, it is known that many students think that dermatoglyphic material is difficult, so it is necessary to develop a practicum guide for dermatoglyphic material.

Material analysis is obtained by determining the material that needs to be presented in the dermatoglyphic material practicum guide. Determination of material based on genetics practicum semester program design. The material presented is the process of forming dermatoglyphics, the benefits of having dermatoglyphics, the basic pattern of fingerprints, and the pattern of fingerprint derivatives. The additional material presented is how to count the number of fingerprint ridges and determine the angle of ATD in dermatoglyphics.

Design Stage

The design stage begins with making a practical guide storyboard. The practicum guide storyboard consists of the beginning, the content, and the end. The initial part consists of a cover, introduction and practice rules. The content section consists of practicum objectives, "Keywords" column, "Let's think!" column, Theory Foundation, "Find the Facts!" column, and "Did You Know!" column, "Info" column, tools and materials, work procedures, results table, post practicum questions, column “additional information”. The final section contains references, biodata of the authors and the final cover of the guide. The practical guide is designed using Microsoft Word and Canva.

The practicum guide that was developed based on guided inquiry because it has components “Let's think” and “Find the facts!” which aims to formulate problems and invite students to think about temporary answers to the problems provided. After students find the answers, the teaching assistant will help direct the right answers. The practical guide is designed according to guided inquiry learning whose activities have five steps consisting of asking questions (problems), formulating hypotheses, collecting data (information), analyzing data and making conclusions. (Maisarah et al., 2015; Uzlifat et al., 2018). Overall, the guided inquiry stage is a stage that helps students to be more independent in finding knowledge from the activities carried out during learning (Widiana et al., 2019).

The guided inquiry-based dermatoglyphic material practicum guide is prepared based on the components of a good practicum guide. The components in the practicum guide must contain the title of the practicum, practicum objectives, theoretical basis, tools and materials, working methods, and evaluation (Budiarti & Anak Agung Oka, 2014; Prayitno, 2017). The practicum guide also has an explanation of the report writing format so that it helps students complete the reports that must be done after the practicum (Anggraini, 2016).

Development Stage

At the development stage, validation of material experts and validation of media experts is carried out. The purpose of the validation is that the practical guide is worth testing. Material validation is carried out twice. Aspects assessed in material validation are content feasibility, presentation feasibility and language feasibility. The results of material validation are shown in table 2.

Table 2. Feasibility Assessment of Practical Guide Materials

No	Assessment Aspect	Stage Validation (%)	
		1	2
1.	Contents	54,3	68,6
2.	Material presentation	63,6	78,18
3.	The use of language	52	68
	Average (%)	56,3	71,60
	Criteria	Good Enough (GE)	Good (G)

Material validation assessment is divided into aspects of content feasibility, material presentation feasibility and language use feasibility. In the aspect of feasibility, the average content of the validation results of stage 1 is 54.3% while the results of stage 2 validation are 68.6%. Feasibility of the content consists of the scope of the material, the accuracy of the material, and its suitability with the development of science and technology (Kartikasari & Widodo, 2015). Some of these indicators that can be assessed to what extent the level of feasibility of the content of the material. Material expert validators provide suggestions to increase the coverage of material on variations in fingerprint patterns whether there are certain fingers.

The next aspect of the assessment is the feasibility of the presentation. The average result of the validation of the feasibility aspect of presenting the material in stage 1 is 63.6%, and an increase in validation stage 2 is 78.18%. The feasibility aspect of presenting the material consists of presentation techniques, presentation support and presentation completeness. The technique of presenting the material contains the systematic consistency of the presentation and the variations in the presentation. Supporting the presentation contains motivational generators by making students participate in learning activities through activities providing questions. The completeness of the presentation of the material shows that there is content, introduction, and closing sections on the developed media (Rismawati et al., 2015). The aspect of the feasibility of presenting the material is in accordance with these indicators. However, the material expert validator provides suggestions to improve the consistency of the words to be consistent with the images in the practicum guide media.

Aspects of the feasibility of using language, it was found that the validation assessment in stage 1 was 52% and in stage 2 validation it increased with a value of 68%. The aspect of language feasibility can be viewed from several aspects, namely communicative and conformity with language rules. Communicative can be judged from the language used in conveying information that is easy to understand, and has the ability to motivate. Aspects of conformity with language rules are assessed from the accuracy in choosing grammar and spelling into effective sentences that refer to good and correct Indonesian language rules (Purnanto & Mustadi, 2018). Suggestions from the validator on the aspect of language feasibility is to improve the sentence structure that is less precise and effective.

The validation of the practicum guide media was carried out three times. Aspects assessed in media validation are guide cover design, and guide content design. The results of media validation are shown in table 3.

Table 3. Media Feasibility Assessment Practicum Guide

No	Aspects of Graphical Assessment	Stage Validation (%)		
		1	2	3
1	Cover Design	26,67	65,67	86,67
2.	Practical Guide Content Design	42,88	65,71	91,43
	Average (%)	34,78	66,19	89,05
	Criteria	Good Enough (GE)	Good (G)	Very Good (VG)

The results of media validation have increased, initially the criteria are quite good with a value of 34.78% in stage 1 validation, then in stage 2 media validation with a value of 66.19% including good criteria, and stage 3 validation of 89.05% including very good criteria. Suggestions for improvement given by the material expert validator are improving the cover so that the color combination is better, adding image illustrations and clarifying the contents of the guide, and improving the appearance of the practicum guide design to make it more attractive.

Based on relevant research Safitri & Hartati (2016) stated that the existence of good and adequate graphic elements in the practical guide textbook is expected to motivate students in studying the material provided. This is in line with the opinion of Adalikwu & Iorkpilgh (2013) which states that good practicum guide teaching materials can act as facilitators between educators and students in developing motivation during learning activities. The media validation carried out in the practicum guide includes the consistency of the typeface, the quality of the illustration images and their descriptions (Safitri & Hartati, 2016).

After material validation and media validation, product trials were carried out. Product trials consist of small group trials and large group trials. The following are the results of small group and large group trials obtained:

Table 4. Results of Small Group Trial and Large Group Trial

No	Assessment Aspect	Small Group Trial (%)	Large Group Trial (%)
1.	Attractiveness	85,93	91,25
2.	practicum guide arrangement	81,67	88,44
3.	Ease of use practicum guide	86,67	91,67
4.	The use of language	85	85,62
	Average (%)	84,82	89,24
	Criteria	Very Good (VG)	Very Good (VG)

The average results of small group trials and large group trials are 84.82% and 89.24% with very good categories. Based on the results of product trials, it is known that students give a good response to the practicum guide. Students also commented that the practical guide that was made was good and made them able to understand the dermatoglyphic material in depth. The practical guide is arranged in a coherent and has clear work procedures, the language used is easy to understand so that it makes it easier for students to understand dermatoglyphic material. Students give suggestions to correct misspelled words, and add pictures to make the guide more interesting. Suggestions from students serve as guidelines for making practical guides better.

The relevant research conducted by Susantini et al (2012) found that the development of a genetic practicum guide received a positive response from students with a readability level of 89% including the very good category because the examples presented in the guide increased their interest in learning. Another study conducted by Asmaningrum et al (2018) showed that during the trial of the product development of the basic chemistry practicum guide, the student response showed a positive response because students were able to understand the material and carry out the practicum well. This is shown from the results of the student response questionnaire of 86.25% with a very decent category.

Implementation Stage

After validation of material experts, media expert validation, and product testing, it is continued to the implementation stage. The results of the implementation phase are in the form of pre-test and post-test. The results of the pre-test and post-test were tested by using the paired sample T-test and the N-Gain score test. Normality test needs to be done before the paired sample t-test as a prerequisite. The normality test shows that the significance value of the pre-test and post-test is 0.2, which means the significance value is greater than 0.05. This shows that the results of the pre-test and post-test data are normally distributed.

Then the paired sample t-Test was performed. The results of the paired sample T-test showed that the significance value of 0.000 was less than 0.05 so that it was known that there was a significant difference between

learning outcomes before and after using the dermatoglyphic material practicum guide and there was a significant effect between the differences in the treatment given. The pre-test and post-test data analysis continued by the N-Gain score test. The results of the N-Gain score test show that the average N-Gain value of 0.73 is included in the high category, this can be observed in table 5.

Table 5. Test Results N-Gain score

Data Type	N	Min	Max	Average
N-Gain	15	0,38	1	0,73

Analysis of the N-Gain score test data aims to determine the increase in students' creative abilities. The results of the N-Gain score test showed an average N-gain score of 0.73 which was included in the high category with an average pre-test of 80.47 and a post-test value of 93.40. A high N-Gain value indicates a relatively high increase in creative thinking skills from 15 students. It is known that 7 students have an N-Gain score test in the high category. This is shown in Figure 1.

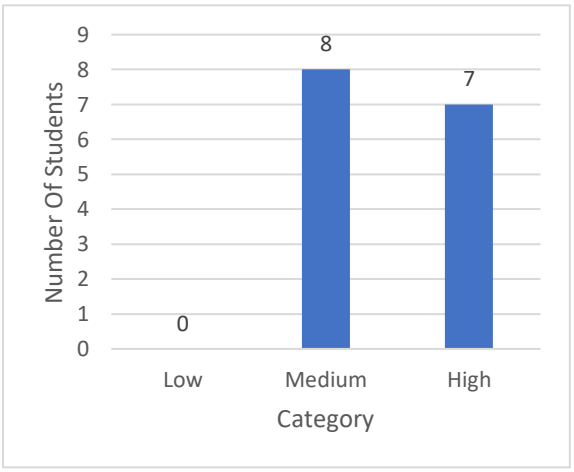

Figure 1. Distribution of Achievement Level of Creative Thinking Ability

The results of this study are in accordance with research conducted by Ariani et al (2018) which examined the development of a guided inquiry-based physics module for dynamic electricity. The results of his research indicate that the physics learning module is designed with guided inquiry learning stages to improve creative thinking skills. The improvement in the aspect of creative thinking skills is seen from the pre-test and post-test which are calculated using a normalized gain score with an N-Gain of 0.58 in the medium category. So, the development of a guided inquiry-based dermatoglyphic practicum guide can improve creative thinking skills.

Guided inquiry-based practicum guides are able to improve creative thinking skills because the application of guided inquiry learning emphasizes students in finding solutions to problems in the learning process actively and independently and is able to encourage students to be more enthusiastic in learning (Rustaman, 2017). Guided inquiry-based practicum learning motivates students to be more active, fosters student creativity and is more courageous in expressing opinions in discussion activities (Sarlivanti et al., 2014).

Evaluation stage

The last stage is the evaluation stage. This stage is carried out individually by the author in order to develop a similar practical guide for the better. This is done if in the future, this research will be continued by other researchers. The results of this practicum guide are expected to be a guide for students if they want to conduct research on observing someone's fingerprints that are associated with inheritance of good traits in the form of diseases, disorders and observations of individual variations.

4. CONCLUSION

Based on the research conducted, it is known that the practicum guide has the feasibility of the practicum guide based on material validation, an increase of 71.60% is included in the good category, while the media validation is 89,05% including the very good category so it is worthy to be tested. Based on product testing to students, it is known that small group trials and large group trials have an average value of 84.82% and 89.24% with very good categories. The results of the implementation of the paired sample T-test with a significance of

0.000 < 0.05 indicate that there is a significant difference between the pretest and posttest values based on the results. While the N-gain test score obtained an average of 0.73 including the high category so that it is known that the practicum guide is able to improve students' creative thinking skills.

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