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Development of Animal Development Practicum Guide Based on Science Process Skills Embryogenesis Observation Material

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Abstract

This development research aims to develop practical guidelines for animal development based on science process skills on embryogenesis observation material. This study uses a 4D development model which is carried out in 4 stages, namely: 1) the define stage defines the product requirements to be developed. 2) the design stage (design) designing prototypes and storyboards on the guide. 3) the development stage is realizing the storyboard then validating the feasibility of the product which is carried out by material experts and media experts. 4) the dissemination stage was only carried out in a large group trial. Trials were conducted to find out student responses to the guidelines developed, trials were conducted on 92 students who contracted animal development courses. Based on the data analysis, it was obtained that the average material validation was 86.03%, and the media validation was 95.72%, the average percentage of student responses was 85.23%, so it can be concluded that the practicum guide is feasible to use.

Keywords : practical guide, embryogenesis, science process skills (SPS)

INTRODUCTION

Biology material in tertiary institutions requires students to really interpret concepts, so that the learning process needs to use laboratory practice methods. Students must be able to understand the concepts obtained from theory with facts through practicum activities (Murti et al., 2014). This agrees with Ulfa's thought Ulfa (2016:65) which states that practicum activities are an integral part of learning, especially biology. Likewise, Suryaningsih (2017) argues that practicum learning provides an opportunity for students to find and prove theories, so that they can support understanding of subject matter.

Practicum activities require a guide that contains an overview of the material and a series of activity instructions in language that is easy to understand and can be studied independently, so that it can help students achieve learning objectives (Setiyadi, 2017). The practicum guide is a facility in the form of a book provided by lecturers so that students can study and work constantly and directed, this book contains practicum topics, objectives of practicum, theory, tools and materials, practicum procedures or work steps, observation sheets and also questions evaluation designed based on the objective of the practicum itself (Asmaningrum et al., 2018). The product developed is in the form of a practicum guide that uses a science process skills base (SPS).

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The most important thing from the biology practicum guide is that it can help students master process skills (SPS). Science process skills (SPS) are students' ability to apply the scientific method in understanding, developing and constructing knowledge. These science process skills include observing skills, submitting hypotheses, using tools and materials properly and correctly by always considering occupational safety and security, asking questions, classifying and interpreting data, and communicating findings orally or in writing, digging and sorting out factual information. relevant for testing ideas or solving everyday problems (Tanjung, 2016:77-78). Mastery of SPS in students makes it easier for them to explore more useful information in the form of facts and concepts, the development of attitudes, values and thinking skills will also develop (Wardani, 2008).

In this research, the science process skills used cover 7 aspects, namely: making observations, then interpreting them into the tables provided, then formulating problems and hypotheses according to the observations to be made, then using tools and materials to make observations, then communicating observation results into tables and observation reports, then apply the concepts that have been learned by answering post-practice questions.

The problems found in the Practicum Guide developed by lecturers at this time, namely that they have not provided opportunities for students to be active and independent in developing science process skills in solving problems in a concept in Biology. On the other hand, the concept of Biology requires students to have scientific process skills (Julianto & Kartikaningrum, 2020). This practicum guide is expected to facilitate students to get hands-on experience, achieve meaningful learning outcomes, and inspire enthusiasm for learning.

Therefore, in this study a practicum guideline for observing embryogenesis in chicken embryos has been developed. This material is considered quite difficult to understand if students do not make direct observations, so students need to practice so they can understand the development of chicken embryos from the first day to the tenth day. Development of embryology practicum guideline based on the results of the needs analysis of students who have carried out practicum courses development of animals which states that the implementation of Embryology practicum has not yet obtained optimal learning results. The old practicum guide did not explain in detail the stages that occur in embryo development until the organs are formed, so that students experience difficulties in determining the visible parts of embryo development. besides that the development of this practicum guide is also reviewed from old guidelines that have never been developed so that the information provided is not updated with the needs of scientific developments.

RESEARCH METHODS

The development of process skill-based embryology practicum guidelines is a type of research and development (Research and Development). The product developed in this study is an embryogenesis practicum guide that can train science process skills. The development model used is the 4D (Four D) model. This development model has stages, namely: Define, Design, Develop and Disseminate. (Tegeh *et al.*, 2019).

The defining stage is useful for determining the needs in the practicum process and gathering various information related to the product to be developed. The purpose of the define stage is to define and explain the product to be developed (Supriyadi *et al*., 2017). At this stage it is divided into several steps, namely by analyzing the beginning and the end where in this analysis a preliminary questionnaire is carried out to find out the obstacles faced by students against the old guidelines that have not been developed, then to do an analysis of the objectives of the practicum, then to do an analysis of the material.

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Next is the design stage. The goal at this stage is to design a practicum guide prototype. The selection of formats and media for materials and the production of initial versions underlies key aspects of the design stage (Asmaningrum *et al.,* 2018) This practicum guide was developed using Microsoft Office Word 2010 Software and Wondershare Filmora9. The results of the practicum guide are made in PDF (Portable Document Format). The design phase is carried out by determining the practicum implementation schedule by the researcher, the product development schedule in the form of a science process skill-based animal development practicum guide on the material for observing the development of chicken embryos, the product development team and the initial design (storyboard) of the animal development practicum guide.

The development stage (develop) is the process of embodiment of storyboards that have been made before so that they become the basis for developing guidelines. The resulting product is an animal development practicum guide based on science process skills on embryogenesis observation material. The practicum guide that has been made is then subjected to material validation and media validation. The development stage is a stage related to the validation of product results developed at this stage requires several experts from various backgrounds of expertise and skills related to learning design, content, and development of learning media (Priyanto, 2019).

After the trials and product revisions have been made, the next stage is the dissemination stage. Disseminate phase Disseminate is the product dissemination phase on a wider scale (Muhajir, 2015). At this stage, only large group trials were conducted on students of the Biology Education Study Program at the University of Jambi who were taking the 2020 Animal Development Practicum Course. The test subjects totaled 92 people.

Data collection techniques were carried out by providing material validation questionnaires, media validation questionnaires and student response questionnaires to the products being developed. The product feasibility assessment was carried out by 2 experts, namely material experts and media experts, as well as from student responses. The following are indicators of product feasibility assessment. The feasibility indicators carried out by the material expert validator are presented in Table 1. The media feasibility indicators are presented in Table 2. The student response indicators are presented in Table 3.

Table 1. Material Feasibility Indicators

Assessment Aspects	Indicator
Content eligibility	a. Coverage of material
	b. Material Accuracy
	c. Sophisticated and contextual
	d. Skill dimension
Presentation eligibility	e. Learning presentation techniques
	f. Supporting the presentation of the material
	g. Presentation equipment
Language eligibility	h. Communicative
	i. Appropriateness of language rules

Source: Modified from (Muljono, 2007))

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Table 2. Media Eligibility Indicators

Assessment Aspects	*Indicator*
Graphical eligibility	*a. Practical guide cover design* *b. Practical guide content design*

Source: Modified from (Muljono, 2007)

Table 3. Student Response Indicators

Assessment Aspects	*Indicator*
Interest	The appearance of the practicum guide makes students interested in doing practicum. The topic of discussion and the order in which the practicum guide is presented have made it easier for students to carry out the practicum.
Material	The purpose of the existing practicum has made it easier for students to find out what skills they must have after participating in learning activities. The material presented is in accordance with the learning objectives. The material presented in the practicum guide can add insight and understanding of the material about the material that has been studied. Evaluation/reflection can help students measure the extent to which they understand the material they have learned.
Bahasa	The language used in the presentation of the material is easy for students to understand.
Keruntutan	The systematic presentation of the practicum guide makes it easier for students to design experiments and obtain practicum results.

Source: Modified from (Zunaidah & Amin, 2017)

The results in the form of scores obtained from giving questionnaires are converted into percentages, which will then be converted into eligibility criteria(Tantu, 2020). The following eligibility criteria that have been converted from each questionnaire are presented in Table 4.

Table 4. Practicum Guide Eligibility Criteria

Value Range (%)	Criteria
84% – 100%	Very good
68% – 83,9%	Good
52% – 67,9%	Acceptable
36% – 51,9%	Poor
20% – 35,9%	Very Poor

RESULTS AND DISCUSSION

At the defining stage, an initial analysis is carried out, namely a needs analysis. The results of the definition from the initial analysis step were obtained through the distribution of preliminary questionnaires to students. From the results of distributing questionnaires to students who have taken animal development practicum courses, it is found that the guidelines that have been used by students for a long time have never been developed according to student needs and also in accordance with the times. In addition, the initial analysis phase was also carried out by distributing a preliminary questionnaire (Student Needs Analysis) via the Google Form to 30 Biology Education students at Jambi University who were contracting animal development practicum courses..

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Based on the results of the preliminary questionnaire, it can be seen that 26.7% of students chose to agree to experience problems when carrying out developmental practicum on chicken embryo development material, and 66.7% considered that they strongly agreed to have problems. This obstacle was in the form of observing the stages of embryo development until organ formation occurred because 56.7% of students considered it very difficult, 33.3% difficult, and 10% not difficult in making observations..

Obstacles faced by students in carrying out embryo development practicum, namely the lack of information regarding proper egg incubation, very little explanatory material regarding embryo development, and work procedures that do not explain how to observe embryos. This shows that Biology Education students at Jambi University still find it difficult to understand the material in the chicken embryo development practicum, for this reason it is necessary to develop a practicum guide for chicken embryo development based on science process skills.

The next stage is design. At the design stage, a guide is designed starting from choosing an application to designing a guide, namely Microsoft Word 2010 and presented in PDF format. Then, the initial design is prepared, starting with collecting reference materials for embryonic development through journals and books, preparing the layout of text, images, or barcodes and make prototypes. The initial design at this stage produces a storyboard which then becomes the basis for the development of the Practicum Guide. After the product is made, it is checked by the supervisor who then gets advice and input to make some improvements in the guide. Next is the development stage.The next stage is the development stage. At this stage validation is carried out by material experts and media experts to assess the feasibility of the product being developed. Material and media validation was carried out 3 times. The expert's assessment of the product has different aspects. In the validation of the material being assessed are aspects of content feasibility, presentation feasibility aspects and language feasibility aspects. whereas in media validation the assessment includes two aspects, namely based on cover design and content design. The results of the due diligence validation by experts are presented in Table 5.

Table 5. Table of due diligence validation by experts

Expert validation -	***Stage-Th Validation (%)***		
	1	**2**	**3**
Material Expert	47,22	59,98	86,03
Media Expert	52,38	79,05	95,72

The material validation was carried out 3 times. In stage 1, a result of 47.22% was obtained with inappropriate criteria. Suggestions from the validator were to improve practicum procedures, explain KPS syntax, and add some theory that was lacking. After being revised, the second stage obtained a result of 59.98% with fairly decent criteria, but still needed improvement in the form of adding footnotes, replacing some post practicum questions, consistent writing fonts in columns, correcting some writing that was still wrong and adjusting it to EYD, besides it's also recommended to highlight the KPS syntax in the table of contents, so the product can't yet. After the revision was carried out according to the suggestions for improvement from the validator, in the 3rd stage a score of 86.03% was obtained with very feasible criteria so that the guide could be said to be feasible for use in practicum. The results of the validation assessment which get a percentage above 62.50% can be declared suitable for use from a product development (Herwati, 2016).

After validating the material, media validation is then carried out by the media expert validator. The results of the 1st validation have an overall average of 52.38% with a fairly decent category, but

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there are some parts of the guide that need to be revised, suggestions from the media validator are to improve the appearance of the cover to make it more attractive, change the photos/images on the cover be a personal observation image, change the footer and header design to be more attractive. The display of the revised results on the cover is presented in Figure 1.

Figure 1. Practical guide cover page

After revision, in the 2nd validation there was an average increase with a percentage value of 79.05% in the feasible category but could not be tested yet because there were still revisions that needed to be perfected, the advice given by the validator was to include headers and footers in all contents of the guide as well as adding sources to each image presented. The header and footer display of one of the pages on the contents of the guide is presented in Figure 2.

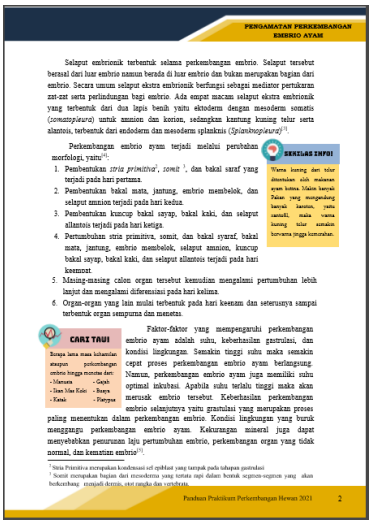

Figure 2. Header and Footer on the guide content page

After revision, the results of the 3rd validation increased by 95.72% with a very feasible category so that the guide can be said to be feasible for use in practicum activities. The practicum guide developed already contains the components that must be in a practicum guide. according to Arifin(Hani *et al*., 2020) the mandatory components in the practicum guide are (1) practicum titles

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consisting of the identity or name of each type of practicum and adapted to practicum material, (2) practicum objectives describing aspects of the test, (3) the basic theory contains concise, clear, and complete material for reference in practicum activities, (4) tools and materials that contain a list of tools and materials needed for practicum activities, (5) work steps. which includes steps to carry out practicum activities, and (6) questions that aim to test the ability of practitioners..

In Figure 3. displays an excerpt from the page that presents the syntax in KPS, namely making observations, making interpretations, asking questions, making hypotheses, using tools and materials, communicating, and practicing concepts.

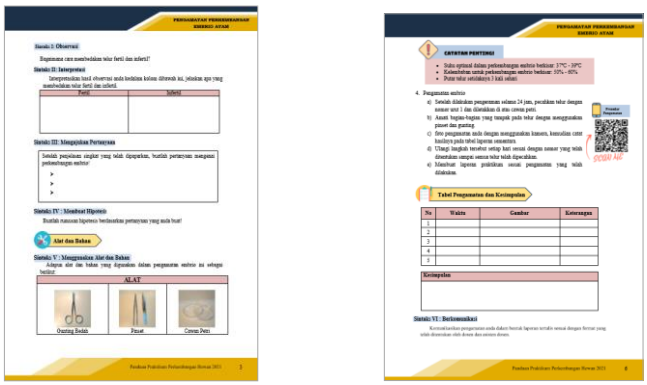

Figure 3. SPS Syntax in the Practicum Guide

After conducting two validations, namely material validation and media validation, in order to produce a Practicum Guide that is ready and suitable for use, the next step is to conduct trials on students. The trials carried out were small group trials with a total of 6 people and a large group with a total of 92 Biology students from UNJA class of 2020. The following results of the small group and large group trials are shown in Table 6.

Table 6. Results of small group trials and large group trials

NUMBER	ASSESSMENT ASPECTS	TRIALS %	
		Small group	Big group
1.	Interest	88,10	84,88
2.	Material	83,33	85,81
3.	Language	85,56	85,65
4.	Regularity	83,34	84,57
	AVERAGE (%)	85,08	85,23
	CRITERIA	Very Good	Good

The results of student response data in a small-scale trial involving as many as 6 respondents obtained a percentage of 85.08% with very good criteria. The results of student response data on a large-scale trial involving as many as 92 respondents obtained a percentage of 85.23% with very good criteria. Aspects of this trial assessment include aspects of interest, material, language, and sequence.

Based on the results obtained from small-scale trials and large-scale trials, it can be concluded that animal development practicum guidelines based on science process skills are very suitable for use in animal development practicums. Students also provide suggestions for practicum guides, including: it is better if the link of the video barcode is attached so that it becomes an option for students to access the video, make the space and font size of the practicum guide larger so that it

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can be read clearly, improve the report format which is still incomplete, and fix several wrong word in typing.

There are several relevant studies which indicate that science process skill-based practicum guides are good for use in practicum activities, including: research conducted by (Wardani, 2008:317-318) the existence of SPS in students makes it easier for them to explore more useful information in terms of facts and concepts , the development of attitudes, values and thinking skills will also develop. In addition, research conducted by Setiawati & Handayani (2018:64) states that with a practicum guide based on science process skills, students can hone their science process skills, increase their activity and can build concepts based on the empirical experience they have done.. (Maison *et al*., 2020) also said that there was a difference between students who used science process skill-based practicum guides and students who only used conventional practicum guides, this difference lay in mastering the points contained in science process skills.

CONCLUSION

Based on the results of research on the development of animal development practicum guidelines based on science process skills on embryogenesis observation material, it can be concluded as follows. Development of animal development practicum guidelines based on science process skills in the material for observing the development of chicken embryos using the 4D development model. The defining stage is carried out by analyzing needs, analyzing materials, and analyzing objectives. At the design stage, the guide is designed by adjusting the syntax component of science process skills. The development stage is carried out with the validation stage by material expert validators and media expert validators and large-scale and small-scale trials are carried out to determine the feasibility of practicum guidelines. The disseminate stage is limited to the large group trial stage for Biology Education students class of 2020 to achieve practicum objectives in accordance with the RPS Practicum for Animal Development. Feasibility of animal development practicum guide based on science process skills on embryogenesis observation material. Based on material validation, an average of 86.03% was obtained, and media validation was 95.72%. the average percentage of student responses is 85.23%, so it can be concluded that the practicum guide is feasible to use.

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