

Design of Science Process Skill Approach-Based Laboratory Work Instruction

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ABSTRACT

The development of a Science Process Skills Approach-based Laboratory Work Instruction has been conducted on Heat of Reaction topic. The subject of the research is the students of class XI in Senior High School 2 Tanjungpinang. The research aims to determine the feasibility of laboratory work instruction in terms of the validity and practicality categories. In the category of validity, there are five aspects studied including the aspects of content feasibility, grammar, presentation, graphical design, and science process skills. The validation results obtained from three validators was 92.46% (very valid category). In the practicality category was conducted on 40 students. In this category, there are seven aspects studied, namely aspects of observing, classifying, interpreting, determining hypotheses, applying, designing experiments, and communicating. The result shows that a science process skills approach-based laboratory work instruction is categorized in the practical criteria (82.28%).

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1. INTRODUCTION

Science Process Skills is an established scientific approach. One of application of learning activities using science process skills approach can be applied to the learning process at each stage of the experiment which is contained in the laboratory work instruction. The lab work instruction is a guidebook for the implementation of an experiment that contains procedures for the preparation, implementation, analysis of data and reporting prepared by a person or group of teaching who follow scientific writing rules (Nurussaniah et al., 2016).

The use of laboratory work instruction is one of the efforts in realizing the goal of national education in Article number three which is contained in Law No. 20 of 2003 on National Education System that develops students' skills in possessing the skills, creativity and independent nature. Some of the laboratory work instruction have been developed to improve student skills include geopark-based laboratory work instruction with inquiry learning approach (Vitdiawati, et al., 2016), guided inquiry-laboratory work instruction (Munika, et al., 2014), and laboratory work-based scientific approach

(Budiarti, et al., 2014).

Based on the needs analysis that has been done, it is necessary to develop Science Process Skills-based Laboratory Work Instruction. The selection of science process skills approach is based on the learning process that must get the learning directly in developing the skills and applying the previous learnt theory. Therefore this study aims to develop a Science Process Skills Approach-based Laboratory Work Instruction is valid and practical to achieve student's experiment design ability.

2. METHODS

Laboratory work instruction is the guideline of laboratory work containing preparation procedure, data analysis and reporting arranged by a person or group of teaching staffs following scientific rules (Nurussaniah, 2016). Laboratory activities constitute the part of teaching and learning activities. It shows that how important the laboratory activities for the achievement of the science is. Woolnough and Allsop in (Handayani, 2011) stated that there are four important reasons in laboratory

activities.

The selection of research subject using simple random technique, sample of six classes of level XI MIPA in Senior High School 2 Tanjungpinang, 40 students were selected as sample in the research. This research used qualitative data that have been analysed from the percentage of

questionnaire results at validation and practicality stage. This research implemented Research and Development using 4-D development model consist of four stages namely define, design, develop and disseminate. However, in this study is limited until the third stage (develop).

The reaseach prosedure as shown as follow:

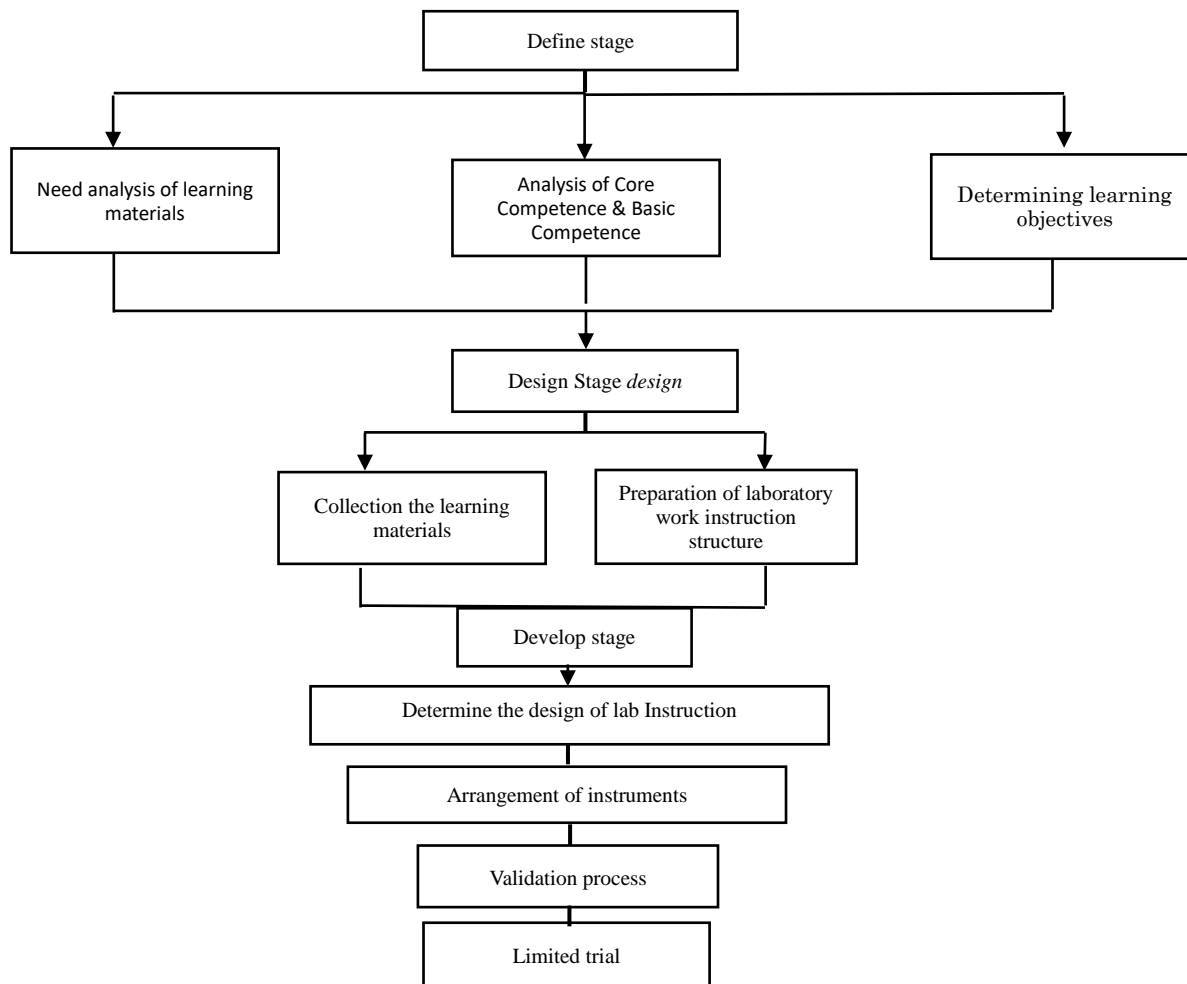


Figure 1. Research Procedure

Determination of the quality of practical Instruction using data analysis techniques described as follows:

a. Validation of Science Process Skills Approach-based Laboratory Work Instruction

The validation data on the obtained laboratory work instruction is presented with Likert scale and then the determined percentage value by using the formula according to Fauzi (2015):

$$\text{Validation Percentage} = \frac{\text{Calculated Score}}{\text{Max Score}} \cdot 100\%$$

Equation (1)

The result of percentage obtained is converted into the level of validity criteria according to Fithryah et. al., (2013). The determination of validity level is given in Table 1.

Table 1. Criteria of Degree of Validity

Percentage (%)	Validation Criteria	Explanation
80-100	Very valid	No Revision
66-79	Valid	No Revision
56-65	Enough	No Revision
40-55	Poor	Revision
30-39	Not valid	Revision

b. Practicality of Science Process Skills Approach-based Laboratory Work Instruction

Student's response data on the laboratory work instruction obtained from questionnaire analyzed practicality value by using the formula by Majid (2014).

$$\text{Practicality Percentage} = \frac{\text{Calculated Score}}{\text{Max Score}} \cdot 100\%$$

Equation (2)

The result of the percentage obtained was converted into the level of practicality category according to Sudjana (2006), the determination of the category of practicality is determined in Table 2.

Table 2. Criteria of Practical Category

Achievement Level (%)	Category
90-100	Very Practical
80-89	Practical
65-79	Enough Practical
55-64	Poor practical
0-54	Not Practical

Students' achievement in designing the experiment was calculated from the questionnaire of the observation using the percentage formula according to Sanjaya (2016):

$$\text{Achievement percentage} = \frac{\text{Calculated Score}}{\text{Max Score}} \cdot 100\%$$

Equation (3)

3. RESULTS AND DISCUSSION

Needs analysis has been done to find out the initial condition of instruction manual that has been used by the students during the learning process by practicum

Table 3. Analysis of Linkage of Core Competence (KI) and Basic Competence (KD) to Competency Achievement

Core Competence (KI 4)	Indicator (IPK)		
	Basic competencies (KD 4.4)	Indicators of Competency Achievement (GPA)	Material
Processing, reasoning and creating in the realm of concrete and abstract realms related to the development of the learning in school independently and acting effectively and creatively and able to use methods according to scientific rules.	Summarizes the results of thermochemical experimental data analysis at fixed pressure	4.4.1. Conducting experiments on determining the heat of reaction at constant pressure using simple calorimetry 4.4.2. Able to analyze the results of experiments on the determination of reaction heat at fixed pressure using simple calorimetry	Determination of changes in the enthalpy of the reaction of calorimetry

Based on the needs analysis that has been done in the previous research, the subject matter of the lesson chosen for the process of developing the laboratory work instruction based on science process skills approach is "Change of Entalpy of Calorimetry Reaction". The subject matter is chosen because there is a good potential to conduct experiments and can generate the activity and creativity of students in the learning process.

The aspects assessed in the validation process include feasibility of content, language, presentation, graphical and science process skills. In developing the laboratory work instruction there are several suggestions from the validator described in Table 4.

Table 4. Validation suggestions by Validators

No	Before	After
Initial Validation		
1	Fix the theoretical basis on the laboratory work instruction on the word "container"	Fixed theoretical basis on the lab work instruction on the word "container" to "tool"
2	Adjust the image of the scientist who directed the student in designing the experiment.	Corresponding images of scientists who direct students in designing experiments
3	The use of language that is still not in accordance with the students	The use of language that is in accordance with the students
Final Validation		
1	Less prominent activities in designing experiments or experiments.	Prominence of activities in designing experiments or experiments
2	The lab work instruction for using experiment are still less clear.	Detailed instructions for using lab manuals

(Source: Research Results)

The suggestions from validators are useful for improving developed laboratory work instruction (Khoirunnisa, et al., 2017). After the improvement is found the validation value of the laboratory work instruction is 92,46% with very valid criteria, content aspect is 90%, linguistic aspect 93.33%, presentation aspect 93.33%, graphical aspect 94%, and science process skill aspect equal to 91.57%.

Table 5. Percentages of Validator's Ratings

No.	Measured aspects	Average Percentage	Criteria
1.	Feasibility of Content	90	Very Valid
2.	Language	93,33	Very Valid
3.	Presentation	93,33	Very Valid
4.	Graphical	94	Very Valid
5.	Science process skills	91,57	Very Valid
Average		92,46	Very Valid

(Source: Research Results)

After being validated, the laboratory work instruction was tested on 40 students. This test is done by using student response data obtained from the student's questionnaire data. The result of the percentage of content feasibility aspect is 80.58%, language aspect is 86.1%, presentation aspect is 81.5%, graphical aspect is 85.38% and science process skills aspect is 77.85%. It showed that Science Process Skills Approach-based Laboratory Work Instruction has been developed is in practical category to be implemented in teaching process. The same research has been performed by other research by Meli, dkk (2013), stating that the Science Process Skills Approach is able to improve student learning achievement.

Table 6. The Results of Student's Response

No.	Measured Aspects	Average Percentage	Criteria
1.	Feasibility of Content	80,58	Practical
2.	Language	86,1	Practical
3.	Presentation	81,5	Practical
4.	Graphical	85,38	Practical
5.	Science process skills	77,85	Enough Practical
Average		82,28	Practical

(Source: Research Results)

4. CONCLUSION

Based on the result of the research, it is concluded that the design of the science process skills approach-based laboratory work instruction that has been developed has passed validation test stage and got very valid result with validation value 92,46% and practicality value 82,28%. These results indicate that the developed Laboratory Work Instruction is feasible and practical to be used in achieving the ability to design student experiments on Heat of Reaction topic in Chemistry subject.

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