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Development of Science Process Skills Assessment Instruments in Environment Based Practicum on Reaction Rate Material

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Abstract

This study aims to produce an Environmental-Based Chemistry Practicum Assessment Instrument for Reaction Rate Material for 11th Grade of MA/ SMA. The development model used in this research is the development model according to Borg and Gall which consists of 4 stages: Potential and Problems, Gathering Information, Product Design, and Design Validation. The development in this study refers to the product produced in the form of an assessment instrument. which is measured until the validity of the expert where the validity aspects are based on the results of the experts' assessment validation questionnaire. The aspects assessed in the product of the environmental-based practicum performance instrument assessment instrument are the feasibility of instructions, content feasibility and language feasibility. The assessment instrument in this content aspect is arranged sequentially according to the practicum procedure. Based on the results of validation by validators, the linguistic aspect obtained a score with a percentage of 93%, then the linguistic aspect is divided into several assessment criteria, including the use of language in accordance with EYD, clarity of instructions and directions and the language used is straightforward and easy to understand Based on the results of validation by validators, the linguistic aspect obtained a score with a percentage of 91%. The validity level of the chemistry practicum performance assessment instrument measured practicum performance in the form of scores 1-4. Determination of the validity of the practicum performance assessment instrument is done by calculating the score given by the validator and analyzing the validator's suggestions and input on the instrument product assessment questionnaire sheet in the form of a check list. The results concluded that the student practicum performance assessment instrument was feasible to use.

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INTRODUCTION

Learning objectives are a description of the achievement of three aspects of competence, namely knowledge, skills and attitudes, which are acquired by students in one or several learning activities. Learning objectives are formulated with regard to evidence or evidence that can be observed and measured in students, so that students can be declared to have achieved a learning objective (Semiawan, 1992; Subiantoro, 2010). Competencies are the abilities that students must demonstrate to show that they have successfully achieved the learning objectives. Guiding questions that teachers can use in developing learning objectives include, Concretely, what abilities do students need to demonstrate and what stage of thinking do students need to demonstrate (Sagala, 2007; Devi, 2013; Dewi, 2016).

Science process skills in chemistry learning involve cognitive, affective and psychomotor abilities (Nuryani, 2003; Nuryani, 2007). Cognitive abilities*(minds on*) because in learning students think, psychomotor abilities*(hands on*) because students are involved in using tools and materials, measuring, preparing or assembling tools, and affective abilities*(hearts on*) because students interact with each other in carrying out teaching and learning activities (Dimyati & Mudjiono, 2015; Dwijayanti & Siswaningsih, 2004)).

So far, learning and measuring chemistry learning outcomes in schools only pay attention to cognitive aspects. Teachers do not train the skills that students have to find their own knowledge. Whereas the nature of chemistry itself is as a process and product. The process skills in question are science process skills. Teachers must measure and develop students' science process skills by using a science process skills test. These skills are fundamental skills or abilities possessed by every student (Djamarah, 2006).

Based on observations at State Senior High School (SMAN) 2 Sungai Kakap, it is known that the implementation of chemistry learning at SMAN 2 Sungai Kakap still tends to be done conventionally. Teachers explain more when delivering material, which is accompanied by questions and answers and giving assignments. Most of the students' learning time is spent listening to the teacher's lecture, memorizing material and recording material. This is supported by the results of an interview with a chemistry teacher at SMAN 2 Sungai Kakap who said. This is reinforced by the observation of the learning process that took place in class.

In the process of student skills, teachers must measure and develop students' science process skills by conducting practicum. These skills are fundamental skills or abilities possessed by every student. Science process skills are skills that are usually done to gain knowledge. These skills or abilities include: observing, making hypotheses, planning research (experiments), controlling variables, interpreting or interpreting data, drawing provisional conclusions, predicting, applying and communicating (Ependi, 2013; Subiantoro, 2010).

At the time of practicum implementation must include the use of practicum instructions equipped with assessment instruments (Sudjana, 1990). Because assessment instruments are very important in learning because they can see students' abilities and skills during the learning process without having to wait until the learning process ends (Fuadi, 2008; Sunyono, 2007). Assessment instruments also provide greater opportunities for teachers to recognize students more fully because in reality not all students who are less successful in objective tests or description tests are said to be unskilled in practicum performance (Ari Laksmi, 2014; Agustina & Saputra, 2016).

When the practicum is carried out, the assessment instrument used by the teacher to assess students' practicum performance is also only limited to the final assessment of the practicum, while the performance of students is not assessed. The absence of this performance assessment instrument causes the assessment of skill competencies to not be measured as a whole (Liandari, 2017; Sari 2013). While one of the aspects that are honed in chemistry learning at school in order to be able to meet the criteria for graduation competency standards is the skill (psychomotor) aspect. is the skill aspect (psychomotor) which includes observing, questioning, trying, presenting and creating activities (Zulpa, 2011; Wisudawati, 2013; Rina, 2017).

In the absence of assessment instruments, teachers cannot know how far a student has achieved the learning objectives that have been set, both aspects of knowledge, attitudes and skills such as skills during practicum (Rauf, et al. 2013; Nelyza, Hasan, & Musman, 2015).

METHOD

The research model used is development research (Research and Development). As for what was developed in this study was an assessment instrument. The subjects in this study were 3 lecturers of the chemistry education study program as experts.

The research and development procedure of the assessment instrument is adjusted to the Borg and Gall model (Borg, 1983; Sugiyono, 2011) as follows:

1) Potential and problems

   The potential and problems in this development research are based on the results of a needs analysis conducted by researchers at SMAN 2 Sungai Kakap. The potential and problems obtained are the rarity of teachers carrying out practicum activities and only assessing the end of student learning activities (cognitive) but nothing to assess student skills during the practicum process (psychomotor).

2) Information gathering

   After conducting observations and interviews, it is necessary to conduct a literature study as a collection of information to solve existing problems. In order for the assessment instrument to be integrated with character values as expected, the alternative is to analyze the needs and analyze the material.

3) Product Design

   The next step is for the researcher to design the developed product. The resulting product is an assessment instrument that will be used in the implementation of an environment-based practicum and uses tools and materials that are easily available in the surrounding environment.

4) Design Validation

   The assessment instrument that has been completed will be tested for feasibility by experts. Experts fill out a feasibility questionnaire to test the feasibility of the instrument that has been made. Experts in this study were 3 lecturers of chemistry education study program FKIP UNTAN.

Data Collection Techniques and Tools

Indirect communication technique is a technique used in data collection in this study, namely by using an instrument feasibility questionnaire. The tool used as a data collector in this study is a feasibility questionnaire. The feasibility questionnaire is tailored to the research needs. The standard components of the feasibility of the assessment instrument in this study are content feasibility and language feasibility.

Data Analysis Technique

The feasibility of the rubric can be known from the validation sheet that has been filled in by expert validators. The validation sheet is filled in before the practicum performance assessment rubric is used to assess student practicum performance during laboratory practicum. The validation sheet filled by the validator contains 2 aspects, namely content and language. Each aspect has a value range of 1-4 with categories namely SB (very good), B (Good), C (Fair), K (Less). The formula used to calculate the percentage is as follows (Afia, 2013; Arikunto, 2011; Riduawan & Akdon, 2008).

$$\% = \frac{\text{Total Overall Score}}{\text{Total maximum score}} \text{ x } 100\ \%$$

The resulting percentage is converted as following figure 1.

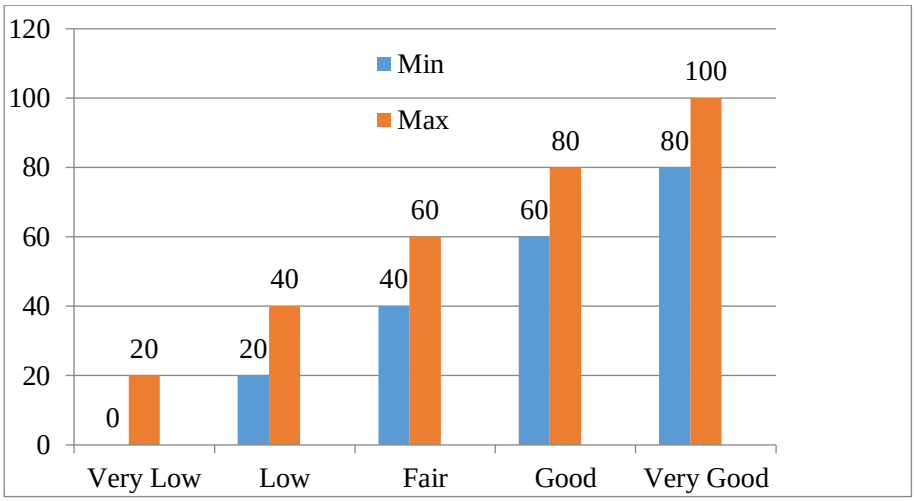

Figure 1. Score description

RESULTS AND DISCUSSION

The results of this research and development are Assessment Instruments on Environmental-Based Chemistry Practicum Reaction Rate Material. The results of this study are. The results of validation by experts obtained a percentage score of 91% in the content aspect with very good criteria and 93% in the language aspect with very good criteria. This development research was conducted in four stages.

Potential and Problems

Potential

At this stage, the researcher made observations at the school, namely SMAN 2 Sungai Kakap. The results of interviews with chemistry teachers at SMAN 2 Sungai Kakap who said that they preferred the lecture method and when doing practicum only assessed the results of the practicum but did not assess the practical performance of students. It is known that the school uses the Thirteen (K13) curriculum, meaning that the school has the potential to develop the type of assessment that can support the practicum. And judging from the curriculum used, it can also be the potential for developing types of psychomotor domain assessment instruments**.**

Problems

Based on interviews with chemistry teachers and several students, the problems in learning chemistry at SMAN 2 Sungai Kakap include:

1) In SMAN 2 Sungai Kakap only a few times practicum was carried out due to limited chemical equipment and materials.
2) Students do not know the rules of practicum and the properties of chemicals.
3) Performance assessment during practicum is only limited to the assessment of practicum results.

Based on the analysis obtained data that the implementation of practicum at SMAN 2 Sungai Kakap is very rarely carried out due to limited tools and materials, besides that the assessment of practicum performance is also limited to the assessment of practicum results or practicum reports even though this practicum performance assessment is one of the demands in the 2013 curriculum.

Information gathering

After conducting observations and interviews, researchers conducted a literature study with needs analysis and material analysis.

Needs Analysis

This analysis was carried out on the chemistry book handbook for students and teachers of class XI odd semester on reaction rate material. In the book there are several learning objectives that students must achieve in the learning process. Based on the results of the analysis, there are several problems including books that have language that is too difficult to understand and practicum carried out using tools and materials that are not owned by the school. To achieve these learning objectives, practicum can be done using tools and materials that are around the school environment and are easily available.

Material Analysis

In the material analysis, the selection of material based on KD and KI is carried out essentially from the entire material of a lesson. Before transforming the material into an assessment instrument, it is necessary to analyze the material to match the potential and problems. The following is the material analysis conducted by the researcher:

a) The selected material must be in accordance with the potential and problems

b) The selected material uses the practicum method in learning

c) The practicum used uses tools and materials that are simple and easy to obtain.

From this analysis, the researcher chose to use reaction rate material on the sub-material of factors that affect the reaction rate (concentration) in Class XI odd semester. The selection of reaction rate material because in this material there is a simple practicum method, one of which is the sub-material of factors that affect the reaction rate (concentration). In addition, the practicum can use tools and materials that are very easy to obtain in the school environment.

The Practical Performance Assessment observation sheet consists of several components including the name of the school, subject, class, observation time, name of the learner, aspects assessed, and a column containing indicators of science process skills.

The rubric on the practical performance assessment instrument developed is accompanied by the criteria of the skills that must be mastered by students during the practicum. These learner criteria are assessment criteria without pictures. The score obtained by students on each assessment item is in accordance with the criteria achieved by students during the practicum.

At this stage, the products that have been designed are then validated by validators to see the advantages and disadvantages of the products developed. Validation of practicum performance assessment instruments was carried out by 3 validators, namely Chemistry Education lecturers at the Faculty of Teacher Training and Education, Tanjung Pura University, namely Dewi Pratiwi S.Pd, M.Pd, Lukman Hadi M.Pd and Rody Putra Sartika S.Pd, M.Pd.

At the validation stage, the validators suggested that the assessment instrument must be in accordance with the feasibility test which includes the feasibility test of instructions, content feasibility and language feasibility test so that the assessment instrument is easy to develop and use by education personnel to assess student performance during practicum.

The level of validity of the chemistry practicum performance assessment instrument

measured practicum performance in the form of scores 1-4. Determination of the validity of the practicum performance assessment instrument is done by calculating the score given by the validator and analyzing the validator's suggestions and input on the instrument product assessment questionnaire sheet in the form of a check list. Based on the validation conducted by the validator, aspects in the product that are not valid are revised based on the suggestions and results of the validator's assessment. The revised product was then consulted and refined. Revisions were made to produce better assessment instruments to be applied in chemistry practicum in the laboratory.

Validator 1 provided some suggestions for improvement on the assessment instrument as follows:

1) Improvement of writing on the assessment rubric
2) Improvement of the assessment on the assessment rubric which in the assessment aspect on scores 2 and 3 are the same

Validator 2 provided some suggestions for improvements to the assessment instrument as follows:

1) Improvements in structuring and scoring on the observation sheet on the assessment items are made based on the criteria contained in the assessment rubric.
2) Improved writing on the assessment rubric
3) Improving the arrangement on the rubric and deleting statements on the assessment rubric

Validator 3 provided some suggestions for improvements to the assessment instrument as follows:

1) Improvement of writing on the assessment rubric
2) Adding pictures of how to use practicum tools
3) Improvement of assessment descriptors on the assessment rubric
4) Addition of assessment instructions on the observation sheet

From the validation results, the instructions aspect was obtained with an ideal percentage of 97% with a very good category. This is because the guiding aspects of the instrument are in accordance with the criteria and this shows that the assessment instrument is easy to use by educators. In the content aspect, the ideal percentage is lower than the instruction aspect with a percentage of 91% but still in the very good category (SB). And in the aspect of language also get a percentage of 94% with a very good category (SB), this is because according to the validator the language used in the instrument is easy to understand.

The aspect of content feasibility is the feasibility of presenting the content in the assessment instrument. The assessment instrument in this aspect is arranged sequentially according to the practicum procedure. The assessment instrument developed is adjusted to the Core Competencies (KI) and Basic Competencies (KD). The practicum material contained in the assessment instrument developed is the reaction rate on the sub-factors that affect the reaction rate, namely concentration. In the content aspect, there are 3 aspects of assessment, namely the suitability of the instrument with indicators, the presentation of assessment instruments makes it easier for students to master skills in practicum and assessment instruments are presented systematically. The total score obtained in the content feasibility aspect based on the validator's assessment is 34 with a maximum score of 36. Based on the results of validation by the validator, the linguistic aspect obtained a score with a percentage of 91% including in the Very Good (SB) category.

The linguistic aspect is divided into several assessment criteria, including the use of language in accordance with EYD, clarity of instructions and directions and the language used is straightforward and easy to understand. In this assessment instrument, the language used is simple and communicative, uses straightforward language and is easy to understand and the statements on the instrument use good and correct Indonesian and do not use foreign language that is difficult to understand. Good language is one of the main components in the assessment instrument in order to help the observer's understanding so that they can assess the students' practical performance accurately and objectively. The total score obtained on the linguistic aspect based on the validator's assessment is 34 with a maximum score of 36. Based on the results of validation by the validator, the linguistic aspect obtained a score with a percentage of 94% including in the Very Good (SB) category.

CONCLUSION

The feasibility of the product Assessment Instrument on Chemistry Practicum Based on the environment of reaction rate material has met the valid criteria. The results of the study can be concluded that the assessment instrument on practicum is feasible to use. The results of validation by experts obtained an idealized average score on the content aspect of 91% with the Very Good (SB) category. The results of validation by experts obtained an ideal average score in the language aspect of 94% with the Very Good (SB) category. The Environmental-Based Chemistry Practicum Performance Assessment Instrument product on reaction rate material has met the valid criteria. The results of validation by experts obtained an idealized average score of 95% in the Very Good (SB) category.

RECOMMENDATIONS

Based on the research that has been conducted, there are several findings that can be used as suggestions. The results of this study can be used as a reference to further develop Practicum Assessment Instruments in other materials or lessons. We recommend that the development of assessment instruments in this practicum be carried out further research at the field trial stage.

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