Development of Structured Assignment Sheet with Example Applications in Daily in Sub-Matter Factors that Affect Reaction Rate

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Abstract- This research has been carried out to produce a Structured Assignment Sheet with Example Applications in Daily (SAS-EAD) on the sub-material factors that affect the reaction rate suitable for use as chemistry learning media for class XI in high school. This research applies the Research and Development (R&D) way to deliver SAS-EAD that complete criteria of validity, practicability, and effectiveness. From January to February 2021, a limited trial was carried out in SMAN 1 Kandangan, who had obtained the factors that affect reaction rate material with a total of 15 people. The instrument used in this study consisted of a validation sheet, a student response questionnaire, and a test sheet. The results: (1) SAS-EAD has achieved eligibility requirements in terms of both construct and content validity criteria with a grade of Mo $\geq$ 3 for every number and R $\geq$ 75%, (2) the developed SAS-EAD was achieved eligibility requirements reviewed. The practicability criteria with an average response value of 98.8%, and (3) the SAS-EAD developed was achieved eligibility requirements in terms of effectiveness criteria with an N-gain grade of 0.80. Thus, the conclusion is that the Structured Assignment Sheet (SAS) has been appropriately developed to use as a learning tool with Example Applications in Daily (EAD) in factors that affect reaction rates material in high school students in class XI.

Index Terms- Structured Assignment Sheet, Example Applications in Daily, Science Process Skills, Factors Affecting Reaction Rate

I. INTRODUCTION

Chemistry always appears in everyday life and plays a vital aspect. It is built on scientific processes, attitudes, and products (Carin). Students should relate among the concepts, principles, laws, and theories of chemistry to solve the problem of daily life by learning chemistry (Permendikbud). Mastering chemical concepts from studying macroscopic, submicroscopic, and symbolic aspects. Some chemistry teachers have trouble integrating these three aspects in learning (Sastradewi et al.), so chemistry learning looks complex and abstract. As a consequence, most students have difficulty understanding it in a short time. Students who have trouble understanding the concept of chemistry will decrease their learning motivation.

Based on interviews with five Chemistry teachers in Kediri, they still use teacher-centered learning methods. Students sit then listen to the explanation and work on the questions given by the teacher without any responses, criticisms, and questions from students to the teacher as feedback in teaching and learning activities. For example, when working on practice questions, only some students complete them while others wait to discuss answers because of the difficulty of chemistry subjects, including abstract topics. According to research (Hemayanti et al., students think chemistry is difficult to learn because it is abstract. In Indonesian, an abstract is something intangible or just an image of the mind. The meaning of the explanation is abstract, immaterial in concrete, or tangible in a sense. It is in stark contrast to the minds of most students who are accustomed to thinking about concrete objects. Therefore, abstract chemical concepts cannot simply be transferred as a collection of information to students but must be given real problems close to their daily lives.

Program for International Student Assessment (PISA), which is held every three years to measure the competence of students in reading, mathematics, and science to solve concrete problems, shows the weak competence of Indonesian students in these three areas. At PISA 2018, the average grade of Indonesian students for science was only 396, while the average score for OECD countries was 489. A more in-depth analysis shows that 1.8% of Indonesian students are below Level 1b, 16.8%. Level 1b, 41.4% Level 1a, 29.2% Level 2, 9.2% Level 3, 1.6% Level 4, 0.1% Level 5, and none belonging to Level 6 (OECD) . Level 2 explains a benchmark that describes the minimum competence of students in understanding basic science knowledge and applying this knowledge in contexts that they are familiar with. The 2018 PISA results show that most Indonesian students aged 15 years have not reached the minimum level, namely Level 2 (OECD). Based on (Trianto), most students cannot connect what they learn with how they apply it to new situations. It is the same as

research (Sintawati et al.) that low problem-solving skills are a serious concern because students can use problem-solving abilities to solve problems in everyday life. Interviews with class XI chemistry teachers at SMA Negeri 5 Pekanbaru showed that students could not relate the concepts they had acquired to problems or phenomena in everyday life, especially in chemistry (Fitri and Fatisa).

The interviews with five Chemistry teachers find that the five teachers gave structured assignments but did not prepare Structured Assignment Sheets (SAS). Therefore, SAS should be developed to support the independent studying process of students in solving problems related to everyday life. Students could take a dynamic character in solving every problem. So those students are trained to think in a more structured or systematic way (Kundi). SAS is used to understand the chemical concept caught and interpret these concepts in problems applied in daily life (Santoso).

Following the K-13 education curriculum, chemistry subjects for high school students aim to make students master chemical concepts and their interrelationships also application in everyday life and technology. It means applying various chemical concepts to solve problems in daily life and technology using the scientific method. The basis or core of the scientific method is process skills. One of the process skills is Science Process Skills (SPS). Science Process Skills (SPS) emphasizes the growth and development of specific skills in students to process information so that new things are found that are useful, such as facts, concepts, and the result of attitudes and values (Semiawan). Based on research (Rahmah et al.), learning Chemistry occurs if students actively utilize science process skills and scientific perspectives. It aligns with research (Wafi and Haryanti) that science process skills can apply to case study-based learning methods in teaching and learning activities. In this case, the indicators of science process skills being used are adopted from (Kheng) which include problem formulation, thinking framework, hypothesis formulation, research variables, operational definitions, experimental design, data collection, and organizing stages, data analysis plans, practice making conclusion, and communication design exercise.

According to the phenomena above, it is essential to have a learning device that uses examples in everyday life using the Science Process Skills (SPS) approach. Therefore, the developer seeks to develop a structured assignment sheet with an example application in everyday life, then SAS-EAD. The developed SAS-EAD raises problems related to "How is the feasibility of SAS with sample applications in everyday life?". The research wants to create SAS-EAD on factors that affect the reaction rate material according to chemistry learning tools with examples in everyday life. The SAS-EAD developed is expected to improve students' competence to solve problems in daily life with the help of science process skills and develop scientific attitudes. In addition, SAS-EAD can also use as a reference for assignment sheets and a reference in developing chemistry learning tools by applying them to everyday examples.

II. METHODS

The development research takes place in the field of education. The method applies to Research and Development (R&D). In teaching and learning, the R&D method is used to produce a product tested for its effectiveness (Sugiyono).

This research lasted from January to February 2022 at SMAN 1 Kandangan. The targets were students of SMAN 1 Kandangan who had obtained the reaction rate material with 15 people.

The steps of the R&D research method are as follows: (1) research and information collection; (2) plan; (3) develop a preliminary form of product; (4) preliminary field testing; (5) major product revision; (6) main field testing; (7) operational product revision; (8) operational field testing; (9) final product revision; and (10) dissemination and implementation. The research was carried out only to the seventh step, namely the revision of the product after the use of the trial that was tailored to the needs.

The type of data is quantitative data obtained from validation, practicality, and effectiveness. The number of variables studied affects a number of research instruments. This research uses a validation sheet, a student response questionnaire sheet, and a pretest-posttest sheet as tools.

The study of the SAS-EAD was conducted to obtain a qualitative assessment related to criticism and suggestions from the lecturers of the Chemistry Major, FMIPA Unesa, as a reference for improving the SAS-EAD. The SAS-EAD validation pertaining to content and construct validity was done by three lecturers of the Chemistry Major, FMIPA Unesa. The practicality of SAS-EAD is obtained through response questionnaires filled out by students openly. The effectiveness of SAS-EAD is identified by the score of pretest and the score of postest.

The data from the validation results were explained by a quantitative descriptive method according to the calculation of the assessment grade criteria using a Likert Scale which shows in the table below:

Table 1 Likert Grade

Rating Category	Grade
Very valid	5
Valid	4
Quite valid	3
Invalid	2
Very invalid	1

(Riduwan)

The validity data (construct and content) were analyzed descriptively quantitatively using the frequently occurring score (Mo) obtained from expert judgment. Validation scores are taken from three validators, so it is necessary to calculate the understanding of their total scores. This is called the percentage of agreement (R) that can be counted in the formula below:

$$R = \left[1 - \frac{A - B}{A + B}\right] \text{ x } 100\%$$

A and B are the scores of the validators (A is the more significant score, and B is the minor score). Validation scores were got from three validators so that each R was determined as a percentage, namely $(R)_{1,2}$; $(R)_{1,3}$; and $(R)_{2,3}$. Construct and content validity are reliable if $R \geq 75\%$ (Borich). SAS-EAD achieves construct, and content validity of every question has the least possible Mo of 4, and if it is no different argumentation between the validators.

The assessment of the practicality of the SAS-EAD was got from the student response questionnaire. The analysis will explain that

the score shows the use of SAS-EAD. The percentage of student response questionnaire data was analyzed according to the Guttman grade to get a firm answer with a "yes" or "no" statement. The calculation of the Guttman Scale can be seen in the table below:

Table 2 Guttman Grade

Answer	Grade
Yes	1
No	0

(Riduwan)

The results data of the student response will be analyzed using a quantitative descriptive method in the form of a percentage of the Guttman Grade data in the formula below:

$$\text{Percentage (\%)} = \frac{\Sigma \text{ grade obtained}}{\Sigma \text{ grade criteria}} \times 100\%$$

The percentage obtained is then interpreted in terms of five response criteria, as presented in the following table:

Table 3 Response Score Interpretation Standard

Percentage (%)	Standard
0-20	Very impractical
21-40	Impractical
41-60	Quite practical
61-80	Practical
81-100	Very practical

(Riduwan)

SAS-EAD is declared easy to practice on chemistry learning based on these criteria if the research results are 81% with efficient standards.

Assessment of the effectiveness of SAS-EAD obtained from the test sheet. The pretest was given to determine the students' initial abilities, and the posttest was given to evaluate the effectiveness of using the developed SAS-EAD.

The student test results data were analyzed descriptively quantitatively that is shown in N-gain grade with the following calculations:

$$\text{N-gain} = \frac{\text{posttest mark} - \text{pretest mark}}{\text{max mark} - \text{pretest mark}}$$

The results of the gain value calculation are explained in terms of the standard that can be seen in the table below:

Table 4 Interpretation of N-Gain Grade

N-gain Score	Standard
$g < 0,3$	Low
$0,3 \leq g < 0,7$	Medium
$g \geq 0,7$	High

(Hake)

Based on these criteria, SAS-EAD is declared effective if an escalation of N-gain grade ≥ 0.7 with a high standard.

III. FINDINGS AND DISCUSSION

The title of this research, "Development of a Structured Assignment Sheet with Applications of Examples in Daily on the Sub-Material Factors Affecting the Reaction Rate," SAS-EAD is a structured assignment sheet that contains comprehensive questions on the factors that affect the reaction rate material by application examples of everyday phenomena. Structured assignment sheets are assignment sheets made to direct students with the teacher's help achieve learning targets (Kundi).

SAS-EAD as a structured task is given to students outside of face-to-face time to train students' independence in constructing their knowledge by relating phenomena of everyday life. It is by the 2013 Curriculum which requires students to master various chemical concepts to solve problems in everyday life and technology using scientific methods. Because the basis of the scientific method is process skills, the developer uses science process skills in this development. This research uses indicators of science skills such as formulation of the problem, writing framework, making hypothesis from the situation, writing steps of the solving problem, data collection, and making conclusion (Kheng).

The developed SAS-EAD needs to be tested for feasibility to be used in chemistry learning. The feasibility of the SAS-EAD was assessed in terms of three criteria according to (Nieveen.) recommendation, which included validity (content and construct), practicality, and effectiveness. The cover of the SAS-EAD already provides to develop the SAS-EAD. By applying examples in everyday life, students can master chemical concepts. The body is designed with illustrations showing the studied material, namely the reaction rate presented in the image below.

Figure 1 SAS-EAD Cover Display

Validity SAS-EAD

One of the eligibility criteria, according to (Nieveen) is validity (construct and content). According to (Sugiyono), validity must meet content validity and construct validity, which is supported by (Nieveen) that indicators of validity include consistency (construct validity) and relevance (content validity). The validation sheet instrument was given to the validators, namely three lecturers of the Chemistry Department, FMIPA Unesa. The score is provided by the validator on the validity indicator, which includes relevance (content validity) shown in the table below:

Table 5 Results related to SAS-EAD Content Validity

Number	Score			Mo	Category
	V_1	V_2	V_3		
1	4	5	5	5	Very valid
2	5	4	5	5	Very valid
3	4	5	5	5	Very valid
4	5	4	5	5	Very valid
5	4	5	5	5	Very valid
6	4	4	4	4	Valid

Table 8 shows that all questions get the mode mark of the three validators at number 6 of 4 (valid category), while at numbers 1,2,3,4,5, it is 5 (very valid type). Based on this, it can be stated that the SAS-EAD has achieved content validity. Validation scores were got from three validators so that each R was

determined as a percentage of every R was calculated, namely $(R)_{1,2}$; $(R)_{1,3}$; and $(R)_{2,3}$. The calculation of the rate of agreement (R) is shown in the table below:

Table 6 Recapitulation of Understanding Content Validity Score

Number	Score			*Percentage of Agreement* (R) (%)		
	V_1	V_2	V_3	$R_{1,2}$	$R_{1,3}$	$R_{2,3}$
1	4	5	5	89	89	100
2	5	4	5	89	100	89
3	4	5	5	89	89	100
4	5	4	5	89	100	89
5	4	5	5	89	89	100
6	4	4	4	100	100	100

From Table 9, it shows that the overall percentage of understanding given by the three validators is in the range of 89% - 100%, which means that the scores of the three validators have no significant difference so that it can be stated that the SAS-EAD meets the requirements in terms of content validity.

The score is given by the validator on the validity indicator, which includes consistency (construct validity) shown in the table below:

Table 7 Results regarding SAS-EAD Construct Validity

Number	Score			Mo	Category
	V_1	V_2	V_3		
1	4	3	4	4	Valid
2	4	5	5	5	Very valid
3	5	4	5	5	Very valid
4	4	5	5	5	Very valid
5	5	5	5	5	Very valid
6	4	4	4	4	Valid
7	4	5	5	5	Very valid
8	4	5	5	5	Very valid
9	5	5	5	5	Very valid
10	4	5	5	5	Very valid

Table 6 shows that the mode of the three validators at numbers 1 and 6 is 4 (valid category). Other questions, namely numbers 2, 3, 4, 5, 7, 8, 9, and 10, all get a mode value of 5 (an excellent category). Based on this, it can be stated that the SAS-EAD has achieved construct validity criteria.

Validation scores were got from three validators so that each R was determined as a percentage, namely $(R)_{1,2}$; $(R)_{1,3}$; and $(R)_{2,3}$. The following is the result of the calculation of the understanding or percentage of agreement (R):

Table 8 Construct Validation Score Agreement Recapitulation

Number	Score			*Percentage of Agreement* (R) (%)		
	V_1	V_2	V_3	$R_{1,2}$	$R_{1,3}$	$R_{2,3}$
1	4	3	4	86	100	86
2	4	5	5	89	89	100
3	5	4	5	89	100	89
4	4	5	5	89	189	100
5	5	5	5	100	100	100
6	4	4	4	100	100	100
7	4	5	5	89	89	100
8	4	5	5	89	89	100
9	5	5	5	100	100	100
10	4	5	5	89	89	100

Table 7 shows that the percentage of understanding of all validators is in the range of 86% - 100%, which means that the scores of the three validators have no significant difference, so it can be stated that the SAS-EAD has achieved construct validity criteria.

Practicability SAS-EAD

The SAS-EAD, validated and revised, was then experimented on 15 class XI students from SMAN 1 Kandangan. SAS-EAD is achieved in a practical category if it is easy to use. The practicability of SAS-EAD is got from the student responses questionnaire. All students or received a percentage of 93% agreed that after learning SAS-EAD can motivate them in learning chemistry, 100% of students decided after studying the SAS-EAD they can determine the problem formulation of the given phenomenon, write a framework for 100% of students, formulate hypotheses for 100% of students, write down the problem-solving steps of 100% of students who agree, write down data for 100% of the students, analyze data for 100% of the students and draw conclusions for 100% of the students, and 93% of the students agree that learning SAS-EAD can quickly solve problems in everyday life. The average percentage of the response questionnaire sheet obtained 98.8%, which explains critical criteria (Riduwan).

The effectiveness of SAS-EAD

The test method used to measure the students' understanding of chemistry by applying the phenomena of everyday life to science process skills in this research is the pretest and posttest methods. Students are given a pretest sheet before working on the tasks in the SAS-EAD, then a posttest sheet is provided. The average grades from pretest and posttest were analyzed that shown in the table below:

Table 8 N-gain Result Recapitulation

$\bar{x}$ Pretest	$\bar{x}$ Posttest	N-Gain	Standard
38	88	0,80	High

The pretest results show that all students have not been able to solve the phenomenon of questions related to everyday life. The average pretest score with a value of 38 proves it. This can happen because the SAS-EAD is still considered foreign among students in class XI SMA. The pretest questions contain phenomena related to everyday life and are solved using the help of science process skills. This aligns with research (Wafi and Haryanti) that science process skills can be applied to case study-based learning methods. But after being given the SAS-EAD, there was an expansion in the ability of students to solve problem phenomena related to everyday life. The average posttest result with a value of 88 proves it.

From the results of the posttest, in the first component, namely determining the formulation of the problem, all students can evaluate the formulation of the situation following the phenomena presented, which are related to surface area and temperature that can increase the reaction rate. , all students can

answer correctly. In the third component, formulating hypotheses, four students still do not respond correctly according to the given formula. In the fourth stage, namely writing the work steps, all students can write down the problem-solving steps according to the experimental video presented in sequence. In the fifth stage, namely writing data, you can write complete data according to the practical video provided. In the sixth stage, which analyzes the data, there are still five students who have not researched it adequately. Students should examine data from the video provided and relate it to the initial phenomenon presented as brainstorming. At the final stage, namely making conclusions from phenomena in everyday life, there are still two students whose decisions are not the same as the hypothesis made even though the intended conclusion is the answer to the hypothesis's truth.

From Table 8, the N-gain mark is 0.80. It was increasing the ability of students to solve problems from everyday phenomena that mean in high standard. So the effectiveness of SAS-EAD developed is said to be practical or very feasible to use to improve students' ability to solve problems from everyday phenomena in factors that affect the reaction rate material.

Learning chemistry using SAS-EAD in factors that affect the reaction rate material can improve students' ability to solve problems from everyday phenomena.

IV. CONCLUSION

From the research data, the results are: (1) SAS-EAD has achieved eligibility requirements in terms of both construct and content validity criteria with a grade of Mo ≥ 3 for every number and R ≥ 75%, (2) the developed SAS-EAD was achieved eligibility requirements reviewed. From the practicability criteria with an average response value of 98.8%, and (3) the SAS-EAD developed was achieved eligibility requirements in terms of effectiveness criteria with an N-gain grade of 0.80. Thus, the conclusion is that the Structured Assignment Sheet (SAS) has been appropriately developed to use as a learning tool with Example Applications in Daily (EAD) in factors that affect reaction rates material in high school students in class XI. For further researchers, it is necessary to develop a structured assignment sheet with examples in everyday life on other chemical materials so that students can comprehensively understand the material in chemistry subjects.

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