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WORKSHEET BASED ON POE: MEDIA DEVELOPMENT ON ACID BASE

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Abstract

This research aims to develop acid base worksheet based on POE and find out their validity and readability to support chemistry lessons. This development research uses the 4D models. The research consists of three steps, define, design, and development. The research subject consisted of two experts and 15 students. Research data collection techniques used expert validation questionnaires and student response questionnaires with a Likert scale of 1 - 4. The results of the study were analyzed quantitatively showing that the worksheets that had been developed met the validity requirements with very valid criteria in terms of material experts and learning design experts with a percentage average 96.06% and 95.51%. Student responses to the product show that the product is very suitable for use in learning based on an average percentage of 91.35%. This means that acid base worksheet based on POE can be one of the teaching materials for chemistry lessons.

Keywords: acid base, POE, worksheet

INTRODUCTION

Chemistry is a science that studies the properties of matter, the changes of matter, the laws and principles that describe the changes of matter, as well as the concepts and theories that interpret or explain the changes of matter (Slaubaugh & Parsons, 1972). The characteristics of chemistry mostly consist of abstract concepts (Kean & Middlecamp, 1985) and also involve mathematical calculations (Sukarna, 2000). One of the materials that has such characteristics is acid base.

Acid base are taught in grade 11 for senior high school student in Indonesia. The material on acid base in the 2013 curriculum starts with KD 3.10 for the cognitive domain and KD 4.10 for the skill domain. Learning about acid base is important because it is a prerequisite for learning about hydrolysis (KD 3.11 and 4.11) and buffer materials (KD 3.12 anda 4.12). Cetingul & Geban (2005) also state that acid base are fundamental concepts in chemistry because most chemical reactions are acid base reactions. However, that fact show that acid base are one of the materials that students often find difficult to understand (Burns, 1982; Huang, 2004; Cetingul & Geban, 2005; Sari, 2013)

One of the reasons for students' low understanding of the concepts of acid base is due to its abstract nature. An effort that can be made to concretize these abstract concepts is through laboratory activities. Laboratory activities have advantages such as making students more confident in the correctness of their own experiments rather than just accepting explanations from the teacher or book, developing a scientific thinking attitude, and resulting

in long-lasting learning and internalization (Sagala, 2012).

The learning process through laboratory activities must be facilitated with teaching materials, in of which is the worksheet. However, the worksheets used in some schools are often unattractive and unable to help students construct their own concept (Fannie & Rohati, 2014; Lisa & Masriani, 2012). According to Barlenti et all, (2017) and Fannie & Rohati (2014), the use of worksheets in schools has not solved the problem of concept understanding because the worksheets used only provide practice excercises based on the given materials.

The worksheet is expected to encourage students to be active during the learning process, guide them in discovering concepts, and develop process skills (Ariska, et al, 2017). Therefore, the worksheet should be developed based on learning model. The use of a model aims to structure anda direct the developed worksheet so that the learning objectives can be achieved.

One of the models that can used in developing a worksheet is the POE (Predict, Observe, Explain) model. The POE model is one of the learning models that originates from constructivist learning theory. Therefore, the POE model will actively involve students in the process of discovering concepts. Widyaningrum, et al (2014) stated that POE is a model with a series of problem-solving process carried out by students through the stages of prediction (Predict), observation (Observe), and explanation of observation results (Explain).

Several studies have reported that POE can improve scientific attitudes and learning achievements (Puriyandari, et al, 2014; Ma'rifatun, et al, 2014) The use of POE can improve students' understanding of concepts (Tlala, 2011; Kala, et al, 2012; Karamustafaoglu & Naaman, 2015) anda reduce misconception s in chemistry (Tlala, 2011). Based on the explanation, research will be conducted to develop POE-based acid base worksheets that can support chemistry learning in senior high school.

METHOD

This research is development research. The development procedure is adapted from the 4-D model developed by Thiagarajan. The research activities consists of four stages, namely define, design, development, and disseminate. Due to limitation in funding and time, the disseminate stage was not conducted.

The research subjects are material experts, learning design experts, and 15 senior high school students in Jombang, East Java. The research instruments are in the form validation questionnaires for experts and students response questionnaires. The data collected in Likert scale from 1 to 4, as presented in Table 1.

Table 1. Criteria for Rating Scale

Scale	Criteria
4	Very Good
3	Good
2	Less
1	Very Poor

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The validation questionnaires from experts and students response questionnaires were analyzed in quantitave using formulas:

$$\text{Percentage} = \frac{\sum \text{score of questionnaire assessment}}{\sum \text{maximum score}} \text{ X } 100\%$$

To determine the validity of the product, criteria presented in Table 2 are used.

Table 2. Criteria for Product Validity

Percentage	Criteria
80,01- 100,00	Highly Valid
60,01 - 80,00	Valid
40,01 - 60,00	Less Valid
20,01- 40,00	Invalid
00,00 - 20,00	Highly invalid

(Riduwan, 2013)

To determine the readability product based on students responses, criteria presented in Table 3 are used.

Table 3. Criteria for Product Readability

Percentage	Criteria
80,01- 100,00	Very Interesting
60,01 - 80,00	Interesting
40,01 - 60,00	Quite Interesting
20,01- 40,00	Not Attractive
00,00 - 20,00	Very Unattractive

RESULT AND DISCUSSION

Worksheet acid base based on POE is developed using the 4D development model. The following are the stages in the development process.

Define

In the stage, several analyses were conducted to establish and define the requirements for product development to meet the needs of the users. Based on the analysis conducted, the information obtained is presented in Table 4.

Table 4. Result of Define stage

Analysis	Result
Front-end Analysis	The teaching materials provided to students contain information about the material, so it does not train the thinking skills of students.
Student Analysis	11th grade high school students are the formal thinking stage (age 12-15 years) according to Piaget's theory of intellectual development.
Task Analysis	The competencies that students must have according to the 2013 curriculum revision of 2018 on acid base material are KD 3.10 and KD 4.10
Concept Analysis	The concept contained in KD 3.10 and 4.10 consist of acid base concept, pH concept, and acid base indicator.

Formulating Learning Objectives	Explaining the properties of acid base solutions Defining the meaning of acid and base solutions according to the Arhenius theory Explaining the conductivity properties of acid base solutions Identifying the strength of acid base based on conductivity properties Identifying the pH value of acid base based on conductivity properties Identifying the pH value of acid base solutions using universal indicator Calculating the pH value of strong acid base solution Calculating the pH value of weak acid base solution Presenting natural extract materials that function as natural indicators Analyzing the pH change trajectory of natural indicators

Design

In this stage, the planning for creating a worksheet is done, referring to the analysis result from the define stage. In the phase, the framework of the content that will be developed into a worksheet is established. The worksheet is developed using the POE model, which means that the activities to be performed by students align with the steps of POE.

The worksheet consist of the following stages of the POE learning process. The fisrt stage is " Predict", which involves engaging students in making predictions about phenomenon. The predictions are based on the prior knowledge that students already possess. The predictions made are then tested throught the "Observe" stage, which is the second stage. The testing of predictions in done through experimental activities. The data obtained from the experimental activities are then analyzed in the third stage, "Explain". In this stage, students compare their predictions with the observed results. Students are also asked to explain the similarities and differences between their predictions and the observed results.

Development

The next step is the development of a POE based worksheet. The developed worksheet consists of 5 section that accommodate the basic competencies and indicators obtained in the define stage. Worksheet 1 discussed acid-base theory. Worksheet 2 covers the electrical conductivity of acid base. Worksheet 3 addresses the pH of strong acid base. Worksheet 4 focuses on the pH of weak acid base. Worksheet 5 delves into natural indicators for acid base.

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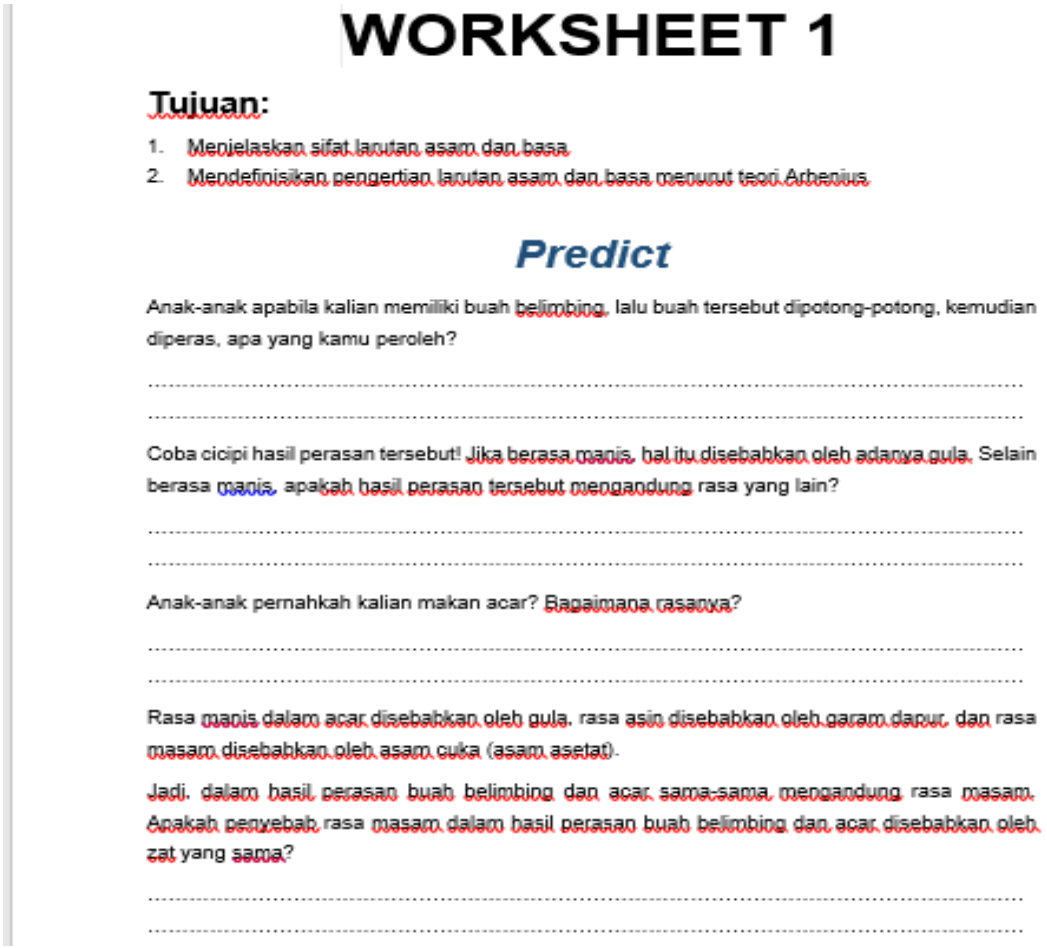

WORKSHEET 1

Tujuan:

1. Menjelaskan sifat larutan asam dan basa
2. Mendefinisikan pengertian larutan asam dan basa menurut teori Arhenius

Predict

Anak-anak apabila kalian memiliki buah belimbing, lalu buah tersebut dipotong-potong, kemudian diperas, apa yang kamu peroleh?

.....

.....

Coba cicipi hasil perasan tersebut! Jika berasa manis, hal itu disebabkan oleh adanya gula. Selain berasa manis, apakah hasil perasan tersebut mengandung rasa yang lain?

.....

.....

Anak-anak pernahkah kalian makan acar? Bagaimana rasanya?

.....

.....

Rasa manis dalam acar disebabkan oleh gula, rasa asin disebabkan oleh garam dapur, dan rasa masam disebabkan oleh asam cuka (asam asetat).

Jadi, dalam hasil perasan buah belimbing dan acar sama-sama mengandung rasa masam. Apakah penyebab rasa masam dalam hasil perasan buah belimbing dan acar disebabkan oleh zat yang sama?

.....

.....

Figure 1. Predict stage in the worksheet

The worksheet product is subsequently validated by 2 validators. The product validation test consists of material expert test and a learning design expert test. The results of assessment can be shown in Table 5 and Table 6.

Table 5. Material Expert Test Result

Rated Aspect	Percentage	Criteria
The suitability of the content of the worksheet	96.67	Highly Valid
Worksheet construction	95.45	Highly Valid

Table 6. Learning Design Expert Test Result

Rated Aspect	Percentage	Criteria
Format	96.67	Highly Valid
Attractiveness	97.73	Highly Valid
The shape and size of the letters	98.33	Highly Valid
Consistency	97.93	Highly Valid
Physical quality	86.87	Highly Valid

Based on the test result of the material and learning design experts it can be concluded that in all aspect of the assessment has highly valid so that the product can be used as teaching material in the learning process.

The trial result that was done to the students to know the readability of worksheet. This stage can only be done on small group, specifically with 15 students. The readability test result can be shown in Table 7.

Table 7. Student Responses

Rated Aspect	Percentage	Criteria
The delivery clarity	91.88	Very Interesting
The language use	95.71	Very Interesting
The display	91.88	Very Interesting
The easiness to use	88.00	Very Interesting
The benefit of use	89.29	Very Interesting

Based on the readability test result above, it was concluded that all aspects assessed were very interesting so that the worksheet can be used as teaching material in the learning process.

CONCLUSION

The research findings show that POE-based acid base worksheet have a high level of validity as assessed by subject material experts and learning design experts, with an average percentage of 96.06% and 95.51%, respectively. Readability POE-based acid base worksheet from students's responses show that it is highly suitable for use in learning with an average percentage of 91.35%. Therefore, POE-based acid base worksheet can be used in chemistry lessons in high school.

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BRIEF PROFILE

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