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Development of Nature-Based Practical Instructions to Improve Science Process Skills in Class XI MIA Acid-Base Material

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Abstract
The results of observations at SMA Hang Tuah 3 Mataram showed that there were no practicum manuals available so students only used practicum guides from textbooks. This causes ineffective practicum activities which have an impact on students' low science process skills.The aim of this research is to develop nature-based practicum instructions, and determine the characteristics and feasibility of practicum instructions, as well as determine student responses to the practicum instructions developed. The research method used is Research and Development or R&D with the 4D development model (define, design, develop, disseminate). Data collection techniques use observation sheets and questionnaires. The research results obtained an average value from the validation of the expert team, namely 87.69% with very feasible criteria. Validation results from practitioners obtained an average of 96% with very feasible criteria. The results of the student questionnaire responses obtained an average of 82.75% with very feasible criteria and the results of observations of science process skills obtained an average of above 75% for each aspect with very feasible criteria. It can be concluded that the nature-based practical instructions that have been developed still need to be carried out in the next stage and are very suitable for use in experiments.

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1. INTRODUCTION

Chemistry onin essenceis a science that studies everything about substances which includes the composition, structure and nature of changes, dynamics and energetics of substances which requires skill and reasoning. Chemistry will be better studied if students have good science process skills. According to Bundu (2006:12) scientific process skills are a number of skills for studying natural phenomena in certain ways to obtain knowledge and further develop that knowledge. Science process skills are very important for students to have, because in the learning process, students are not only required to achieve good results but students are also required to have scientific skills, scientific work processes, and a scientific mindset as provisions and training in facing the demands of the globalization era. At the moment. Through science process skills students are trained to think logically in solving problems.

To develop science process skills, students need to be trained continuously through appropriate learning, namely practicum-based learning. Practicum-based learning is one method that can attract students' interest in developing concepts, because it can provide direct experience for students to observe a phenomenon that occurs, so that students more easily understand the concepts being taught. The practicum method involves developing many science process skills, because the practicum method provides students with the opportunity to empirically practice a chemical concept with cognitive, affective and psychomotor abilities, which can be seen from indicators of science process skills.

Based on the results of initial observations through interviews with one of the chemistry teachers at SMA HANG TUAH 3 Mataram, information was obtained that practicum

activities in chemistry learning were only carried out once on acid-base identification material due to limited time and equipment as well as chemical materials, difficult laboratory waste. resolved, and there is no practical manual available. The guidebook used in practical learning is in the form of a teacher's handbook, so it can sometimes be a burden on students. The solution that can be done is to carry out nature-based practical activities. Nature-based practicum is a direct and simple experiment that uses materials in the surrounding environment that are easy to find and relatively affordable (Tiak, et al, 2019).

Good practicum implementation must be supported by guidelines so that the objectives of practicum implementation can be achieved correctly. One learning resource that can be used as a guide is practical instructions. According to Rustaman (2003), practical instructions are some of the tools needed so that activities in the laboratory run smoothly, the main goal is that learning can be achieved, reducing the risk of accidents occurring and so on. The nature-based practical instructions are designed with tools and materials that are easily found in the surrounding environment, such as fruit and vegetables, so that students can easily obtain materials and can do them at home. Practicum using tools and materials from nature does not eliminate the role and function of practicum (Arifin, 2003).

Based on research conducted by Ida Royani and Ali Imran (2020) with the title research on developing high school biology practical instructions using online methods to improve students' science process skills, it shows that the media developed in the form of an instruction book is very suitable for application in learning and for science process skills. Students obtained a score of 70.5 in the skills category, 81.5 in the highly skilled category and 92 in the highly skilled category. Meanwhile, research conducted by Eny Ernawaty (2021) developed practical instructions for determining pH trajectories using natural indicators based on local wisdom. The results of the practical instructions were developed with content appropriateness of 98.6% (very high), language appropriateness of 95.3% (Very High), and graphic appropriateness of 98.6% (Very High) (2) Student response to the pH route practical manual with natural indicators based on local wisdom of the Singkawang community 77.6% in the high category (3) Teacher response to the pH route practicum manual book with natural indicators based on local wisdom of the Singkawang community 95.68% in the very high category.

Based on the description above, it is necessary to carry out research to develop a nature-based practicum guide to improve students' science process skills in class XI MIA high school acid base material. The subject matter chosen as supporting material in this research is acid-base material. Acid-base material is material whose learning is more linked to examples of the use of materials in everyday life and can be used as a learning resource that can support students' science process abilities (Anggraeni and Wardani, 2020).

1. METHOD

This type of research is Research and development or Research andDevelopmentor (R&D), which is a process carried out to obtain certain products and test the success of these products (Sugiyono, 2018). This research was conducted to develop nature-based practical instructions. The development model used in research is the 4D development model developed by Thiagarajan (1974) which consists of four stages, namely Define, Design, Develop and Disseminate.

The define stage includes initial analysis, student analysis, task analysis, concept analysis and formulation of learning objectives. So the results of this analysis require a bookinstructionnature-based practicum. The second stage is designwhere there are two stages carried out, namely format selection and initial design. At this stage the researcher designed a media in the form of a nature-based practicum manual that was developed. The third stage, namely development, includes the development stage which is the stage for

producing a development product. This stage consists of two steps, namely expert appraisal accompanied by revision and *developmentaltesting* (development trial). This expert assessment stage was carried out by two experts, namely lecturers from the Chemistry Education Study Program, FSTT, UNDIKMA as material and media experts, as well as one of the chemistry subject teachers at Hang Tuah 3 Mataram High School. The limited trial subjects were 10 students from SMA Hang Tuah 3 Mataram class XI MIA.

InstrumentData collection was carried out by providing validation questionnaires to material experts and media experts to measure the level of suitability of the practical manual, as well as a questionnairewhich are filled in by students to see student responses, as well as observation sheets used to obtain data for initial analysis and to measure students' science process skills which are filled in by student observers who are assessed during the practicum process.

TechniqueData analysis is a series of activities of reviewing, grouping, systematizing, interpreting and verifying data so that a phenomenon has social, academic and scientific value (Branen in Sangadji & Sopiah, 2010). The data analysis technique in this research is as follows:

Data Analysis of Validation Results of Practical Instructions

The scores obtained from the validation results of material experts, media, field practitioners, and also student responses were analyzed using the following formula:

$P = \frac{\Sigma \chi}{\Sigma \chi 1}$ x 100%

Information:

P = Percentage Number (percentage of eligibility)

$\sum\chi$= score obtained

$\sum\chi 1$= maximum score that can be obtained

As a result of the feasibility of nature-based practicum instructions, percentage analysis based on categories was used as a reference obtained from expert experts. As for obtaining the eligibility percentage, it is put into categories based on table 1.

Table 1. Eligibility Criteria for Practical Instructions

No	Average score (%)	Validation criteria
1	75% - 100%	Very worthy
2	56 - 74%	Worthy
3	40 – 56%	Not worth it
4	0% - 39%	Not feasible

(Source: Hariadi, 2019)

Analysis of Data from Observations on Students' Science Process Skills

The dataobtainedFrom the results of the assessment of the observation sheet, a score is given according torubricwhich has been made. After the data is obtained, it is then analyzed using the following formula:

$$\text{P x100\%} = \frac{n}{N}$$

Information

n : the number of scores obtained by students

N : the number of scores that should be obtained

Once the calculation results are known, they are identified into categories according to the science process skills criteria table in table 2

Table 2 Criteria for Students' Science Process Skills

No	Average score (%)	Validation criteria

1	75% - 100%	Very Skilled
2	56 - 74%	Skilled
3	40 – 55%	Less Skilled
4	0% - 39%	Unskilled

(Source: Jannah, 2018)

2. RESULTS AND DISCUSSION

Results of validation by material and media experts

Data from validation results from material and media experts on nature-based practicum instructions can be seen in tables 3 and 4 respectively.

Table 3 results of material expert validation

No	Assessment indicators	Percentage of expert assessments		Criteria
		Expert 1	Expert 2	
1.	Material suitability	75%	95%	Very worthy
2.	Up-to-date material	90%	90%	Very worthy
3.	Material accuracy	75%	100%	Very worthy
4.	Encourage curiosity	87.5%	100%	Very worthy
5.	Presentation support	87.5%	100%	Very worthy
6.	Straight forward language	100%	87.5%	Very worthy
7.	Interactive dialogue	75%	100%	Very worthy
8.	Conformity to language rules	100%	75%	Very worthy
	Average	**89.38%**		**Very worthy**

Table 3 explains the expert validation assessment on the material aspects of nature-based practicum instructions where there are 20 statement items with an overall average percentage score of 89.38% with the material category Very Appropriate to be used as nature-based practicum instructions, but it is still necessary. slight improvements based on expert advice. Some suggestions from material experts include: KD and learning objectives on the page after the laboratory rules, as well as changing the sentences in the material descriptionbecomeseveral paragraphs so it's not too long to read. Meanwhile, suggestions from media experts include the cove order pagereplacemake the font more attractive, improve the position of the title, and change the color to a lighter color. On the contents page, use a contrasting background color so that the writing is cleareasyRead it and use a different background for each main sub-sub to differentiate one sub from another.

The following data from validation results from media experts can be seen in table 4

Table 4 Data from validation results from media experts

No	Assessment indicators	Percentage of expert assessments		Criteria
		Expert 1	Expert 2	
1.	Size of practical instructions	87.5%	75%	Very worthy
2.	Practical guide cover design	92%	87.5%	Very worthy
3.	Design the content of practical instructions	87.5%	95%	Very worthy
	Average	**86%**		**Very worthy**

Table 4 explains the expert validation assessment of media aspects of practicum instructionsbasednature where there are 14 statement items obtained an overall average score of 86%. with the Very Suitable media category to be used as a nature-based practicum guide. The average value of the two validated aspects is 87.69% with very feasible criteria, so it can be concluded that the media developed in the form of nature-based practical instructions on acid-base material is suitable for use in acid-base practical learning.

Validation of field practitioners (teachers)

Data from validation results from expert field practitioners (teachers) can be seen in table 5.

Table 5 data from teacher practitioner validation results

Material aspect	Number of each indicator	Percentage	Criteria
Material suitability	5	100%	Very worthy
Updatematerial	5	95%	Very worthy
Accuracy	2	100%	Very worthy
Encourage curiosity	2	87.5%	Very worthy
Presentation support	2	100%	Very worthy
Straightforward Language	2	100%	Very worthy
Dialoginteractive	1	100%	Very worthy
Conformity to language rules	1	100%	Very worthy
Average		97%	Very worthy
Media aspect			
Size of practical instructions	2	100%	Very worthy
Practical manual cover design (cover)	6	87.5%	Very worthy
Design the content of practical instructions	6	100%	Very worthy
Average		95%	Very worthy

Table 5 explains the validation results of chemistry subject teachers at Hang Tuah 3 Mataram High School regarding the practicum instructions developed, with an overall average percentage of 96% with a very suitable category to be used as nature-based practicum instructions. A little input from expert practitioners is for good cover. uses red and blue to represent acids and bases and the font size is slightly enlarged.

Results of student responses to nature-based practical instructions.

Data on student response questionnaire results obtained from filling in the questionnaire sheet can be seenin Table 6.

Table 6. Datathe results of student responses

No.	Assessment criteria	Number of students who responded				Percentage	Criteria
		1	2	3	4		
1.	The steps provided in the practical instructions are clear			7	3	82.5%	Very good
2.	The language used in the practical instructions is easy to understand			6	4	85%	Very good
3.	The materials used in this practicum are easily available in the surrounding environment			6	4	85%	Very good
4.	The cover image of the practical instructions is interesting		1	6	3	80%	Very good
5.	The text and writing in the practical instructions are easy to read			8	2	80%	Very good
6.	The presentation of practical instructions based on natural ingredients is carried out neatly		1	4	5	85%	Very good
7.	These practical instructions made me more independent in carrying out acid-base practicals		1	6	3	80%	Very good

8.	Practical instructions based on natural ingredients increased my motivation to do practical work	1	7	2	77.5%	Very good
9.	In my opinion, nature-based practical instructions are appropriate in reducing laboratory waste		5	5	87.5%	Very good
10.	The material presented in the practical instructions is short and clear.		6	4	85%	Very good
	Overall percentage average				82.75%	Very good

Table 6 shows the results of filling out the questionnaire sheetwhere questionnaires were distributed to 10 students to fill out, which was carried out in the classroom in the limited test group. Based on the student responses, the overall percentage was obtained, namely 82.75%, this percentage figure is included in the "very feasible" criteria for application. So, it can be said that the development of nature-based practical instructions on acid-base material has received a very good response and is very suitable for application in schools, especially SMA Hang Tuah 3 Mataram.

Observation Data on Students' Science Process Skills (Limited Test)

The percentage of observation results of science process skills of Hang Tuah 3 Mataram High School students can be seen in table 7.

Table 7. Observation results of students' science process skills

No	PPP aspects	Number of indicators	Score	Maximum score	Percentage	Criteria
1.	Observation	1	3	4	75%	Very skilled
2.	Classifying	1	3	4	75%	Very skilled
3.	Interpretation	1	3	4	75%	Very skilled
4.	Prediction	1	3	4	75%	Very skilled
5.	Asking question	3	10	12	83%	Very skilled
6.	Make a hypothesis	3	9	12	75%	Very skilled
7.	Planning an experiment	3	11	12	91%	Very skilled
8.	Communicate	4	14	16	87.5%	Very skilled

Based on the results of research conducted at Hang Tuah 3 Mataram High School with practicum in event 5, namely "making litmus paper from strawberries", the KPS that emerged during the practicum were observation, classification, interpretation, prediction, planning experiments, asking questions, hypothesizing and communicating.

a. Observation

Science process skills in the observation aspect have one assessment indicator, namely showing students strawberries and litmus paper and asking students to say what they imagine about strawberries and litmus paper. In this section, students get a score of 75% with the criteria of being very skilled, meaning that students have skills in the observation aspect because students know the object being shown well, understand the object being observed, document it, but the student has a slight weakness, namely not knowing the relationship between strawberries and litmus paper. .

b. Classifying/grouping

Science process skills in the classifying aspect have one assessment indicator, namely recording each characteristic that students put forward about litmus paper and strawberries. In this section, students get a score of 75% with very skilled criteria, meaning that students have very good skills in this aspect of classifying. Students correctly note the characteristics of objects observed butStillThere is a slight weakness of students, namely not mentioning it completely.

c. Interpretation

Science process skills in the interpretation aspect have one indicatorevaluationnamely, connecting each characteristic stated and concluding each characteristic stated about litmus paper and strawberries by searching for sources on the internet. In this section, students get a score of 75% with very skilled criteria, meaning that students have very good skills in this aspect of interpretation. Students correctly connect the characteristics of strawberries and litmus paper, but students cannot correctly conclude the meaning of these two ingredients.

d. Prediction

Science process skills in the prediction aspect have one indicatorevaluationnamely Predicting that litmus paper can be made from natural materials. In this section, students get a score of 75% with very skilled criteria, meaning that students have very good skills in this aspect of prediction. Students predict correctly and in accordance with the objectives of this practicum.

e. Planning an experiment

Science process skills in the aspect of planning experiments have three indicatorsevaluationnamely looking for work procedures in books, the internet or other sources regarding practical acid-base testing using litmus paper, determining and taking the tools needed for the practical, preparing materials to test the properties of acids and bases. In this section, students obtained a score of 91% with the criteria of being very skilled, meaning that students have very good skills in this aspect of planning experiments. Students prepare the materials needed to test the properties of acids and bases correctly.

f. Asking question

Science process skills in the aspect of asking questions have three indicatorsevaluationnamely, students ask about how to test acid-base properties using litmus paper made from strawberries. Students ask about the impact of acids and bases. In this section, students got a score of 83% with very skilled criteria, meaning that students have very good skills in the aspect of asking questions. Students ask questions according to context, listen enthusiastically and document what is explained.

g. Hypothesis

Science process skills in the hypothesizing aspect have three indicatorsevaluationnamely: Proving that acids can turn red litmus and blue litmus, and bases can also turn red litmus blue and remain blue in blue litmus, showing that the pH of acids is < 7 and bases > 7, showing one of the characteristics of acids and bases. In this section, students get a score of 75% with very skilled criteria, meaning that students have very good skills in this aspect of hypothesizing. Students hypothesize and can explain well.

h. Communicate

Science process skills in the communication aspect have four assessment indicators, namely discussing practicum results, making observation tables, making conclusions from practicum results, making reports. In this section, students obtained a score of 87.5% with very skilled criteria, meaning that students have very good skills in this aspect of communicating. Students make appropriate conclusions according to the results of the practicum, answer questions in the practicum manual and make interim reports completely and systematically.

Based on the results of this research, learning process skills is an alternative for involving students' physical aspects and mental activities in learning activities, so that students gain a complete understanding of an object (Ningrum, 2012). Therefore, teachers in the classroom must be able to provide activities that cangiveopportunities for students to develop science process skills. The results of this feasible research are

adapted to the use of nature-based practical instructions on acid-base material. It is hoped that students can learn actively and continue to carry out practical work assisted by simple tools and materials that are easy to find in the surrounding environment through the research process, in order to improve process skills. science students.

3. CONCLUSION

1. The media developed is in the form of nature-based practical instructions on acid-base material. Based on the validation results of material experts and media experts on the development of nature-based practical instructions on acid-base material with a percentage of material experts of 89.38%, with very feasible criteria and a percentage of media experts of 86% with very feasible criteria, so an average percentage of 87 was obtained. 69% with very feasible criteria, it can be concluded that the media developed in the form of nature-based practical instructions on acid-base material is suitable for application in chemistry practicals
2. The results obtained from student responses to nature-based practical instructions on acid-base material were 82.75%, with the criteria "very feasible"
3. The results of the trial of practical instructions on acid base material to measure students' science process skills from the 9 aspects of KPS were assessed on average for each aspect above 75% with very skilled criteria so it can be said that the practical instructions produced can be understood by students and are easy to apply in the practical process.

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