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Instrument of science practice guidelines based on discovery learning to increase learning outcomes and process skills in remboken AT SMP Negeri 1 Remboken

Carolina P Ngantung[1], Sherly E Kaunang[2], Rudi A Repi[3], Cosmas Poluakan[4]
[1] Student of Master Program, Study Program of Natural Sciences Education, Postgraduate Program, Manado State University, Indonesia
[2, 3] Postgraduate Program, Manado State University, Indonesia

Abstract
This study aimed at designing a Natural Science practical guide based on *Discovery Learning* on the material of life organization system to improve learning outcomes and science process skills at SMP Negeri 1 Remboken. The research sample was taken from the learners of VIIa class as control class and VIIb class as experimental class. This research is a development research (*Research and Development*) following the 7 stages of implementation according to Dick and Carrey namely: stage (1) planning (2) exploration studies (3) development of initial product forms (4) data collection and analysis instruments (5) validation (6) revision based validation and (7) product testing. The validity test result of the product were obtained from the validator's assessment of the product development which was tested by 2 experts namely material and practicum experts. The data collected were obtained using an expert validation questionnaire and practical guide, test learning outcomes and science process skills. Research result shows that the quality of teaching materials developed by subject matter experts with the percentage of are 94.77% valid and 87% according to practicum experts. Data obtained were analyzed descriptively and used test analysis of *independent sample t-test* with the standard precondition test and homogeneity test with $\alpha = 0.05$. While the percentage value shows process skills average improvement science process skills that there are an increase in the percentage of observing process (0.14%). Skills of measuring process (1.46%), Skills of the classifying process (0.2%), communicating process skills (0.1%) and concluding process skills (0.96%). Then it can be concluded that the practicum guide developed can improve learning outcomes and science process skills at SMP Negeri 1 Remboken.

Keywords: practical guidelines development, discovery learning, learning outcomes, life organization

1. Introduction
Biology Natural science is one of the subjects taught in junior high school. Learning material is in accordance with the existing curriculum. Natural Science also developed through the giving of direct experience, laboratory activities and from imaginative and scientist thoughts. Therefore, one way for someone to acquire and develop a set of knowledge they have is through practicum. If students can experience or do it themselves, they can directly improve learning outcomes and the process skills of students are higher than just watching or listening. Therefore,
practicum is needed to make students better in understanding and interpreting science so that the knowledge lasts long in their memories.
In addition, students need to be helped to develop a number of process skills so that they are able to explore and understand the surrounding environment. In this learning process, students use their mental abilities to learn learning materials. Abilities - cognitive, psychomotor, and affective abilities that are taught by learning materials or practicums will become stronger with the presence of process skills from students. Evaluation and success of learning will make students more aware of their own abilities.
Science lessons are seen as a rapidly developing science both in content and application that can influence students to be able to think logically, systematic, creative and effective collaboration.
However, the fact shows that until now the science learning outcomes still have not shown satisfactory results, with high-level thinking skills still not showing progress in a process that basically must be owned by every student. Because the majority of students tend to assume that science subjects are only in the form of memorization and boring. The actual material must be understood and applied in the learning process. Therefore, teachers should know better to choose suitable methods to be applied with active learning situations so that learning objectives can be achieved.
Based on the results of observations conducted at SMP Negeri 1 Remboken, it was found that there was still a lack of thinking patterns and students did not understand the basic concepts because they very rarely carry out laboratory work at school. Thus the skills of students towards science learning tend to only know and memorize the material without any action or practicum according to the learning material that supports the activeness and creativity of students. In addition, teachers tend to still use the media in the form of *LKS* (Students' Worksheet) with staff coverage that is only limited so students are less motivated which causes them to be often bored to learn. Looking at the condition of students who often lazy learning in class, lack of activity and creativity in learning, learning outcomes of students are still 35% who have not reached *KKM*.
To overcome the problems in the process of teaching activities there should be assistance in the form of models, flexible use of teaching media, and the use of relevant learning resources. Indonesian Education recently changed the reference corridor for the implementation of Education or changed the curriculum from 2006 *KTSP* to a curriculum

that we just know as the 2013 curriculum. One of the learning models recommended in the 2013 curriculum is a *Discovery Learning* model.

Discovery learning models emphasize discovery. This model changes the conditions of learning that are passively active and creative. This model changes the *teacher* 's learning *oriented* where teachers become information centers become *student oriented* where students become active subjects of learning. Based on these facts, the authors were motivated to conduct research on "Development of *Discovery Learning* based on Science Practicum Guidelines to Improve Learning Outcomes and Process Skills of Students".

Research methods

This research used development research (Research and Development) following 7 stages of implementation according to Dick and Carrey including : 1) planning (2) exploration studies (3) development of initial product forms (4) data collection and analysis instruments (5) validation (6) revising based on validation and (7) product elimination. product validity test results. This research was conducted in May 2019, taking place at SMP Negeri 1 Remboken. The target population is the entire students of VII class and affordable populations are all VIIa class as control group and VIIb as experimental group.

To obtain data of the natural science practice guidelines development on science on the life organzation system based on discovery learning, the tools (instruments) needed for collecting the data are as follow:

1. Interview method, The interview used in this data collection is a guided interview. Guided interviews are interviews conducted by the subject of evaluation by asking questions that have been prepared in advance. This interview method was used for analyzing media needs used in learning
2. The questionnaire method (survey) was used for the feasibility test and the validity of the practicum guideline test, the responses of experts and students. The type of questionnaire for the feasibility test and the validity test of the practical guide is a *checklist* that is a series of statements (which are usually short) where the respondent just needs to put a *checklist* (√) in the place provided.
3. The method of observation is done by observing the behavior of students. Observations are carried out using observation sheets that contain observational instruments and refer to the rubric of science process skills.
4. Test method

The tests given are *pretest* and *post*

The *t-test* which then measured the comparison of students' mastery of concepts before and after using the science practicum product developed. Also in measuring the process skills used, the rubric consists of: observing, classifying, measuring, communicating and concluding.

Data analysis techniques in the study using SPSS 25 *software* to perform tests of normality, homogeneity, hypothesis testing and test of *independent sample T-test.* Using data obtained from before and after product use in the control class and experimental class.

The mean difference test is done to test the research hypothesis. The data analyzed are as follows.

1. Validity of the practicum guide processed from the assessment questionnaire and expert validation consisting of 2 aspects, namely the material aspects and practicum. The data obtained were analyzed by comparing the number of answers from respondents with the ideal number multiplied by 100%.

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$ (Arikunto, 2006)

2. The effectiveness of the practical guide is determined from the physical appearance aspects of the science practicum guide, the complexity of sentences and the level of readability and integrity of *discovery learning*
3. The implementation of the practicum guide is determined through the students' responses to the initial (small scale) trial. This test is conducted to 15 learners in VII grade at SMP SATAP Tondano. This class was not used for the control class or the experimental class

Criteria for percentage scores were obtained from expert validation, student responses, teacher responses, activeness observations and observations of characters are shown in Table 1.

Table 1: Percentage Criteria for Assessment Scores

Score	Category
Number 0% - 20%	Very Weak
Number 21% -40%	Weak
Number 41% -60%	Enough
Number 61% -80%	Strong
Number 81% -100%	Very strong

The indicators of success in this study are: a) The results of the validation of experts / experts achieve a percentage score> 6 1, 8 0%, b) The results of student responses reach a score of> 70% (agree). c) learning outcomes and student process skills : Average results of posttest > pretest.

Results and discussion

Based on the objectives that have been set, the difference from the average of Natural Science learning outcomes on field tests before and after using the guide practicum with assisted SPSS 25 on the pre-test grade control and post-test grade control (37.2935 and 69.2400) there is a difference of 31.94 which indicates there is a difference in the increase in learning outcomes but has not reached *KKM*, while the pre-test of experimental class and the post-test of experimental class (39.5335 and 84.9475) having a difference of 45.41 which indicates an increase in student learning outcomes and has reached *KKM*. For science process skills there is an increase with percentage of observation process skills (0.14%). Skills of measuring process (1.46%), Classification process skills (0.2%), communication process skills (0.1%) and concluding process skills (0.96%).

The practical guide book page is not made back and forth so that students have many places to give or add notes which is needed when practicing. For example book page *layout* practicum guide the results of development can be seen in the following figure :

Fig 1: Figure of front cover

Validation Analysis of Practicum Guide Experts

Draft handbook practicum then get validation by material experts and practicum.

1) Test material experts for IPA practicum guidance products based on *discovery learning* consist of 2 experts, namely the first expert lecturer in biology education who holds a professor and employs cell biology courses, learning strategies to teach and has many learning experiences in scientific subjects in biology majors and in the graduate program. The second expert is a lecturer who holds a doctorate in education who is an expert in *discovery learning* models.

Amount of percentage value from material experts:

$$\frac{\text{Total of obtained score}}{\text{Total of maximum score}} \text{ x } 100\%$$

$$= \frac{182}{196} \text{ x } 100\% = 94,77\%$$

The assessment of material experts is in a very strong category with a number of 94.77% meaning that the material that has been developed has a good assessment so that it can already be used in research

2. The practicum guide expert test consists of 2 biology lecturers. The first was a guide expert with a doctorate in biological sciences who had served as head of a laboratory in the department of biology and currently serves as chair of biology at Manado state university. While the second expert is a lecturer who is an expert in the field of zoology and has served as secretary of biology at Manado state university. So that these two experts are very suitable to validate the IPA practicum product guide based on discovery learning.

Amount of percentage value from practicum guide expert:

$$\frac{\text{Total of obtained score}}{\text{Total of maximum score}} \text{ x } 100\%$$

$$\frac{206}{238} \text{ x } 100\% = 87\%$$

The assessment of the practicum guide expert was in a very strong category with a 87% number, meaning that the developed guide received a good assessment so that it could already be used in field research.

To be able to assess the skills of students can use the descriptor for science process skills rubric. The total of improvement in posttest group process skills k ontrol class and experiment can be seen in table 2.

Table 2: Total of Improvement of Process Skills in the post-test of the control and experimental group can be seen in

Process skills	Average Score (%)
1. Observing	0.14%
2. Measuring	1.46%
3. Classifying	0.2%
4. Communicating	0.1%
5. Making Inference	0.96

In addition, the learning outcomes of the control class and experiment for pretest and posttest can be seen in table 3.

Table 3: Data of the Learning Outcomes in Control Class

Name of students	Pretest	Posttest
UCKB-001	57.50	70.77
UCKB-002	50.22	68.90
UCKB-003	40.33	60.40
UCKB-004	38.28	60.00
UCKB-005	45.56	69.33
UCKB-006	52.45	72.86
UCKB-007	63.11	61.34
UCKB-008	10.57	70.05
UCKB-009	15.89	890.22
UCKB-010	13.27	68.00
UCKB-011	21.65	62.70
UCKB-012	38.02	58.62
UCKB-013	11.42	75.22
UCKB-014	44.45	69.45
UCKB-015	10.34	57.97
UCKB-016	52.71	78.22
UCKB-017	25.89	70.82
UCKB-018	45.67	70.22
UCKB-019	54.27	78.89
UCKB-020	54.27	80.78

Table 4: Data of the experimental class learning outcomes data

Name of students	Pretest	P osttest
UCKB-001	57.50	81.01
UCKB-002	50.22	85.31
UCKB-003	40.33	75.54
UCKB-004	38.28	87.48
UCKB-005	45.56	84.75
UCKB-006	52.45	65.66

UCKB-007	66.43	87.50
UCKB-008	10.57	94.76
UCKB-009	15.89	97.19
UCKB-010	13.27	91.26
UCKB-011	21.65	82.29
UCKB-012	38.02	78.02
UCKB-013	55.01	65.59
UCKB-014	44.45	81.62
UCKB-015	8.23	84.35
UCKB-016	52.71	78.67
UCKB-017	25.89	90.48
UCKB-018	45.67	92.87
UCKB-019	54.27	96.65
UCKB-020	54.27	98.04

Table 5: Data Normality Test Results

	Kolmogorov-Sminorv			**Shapiro - Wilk**			
	Kelas	**Stastistic**	**df**	**Sig**	**Stastistic**	**df**	**Sig**
SMPN1Rem-	Cont	,166	20	.149	,894	,20	,032
Pretest	Exp	,166	20	,153	,910	,20	,036
SMPN1Rem-	Cont	,132	20	,200*	,934	20	,184
ttest	Exp	,087	20	,200	,944	20	,032

The results of this normality test aim to determine whether the samples taken are from populations that are normally distributed or not. Based on table 5 the results of the normal test data show that the value obtained> from the value, seen in the *Shapiro-Wilk* column so that the data can be concluded to be normally distributed.

Table 6: Test Results for data Homogenity

			Levene'S	**df 1**	**df 2**	**Sig**
Prettest value	excl	Based on Mean	, 071	1	38	, 026
Posttest value	excl	Based on Mean	.099	1	38	, 791

a. Lilliefors Significance Correction

If it is measured significant more than 0.05, then it can be said that the variant of the data used is homogeneous. In table 6 it can be seen that the data for the post-test is more than the significance value of 0.05 while for the *pre-test it is* found that the data obtained is slightly smaller than the significance value of 0.05 so that the data can be considered homogeneous.

Table 7: The average results of the experimental class and the control class

	Class	**N**	**M ean**	**Std. Deviation**
SMPN 1Rem-	Cont	20	37.29	17,779
Pretest	Exp	20	39.53	17,548
SMPN 1Rem-	Cont	20	69.24	7,226
Posttest	Exp	20	84.94	9,333

Based on the above data it can be seen that for the control class and experimental class the average value is very different for both the *pre-test* and *post-test* values. The average value of the pretest in the control class is only 69.24 while the average value of the *posttest* in the experimental class can reach 84.94. from these results it can be concluded that the use of products developed can increase the average learning outcomes of students.

Next to assess how the activeness of students and the facts and concepts in practical activities are assessed using the process skills rubric.

Table 8: Total Number of KPS in the Control Class and Experimental Class

	Skills Aspect	**Control and Experimental**		
NO	**Science Process**	**Prettest**	**Posttest**	**Remarks**
1	Observing	0.63	0.77	Increased
2	Measuring	0.36	1.82	Increased
3	Analyzing	0.62	0.82	Increased
4	Communicating	0.31	0.41	Increased
5	Making Inference	0.26	1.52	Increased

Furthermore, hypothesis testing is done by using *independent* SPSS test *software sample t-test*. the test results are seen in table 9.

Table 9: Results of Hypothesis Test Analysis Independent Sample Test

t- test for Equality of Means							
		t	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**Lower**	**Upper**
SMPN1Rem- Pretest	EqualVarience assumend	,401	38	,691	2,24000	-9,06818	13,54818
	Equal Varience Not assumend	,401	37.993	,691	2,24000	-9,06824	13,54824
SMPN1Rem- Posttest	EqualVarience assumend	5,591	38	,000	15,70750	10,36397	21,05103
	Equal Varience not assumend	5,951	35.758	,000	15,70750	10,35295	21,06205

Based on the learning outcome data found in the study, it can be seen for hypothesis acceptance criteria if sig. (2-tailed) is greater than 0.05, then H_0 accepted and H_1 rejected. If sig, (2-tailed) is smaller than 0.05 then H_0 rejected and H_1 accepted. Data analysis results were found to correspond to the table shows that the *pretest* significance value 0.691 <0.05 and value significance *posttest*, 000 <0.05 then H_{0} rejected and H_1 accepted. This means that there are differences in the average value of the control class and experiment.

Based on the results of the research and discussion above, then in accordance with the objectives achieved by this researcher is to produce a practical guideline on life organization systems based on *discovery learning.* Eligible for use and distribution. K arena implementation of product development can improve learning outcomes and science process skills implementation of learning by using product development there is an increase in learning outcomes before and after implementing learning and can assist teachers in implementing learning / practicum and can encourage teachers to innovate to develop higher practicum guidelines.

Conclusion

1. 1) The science practicum product guide on life organization systems based on discovery learning has been designed and developed using the stages of research and development (R and D), based on the results of the validation carried out on the material and practicum guidelines obtained a score of 94.77% and 87%. it can be concluded that it is good and feasible to use the learning process.
2. The results of the t test analysis on field trials (large group) obtained the significance value in *pretest* 0.691 <0.05 and significance invalue *posttest*, 000 <0.05 then H_{0} rejected and H_1 accepted, meaning that there are differences in the significant increase in the average value of participants' learning outcomes before and after using a practical guide product on the life organization system based on discovery learning.
3. The results of the science process skills analysis gain an increase with the percentage of the observation process skills (0.14%). Skills of measuring process (1.46%), Skills of the classification process (0.2%), communication process skills (0.1%) and concluding process skills (0.96%). This can be said that there is an increase before and after using the product developed
4. Product science practice guide for life organization systems based on *recovery learning is* good for use in the teaching and learning process especially for VII class in natural science subject in junior high school.

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