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Designing Practical Guides Based on Simple Tools and Materials to Improve Students' Understanding in Scientific Learning at School

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Abstrak
Scientific learning plays an important role in the development of students' understanding of concepts and skills in science. Although there are often obstacles in providing practical experience to students, this triggers teacher creativity and innovation to overcome the limitations of tools and materials at school. This study aims to design a practicum guide based on simple tools and materials that are feasible to use to improve student understanding in scientific learning at school. The research *method used in this study is the development research method according to Borg and Gall (1983) modified by Rengkuan and Howan (2016), into five development steps which include: (1) Need Analysis & Reference Study, (2) Material Development, (3) Expert Validation, (4) Try Out, (5) Final Production. The results showed the feasibility of designing a practicum guide based on simple tools and materials obtained from material experts with a percentage of 93.3% with a very feasible category, from media experts with a percentage of 90.3% with a very feasible category, from student practicality assessments with a percentage of 84.3% with a very feasible category, and from teacher responses with a percentage of 90.3% with a very feasible category. So it can be concluded that the design of practicum guides based on simple tools and materials is very feasible to use to improve student understanding in scientific learning at school.*

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1. INTRODUCTION

Advances in science require changes in educational approaches. This challenge involves the integration of technology in the curriculum, increasing competencies appropriate for the 21st century, and a more efficient understanding of the best steps for teaching and learning [1]. There is an understanding that more traditional learning models, which tend to be dominated by the lecture approach, do not involve students actively, so that learning models that are innovative and relevant to current developments are needed [2] Scientific learning is the foundation needed to face these problems. Effective scientific learning must include theoretical and practical aspects [3] However, scientific learning is often limited to theoretical aspects in the classroom, while practical experience is often ignored. Active learning, which involves students in experiments and practicums, has been proven to be more effective in understanding scientific concepts compared to passive learning [4] To gain understanding, the learning process must be carried out actively, for example students' understanding to do something, to search and find concepts through various functions, the function that can be used to make this happen is through learning with a scientific approach [5]. With a scientific approach, students are exposed directly to actual conditions related to learning material, both natural conditions and conditions influenced by experiments [6] Appropriate scientific learning can help students identify connections between the theories they learn and applications in the real world.

Practical activities are still rarely carried out in schools as a result of many problems related to inadequate laboratory facilities and infrastructure, a lack of tools and materials needed, Biology

practice manuals are still lacking, practical worksheets are still very few and depend on teacher and student guidelines, lack of a fixed practicum schedule and limited study time [7] Some students who have little or no practicum experience result in a weak understanding of scientific concepts and a lack of practical skills that are important in scientific education. Regardless of background or school location, every student should have the opportunity to gain scientific practicum experience. One of the parts of the facilities and infrastructure used in quality education is the practicum guide [6]Practical results are often not evaluated systematically, which reduces the teacher's ability to provide useful responses to students regarding the development of their understanding [8]. However, a practicum guide allows teachers to more efficiently teach and facilitate practicum learning, even in situations with limited resources. Students often have difficulty connecting theoretical concepts learned in class with their practical application in experiments, which hinders their understanding of concepts and the development of their skills [9]

Practicums using simple tools and materials allow students to experience scientific concepts directly which can strengthen their understanding. Experiments involving dangerous materials or complicated equipment can create risky situations, especially if there are no clear guidelines regarding work safety [10] By reducing the risks associated with the use of hazardous materials or complex equipment and avoiding potential accidents or dangerous incidents, lab work with simple tools and materials tends to be safer for students. Students often feel less motivated to study science because they do not see its relevance to their daily lives which can result in low interest in scientific subjects [11] However, interesting and relevant practicums can increase students' interest in science. Many educational curricula mandate the implementation of practicums as an integral part of the teaching and learning process [12] However, the implementation of practicums can vary in different schools. By creating a cheap, easy and fun laboratory work idea packaged through a practicum module, you can improve student learning outcomes in Senior High Schools (SMA)[13]. Practical guides based on simple tools and materials can ensure that more students have facilities for quality scientific learning, while maintaining their safety and strengthening their understanding of scientific concepts. In addition, designing practicum guides based on simple tools and materials can be a relevant step in bridging the accessibility gap in scientific learning. There were 61.5% of students having difficulty understanding the concept and carrying out practical work on the human digestive system. One of the reasons students have difficulty understanding the concept and carrying out practical work on the digestive system in humans is because the learning process is carried out passively and is limited to theoretical aspects in the classroom while practical experience is often ignored due to the limited tools and practical materials available in the school laboratory. Therefore, efforts to increase students' understanding through scientific learning using practicum guides based on simple tools and materials are very necessary.

2. RESEARCH METHOD

StudyThisThis was carried out at Seretan Christian Middle School, in the odd semester of October-November of the 2023/2024 academic year.

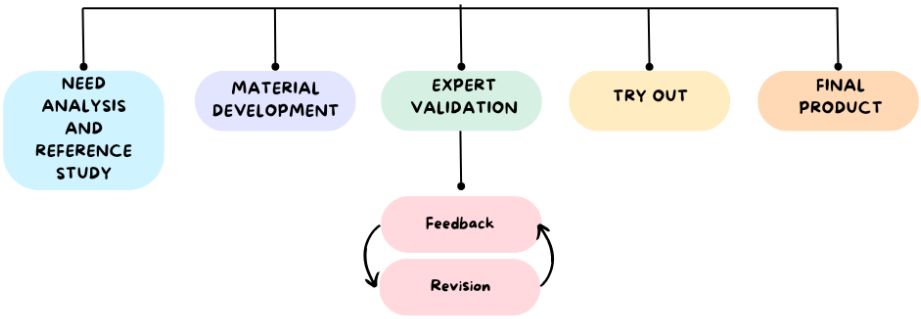


Figure 1. Development steps according to Borg and Gall 1983 (Source: Rengkuan and Howan 2016)

This research uses the Development Research Model according to Borg and Gall (1983) which was modified by Rengkuan and Howan (2016) into five development steps which include: (1) Need Analysis & Reference Study, (2) Material Development, (3) Expert Validation, (4) Try Out, (5) Final Production.

Data was collected in this research using interviews, questionnaires and documentation. The use of interview techniques in this research is aimed at teachers to find out the situation and conditions of implementing learning in the school and the data obtained from the interview results are used as initial data for product needs analysis. The use of questionnaires in this research aims to measure and collect data or opinions from material experts, media experts, teachers and students regarding the feasibility of the practicum guide that has been designed. The use of documentation techniques in this research aims to assist in ensuring that the practicum guide design process is carried out well, and that all necessary steps have been well documented.

The data analysis technique in this research uses qualitative descriptive analysis and descriptive statistical analysis. Qualitative descriptive analysis was used to collect qualitative data in the form of interviews, comments and suggestions for improvement which were used as a reference for improving and revising practicum guides based on simple tools and materials. Descriptive statistical analysis in this research aims to obtain conclusions about the aim of this research, namely regarding the level of feasibility of practicum guides based on simple tools and materials through the percentage of achievement of the results from the questionnaire. Descriptive statistical data analysis techniques aim to describe data [14]

Assessment of feasibility levelproducts are calculated using the following formula [15]):

$$P = \frac{\text{f0}}{\text{N}} X\ 100$$

Information:

P : Percentage gain
f0 : The total score obtained
N : Maximum total score/value

Table 1. Feasibility Scale Categories

Achievement Rate (%)	Category	Information
76 % – 100 %	Very Worth It	Very Valid
56 % – 75 %	Worthy	Valid
40 % – 55 %	Not Worth It	Less Valid
0 % – 39 %	Not feasible	Invalid

Source: (Optiana, 2019)

3. RESEARCH RESULTS AND DISCUSSION

This research produces a product, namely a practical guide based on simple tools and materials that can help improve students' understanding of scientific learning at school.

The material expert validation assessment in this research involved five aspects consisting of material suitability, construction, presentation, language, and practicality. The following are the assessment results from material expert validators:

Recapitulation of Material Expert Validator Assessment Results for the practicum guide based on simple tools and materials in this research can be seen in table 2. Recapitulation of Material Expert Validator Assessment Results.

Table 2. Recapitulation of Material Expert Validator Assessment Results

No.	Rated aspect	Percentage	Category	Information
1.	Material Feasibility	90%	Very Worth It	Very Valid
2.	Construction	100%	Very Worth It	Very Valid
3.	Presentation	87.5%	Very Worth It	Very Valid
4.	Language	100%	Very Worth It	Very Valid
5.	Practicality	91.6%	Very Worth It	Very Valid
	Total	**93.3%**	**Very Worth It**	**Very Valid**

Based on the data in the table above, it shows that the results of all aspects of the assessment obtained from the material expert validator for the practicum guide based on simple tools and materials in this study were 93.3% in the Very Appropriate category.

The validation assessment of media experts in this research includes two aspects consisting of cover design and this design. The following are the assessment results from material expert validators:

Recapitulation of the Media Expert Validator Assessment Results for the practicum guide based on simple tools and materials in this research can be seen in table 3. Recapitulation of the Media Expert Validator Assessment Results.

Table 3. Recapitulation of Media Expert Validator Assessment Results

No.	Rated aspect	Percentage	Category	Information
1.	Cover Design	93.7%	Very Worth It	Very Valid
2.	Content Design	85%	Very Worth It	Very Valid
	Total	**90.3%**	**Very Worth It**	**Very Valid**

Based on the data in the table above, it shows that the results of all aspects of the assessment obtained from media expert validators regarding the practicum guide based on simple tools and materials in this research were 90.3% in the Very Appropriate category.

Students' practicality assessment in this research involved four aspects consisting of attractiveness, ease of use, material/content, and benefits. The following are the results of the recapitulation of practicality assessments from students, can be seen in table 4. Recapitulation of Student Practicality Assessment Results.

Table 4. Recapitulation of Student Practicality Assessment Results

No	**Respondent's Initials**	**Percentage**	**Category**	**Information**
1	A.M	92.5%	Very Worth It	Very Valid
2	AW	77.5%	Very Worth It	Very Valid
3	FM	85%	Very Worth It	Very Valid
4	JY	90%	Very Worth It	Very Valid
5	K.S	75%	Worthy	Valid
6	MT	85%	Very Worth It	Very Valid
7	M.S	90%	Very Worth It	Very Valid
8	N.P	82.5%	Very Worth It	Very Valid

9	NS	82.5%	Very Worth It	Very Valid
10	NL	84%	Very Worth It	Very Valid
11	RM	77.5%	Very Worth It	Very Valid
12	RP	80%	Very Worth It	Very Valid
13	YP	95%	Very Worth It	Very Valid
	Average	**84.3 %**	**Very Worth It**	**Very Valid**

Based on the data in the table above, it shows that the recapitulation of the results of the practicality assessment of all aspects obtained from students regarding the practicum guide based on simple tools and materials in this study was 84.35% with the Very Appropriate category.

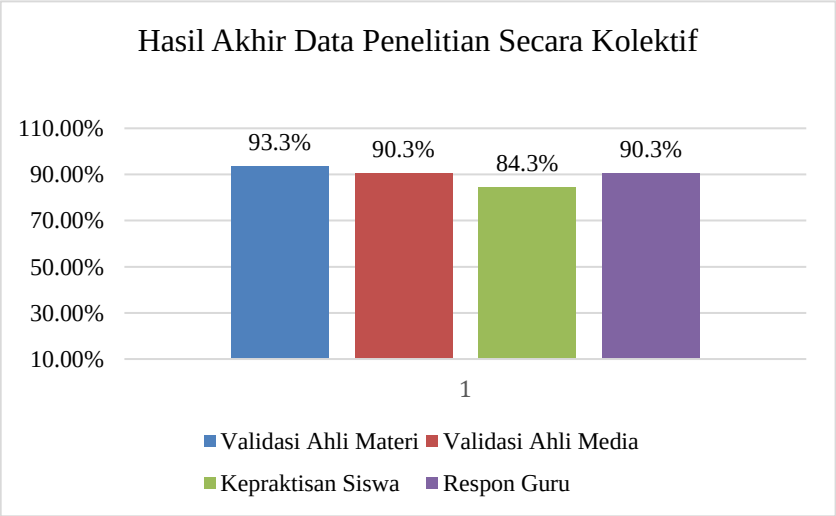
The results of teacher responses in this research involve five aspects consisting of presentation, suitability of material, language, content design, and practicality. The following is a recapitulation of teacher responses to the practicum guidebased on simple tools and materials:

Table 5. Recapitulation of Teacher Response Results

No.	Rated aspect	Percentage	Category	Information
1.	Presentation	95%	Very Worth It	Very Valid
2.	Material Feasibility	83.3%	Very Worth It	Very Valid
3.	Language	75%	Very Worth It	Very Valid
4.	Content Design	87.5%	Very Worth It	Very Valid
5.	Practicality	100%	Very Worth It	Very Valid
	Total	**90.3%**	**Very Worth It**	**Very Valid**

Based on the data in the table above, it shows that the recapitulation of teacher response results from all aspects of the practicum guide based on simple tools and materials in this study was 90.3% with the Very Appropriate category.

To find out the comparison of assessments of different aspects from material expert validators, media expert validators, students and teachers against practicum guides based on simple tools and materials, the final data results were obtained research collectively as follows:



Graph 1. Final Results of Collective Research Data

IfThe assessment score for the practicum guide based on simple tools and materials shows very valid criteria, this indicates that the guide is strongly recognized by material experts, media experts, students and teachers as a correct, appropriate, useful and effective tool in supporting learning. science at school. So, it can be concluded that with the assessment scores that have been achieved, the practicum guide based on simple tools and materials is very valid and very suitable for use as a tool to support the scientific learning process in schools.

There is an understanding that more traditional learning models, which tend to be dominated by a lecture approach, do not actively involve students [16] Practicums based on simple tools and materials are designed to increase student involvement during the learning process. The evaluation results showed that there were deficiencies in understanding scientific concepts among students (Noviana, 2017). Practical guides are designed to provide direct and concrete experience, allowing students to understand scientific concepts in more depth. Most schools may face limited resources, including laboratory facilities and sophisticated practicum equipment [17] The design of a practicum guide based on simple tools and materials aims to provide practical solutions that are appropriate to the availability of resources. There is awareness of the importance of creating accessible learning environments for all students, including those in schools with limited resources. The simple approach in the practicum guide supports equality in the accessibility of scientific learning. There is an emphasis on learning that is relevant to students' everyday lives. Practical guides are designed to create direct connections between scientific concepts and real-life situations using simple tools and materials. Student motivation for scientific learning is often a challenge for educators [18] An interesting and accessible practical guide designed to develop students' interest and motivation in the field of science. In diverse classroom contexts, challenges arise in dealing with variations in students' levels of understanding and learning styles. Practical guides based on simple tools and materials can be adapted to various skill levels and take into account student diversity. There is support for the concept that active and practical learning has a positive impact on understanding scientific concepts and retention of information. The practicum guide is designed to exploit the benefits of this approach. There is a policy or encouragement to direct the curriculum in a direction that is more practical and related to everyday life [19] Practical guides based on simple tools and materials are in line with this orientation in increasing the effectiveness of the scientific curriculum. Promote an inclusive approach to science education, which reaches all students regardless of their background or abilities. Practical guide can bean effective tool in supporting inclusive education.

4. CONCLUSION

Based on the final research data, it was found that the percentage of feasibility from material experts was 93.3% in the very feasible category, from media experts it was 90.3% in the very feasible category, from students' practical assessments it was 84.3% in the very feasible category, and from teacher responses it was 90.3% with Very suitable category for practical guidance based on simple tools and materials. So, it can be concluded that designing a practical guide based on simple tools and materials is very suitable for increasing students' understanding in scientific learning at school.

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