

DEVELOPMENT STUDENT WORKSHEET GUIDED INQUIRY ORIENTED TO TRAIN STUDENT CREATIVE THINKING SKILLS IN MATTER ACID BASE INDICATOR BASED ON NATURAL PRODUCT

Lia Yuli Kusumawati and *Mitarlis

Chemistry Departement FMIPA State University of Surabaya

email: mitarlis@unesa.ac.id.

Abstract

The aim's of this research was to develop student worksheet guided inquiry oriented to train student creative thinking skills of acid base indicator matter based on natural product. The feasibility of student worksheet that developed assessed from criteria the validity, practicality, and effectiveness. This research used Research and development (R&D) model that limited until stage of preliminary field. The feasibility of student worksheet in terms of validity is obtained based on assessment by validator consisting of two chemistry lecturers and one chemistry subject teacher. The validation by experts about content validity and construct validity obtained a percentage in a row that is 85,93% and 92.22% with the category is very valid. The feasibility of the practicality criteria assessed from responses of student who get a positive response of 99,21% with a very practical category, supported by the observation of student activities during learning that obtained average relevant activity 98.39% on very good interpretation. The feasibility of effectiveness criteria assessed from result student creative thinking test that show all students get the above of minimum learning completeness ≥ 76 with student creative thinking skill on aspect originality obtained the average percentage of 94,67%, fluency 86,67%, and flexibility 80% on high category.

Keywords: Students Worksheet, Guided Inquiry, Creative Thinking Skills, Acid Base Indicator, Based on Natural Product.

INTRODUCTION

The 2013 curriculum of Indonesia National Education applies a scientific approach in learning and authentic assessment that uses the assessment principle as part of learning. The scientific approach in learning needs to be strengthened by applying discovery/inquiry learning models [1]. Chemistry related with how to find out about natural phenomena systematically, so that results will be obtained when the learning process, not just mastery of a collection of knowledge in the form of facts, concepts, or principles alone but also about the process of discovery. Suyanti (2010) states that the abstract chemical concept that must be absorbed in a relatively limited time causes many of student fail to learn chemistry [2].

Another factor in the failure of students to understand the concept of chemistry is not only the amount of chemical concepts that must be absorbed in a relatively limited time, but also on the creative thinking ability of students. Creative thinking is the ability to think that begins with the sensitivity to the situation at hand, that in the situation it is seen or identified the problem to be solved [3]. Based on observations and interviews with chemistry teacher SMA Negeri 1 Cerme obtained information that

when the process of learning chemistry, teachers have never tried learning that train creative thinking skills.

Based on the analysis of Center for Development and Empowerment of Educators and Education Personnel (CDE3P), explained that the students in Indonesia are still lacking in creativity so that it will affect the motivation, confidence, and belief in the efforts they do in learning related to the process of solving problems in everyday life [4]. In this case, to support the problem solving activities in everyday life so it will enable a students to accustomed to develop the creative thinking skills. The teacher as facilitator is expected to provide a method of learning that attracts the students to participate actively and provide sufficient space in develop their ideas, so that the expected competencies will be achieved well.

The expected competence after following the chemistry lesson in SMA/MA is that students are able to understand the surrounding natural phenomena and be able to solve the problems faced in their life based on the result of a learning activity.

Acid base is one of the materials in chemistry study that given in class XI of SMA stage 2. Based on the syllabus of 2013 curriculum

revised edition, the basic competence which is expected to be achieved on acid base material is covering KD 3.10 understand the concept of acid and base and its strength and equilibrium its ionization and KD 4.10 determine the changes of pH trajectory some indicators that extracted from natural product. Based on the basic competence it can be seen that acid base material requires a practicum to support the understanding of the student in mastering the concept, for example determining the pH of a solution.

Based on the result of pre-research questionnaire in class XII IPA 1 SMA Negeri 1 Cerme, tools/materials that usually used in Laboratory to measure the acidity (pH) in matter acid base indicator shows the following results: as much as 50% of students stated using litmus paper, 21,42% use universal indicator and 17,85% use pH meter, so less use natural sources as alternative material for practicum maximally. In addition, based on pre-research results, 96,42% of students know about acid-base indicator based on natural sources, but after being asked to mention the benefits in everyday life as much as 53,14% of students are unable to mention correctly, 14,28% of students are able to mention but not yet accurate, and only 32.14% of students are able to mention the benefits of acid-base indicator based on natural product in everyday life correctly.

Therefore, in a teaching and learning process required the existence of a learning design that is expected to provide direct experience to learners, especially in utilizing natural materials as an alternative use of tools/materials when practicum. Through these activities the students get direct experience to link the concept of chemistry in everyday life that is very useful for him to be able to actively take a large part in implementing the steps in scientific thinking [5]

Learning to teach process is a system that can not be separated from other components that interact in it, one of which is required a teaching material.

Student Activity Sheet is one of the teaching materials developed by the teacher as a supporter in a lesson. In the curriculum of 2013 the term of Student Activity Sheet has been revised to student worksheet. Student worksheet are the sheets of assignments to be done by the students. Student worksheet is usually a hint, steps to complete a task [6].

Based on observations and interviews with chemistry teacher of SMA Negeri 1 Cerme in chemistry learning process teacher use handbook and not student worksheet as learning resource, so

that is general and not yet adjusted with characteristic of the students. It is less motivating the student to be free to make the discovery process about the concept of chemical matter. In addition, the use of student worksheet will not provide satisfactory results without any teaching skills in a learning process. Creative learning is needed especially to encourage the students to be more free to learn the meaning that he learned because creative learning aims to develop students' thinking ability. Therefore, teachers should create diverse learning activities that meet the various levels of students abilities [7].

The creative potential of students can be enhanced through learning [8]. This underlying the need for student worksheet which provides an opportunity for the students to perform the discovery process by presenting the phenomenon in everyday life and students are given space to determine how to solve the problems contained in the phenomenon and can find their own chemical concepts, especially on the material acid-base indicator based on natural sources through experiment activities. With the teaching materials such as student worksheet, so the basic competencies that are expected to be achieved and help the students for process of solving the problems and can train creative thinking skills of the student.

Creative thinking skill of students is not determined by Intelligence Quotient (IQ), with the understanding that the creative thinking skill of students who have an IQ can be grown developed through proper practice [9]. In response, the government paid great attention to the inclusion of creative thinking as one of Permendikbud's points. 22 year 2016 on the Standard of Basic and Intermediate Education Process which states that the learning process is held interactively, inspiration, fun, challenging, motivate students to actively participate, and provide sufficient space for initiative, creativity, and independence according to talents, interests and physical and psychological development of students. The implication of this statement is student-centered learning in which students act actively in the learning process. In realizing this goal, then the role of teachers is one determinant factor to improve the ability of creative thinking students.

Creative thinking according Torrance (1965) is the ability to sense problems, make a hypothesis, generate new ideas, and communicate results [9]. In addition, creative thinking focuses on exploring ideas, generating possibilities, finding the right answers, not just one right answer [10]. These

components are considered in accordance with the syntax of inquiry learning model. According to Joyce and Weil (2011) the core of this model is to engage the studnets in a truly original problem of discovery by confronting them in the field of investigation, helping them identify the conceptual or methodological issues in the field and inviting them to designing ways to solve problems [11]

Inquiry learning strategy is suitable to solve problems in the material that is close to everyday life. One of them is acid base material. Inquiry method can help teachers to relate between material taught to real-world situations and encourage the student to make a connections between their knowledge and application in everyday life. So, after the application of inquiry learning model on the acid-base material is expected to be able to train creative thinking skills of the students and will enter into long-term memory and improve learning outcomes of students. Overcoming this problems will be conducted research "**Development Student Worksheet Guided Inquiry Oriented to Train Student Creative Thinking Skills in Matter Acid Base Indicator Based on Natural Product**". This study aims to describe the feasibility of student worksheet that developed.

METHOD

This research is development a student worksheet that uses Research and Development (R&D) design model [12]. The steps undertaken in this study are only limited to the fourth stage of preliminary field.

This development design consists of three main stages: preliminary study stage, planning stage and development stage. The preliminary study stage consists of identification of problem and information collecting. In the planning stage collected data as material for product design. In the development study stage includes product design, review, design revision, design validation and preliminary field.

The objectives of this research are student worksheet guided inquiry that developed to train creative thinking skill in matter acid-base indicator based on natural product.

Subjects in this research were 30 students of class XI IPA 2 in SMA Negeri 1 Cerme in the even semester which has a variety of academic ability and has received acid base material.

Instruments that used in this research, include: review, validation, questionnaire response of the student, student activity, and test of creative thinking skills. Design of the student worksheet product that has been completed as draft I, further

will be review by a chemistry lecture who was used to obtain inputs and suggestions from reviewers for improved student worksheet that developed. Then made a revision in accordance with the input and suggestions from experts who then produce draft II. The data obtained, will then be analyzed descriptively.

Draft II, then validated by two chemistry lecturers of State University of Surabaya and one chemistry teacher of SMA Negeri 1 Cerme. Validation data were analyzed for each component. Percentage of data validation results are analyzed by Likert scale as in Table 1 below:

Table 1. Likert Scale

Rating	Value Scale
Very Good	5
Good	4
Medium	3
Bad	2
Very Bad	1

[13]

The validation results that was percentages, then interpreted into the validation assessment as in Table 2 below:

Table 2. Percentage Value

Percentage(%)	Value Scale
81-100	Very Valid
61-80	Valid
41-60	Quite Valid
21-40	Less Valid
0-20	Invalid

[13]

Student worksheet that developed is valid if it the percentage of $\geq 61\%$ [6]. Student worksheet that has been validated and then conducted a preliminary field of 30 students in class XI IPA 2 in SMA Negeri 1 Cerme. After a preliminary field the tests are used as a benchmark for assessing the creative thinking skills of the studnets. Creative thinking skills analyzed in this research include originality, fluency and flexibility. Every aspect of creative thinking is calculated using the following formula.

$$\text{Percentage of creative thnking skills} = \frac{\text{Value Obtained}}{\text{Maximum Score}} \times 100\%$$

[13]

The percentage value of the creative thinking component is then interpreted in accordance with Table 3 below.

Table 3. Interpretation Score Criteria

Percentage(%)	Value Scale
0-30	Very Valid
31-54	Valid

Percentage(%)	Value Scale
55-75	Quite Valid
76-80	High
90-100	Very High

[14]

Based on these criteria, then each component of creative thinking can be said to be successfully trained if obtained a percentage of $\geq 75\%$ with high category. As for the analysis of the creative thinking skills test results of individual learners, namely by conducting an assessment in accordance with Permendikbud's point. 23 year 2016 which states the assessment in the form of numbers on a scale of 0-100. Student worksheet is said to be effective if the result of creative thinking test of learners reaches value ≥ 76 according to minimum learning completeness criteria in SMA Negeri 1 Cerme.

In addition, the data obtained in the form of a questionnaire response of student is supported by the student activity to determine the practicality of student worksheet developed. The result of questionnaire of students response was analyzed descriptively based on Guttman Scale calculation as in Table 4 below:

Table 4. Guttman Scale

Assesment	Score Value
Yes	1
No	0

[13]

The percentage results are then interpreted in accordance with Table 5 below:

Table 5. Interpretation of Student Response Score

Percentage(%)	Value Scale
0%-20%	Very Valid
21%-40%	Valid
41%-60%	Quite Valid
61%-80%	Less Valid
81%-100%	Invalid

[13]

Based on criteria response of the student, the developed of student worksheet is considered practical if the percentage obtained based on the data analysis results $\geq 61\%$ [6].

The student response is supported by the observation data of student activity during the learning process takes place. The data were filled by 4 observers. The student activities said to be well executed and support the effectiveness of student worksheet that developed to train creative thinking skills if the percentage of student activity relevant is greater than irrelevant student activity.

RESEARCH RESULT AND DISCUSSION

This study aims to describe the feasibility of student worksheet guided inquiry oriented to

train creative thinking skill in matter acid-base indicator based on natural sources which is reviewed based on validity, practicality and effectiveness.

Validity of Student Worksheet

The validity of the student worksheet that developed was obtained through a validation process by a validator consisting of two chemistry lecturers and one chemistry teacher. Before the validation stage, draft 1 student worksheet was reviewed by a chemistry lecture to get suggestions and comments for the improvement of the student worksheet that developed.

Based on the review result, there are some comments and suggestions from the reviewers, among others: related to the cover of student worksheet to be more representative so as to facilitate the student to know the contents of the material and to look for it, the addition of the purpose of preparing student worksheet in the introduction, the clarity of the source of the image, and the improvement of the writing student worksheet that developed. These suggestions and inputs are then used for the improvement of student worksheet so produce draft II student worksheet that will be validated.

In the validation process, student worksheet is assessed based on the criteria of content validity and construct validity. The validity of the content there are several components in it that includes the completeness, accuracy and appropriateness of student worksheet with materials, curriculum and indicators of learning; student worksheet conformity with guided inquiry instruction model; suitability of student worksheet with the components of creative thinking skills. While construct validity is assessed based on linguistic component, presentation, and gradability [15].

Validation results then analyzed and presented per component by using the likert scale. Based on the percentage of assessment, it is known that the average score of content validity obtained percentage of 85,93% so categorized very feasible and the construct validity obtained percentage of 92,22% so categorized very feasible.

Practicality of Student Worksheet

The practicality of student worksheet that developed is reviewed based on the student response and supported by the student activities during the learning using student worksheet that developed. Questionnaire responses contained a number of positive and negative questions with "yes" or "no" answer options that were

disseminated after the learning implementation using student worksheet that developed to 30 student. Student worksheet developed is said to be practical if the data results of the questionnaire response of learners showed $\geq 61\%$ positive response [6].

Based on the results of student questionnaire responses, student worksheet that developed get an average response of 99.21% or categorized very practical. Practically described as student worksheet products easy to use and understand [15]. The response questionnaire data is supported by the observation of student activities during the learning process using the developed student worksheet.

Based on the data observational student activity it can be seen that during the preliminary field using student worksheet guided inquiry to train creative thinking skill in matter acid base indicator base on natural product obtain the relevant student activity larger with the average percentage at the first meeting and the second meeting is by 98,75%.

This shows that the student during the learning process are very enthusiastic and interested when using student worksheet developed, so it can be concluded that the response questionnaires filled by student in accordance with their opinions and their actual circumstances and relevant to the results of observed activities.

Effectiveness of Student Worksheet

The effectiveness of student worksheet guided inquiry oriented to train creative thinking skill in matter acid base indicator based on natural sources is measured based on the test result of creative thinking skill of the student. Instruments used to obtain data creative thinking skills of the student that is a matter of pretest and posttest questions. The components of creative thinking skills assessed include aspects of originality, fluency, and flexibility.

The following is presented in Table 6 on the data of posttest result of creative thinking skill of the student in every aspect.

Table 6. Data of Pretest and Posttest Result of Creative Thinking Skills of Students in Each Aspect

No.	Aspect of Creative Thinking Skill	Average of The Percentage (%) and Description	
		Pretest	Posttest
1	Originality	78 (High)	94,67 (Very High)
2	Fluency	56,83	86,67

No.	Aspect of Creative Thinking Skill	Average of The Percentage (%) and Description	
		Pretest	Posttest
3	Flexibility	50 (Low)	80 (High)

Based on the results of the description in Table 6 regarding the three aspects of creative thinking skills above, namely originality, fluency and flexibility, it can be concluded that every aspect of creative thinking skill has been successfully trained by the percentage acquisition aspect 94,67%, fluency 86,67%, and flexibility 80% with high category.

While the result of creative thinking skill test of students in general after dilatihkan using student worksheet developed, it can be seen that as many as 30 students get the value above the minimum learning completeness defined by SMA Negeri 1 Cerme, that is ≥ 76 and it can be concluded that student worksheet oriented guided inquiry to train students creative thinking skills in matter acid-base indicator base on natural product that meets the criteria of effectiveness or feasible to used as teaching materials.

CLOSURE

Conclusion

Based on the results and discussion of the research, it can be concluded that the student worksheet guided inquiry oriented to train creative thinking skills in matter acid-base indicator based on natural product that has been developed has feasible to be used as teaching material since it has reached and fulfilled all the eligibility criteria, as follows:

1. Validity aspect of student worksheet developed is considered very valid based on the assessment of the validator consisting of two chemistry lecturers and one chemistry teacher. The validity value is evaluated from the content validity and the validity of the construct with the percentage respectively 85,93% and 92,22% with very valid category. This indicates that the developed developed of student worksheet meets the criteria of validity.
2. Practical aspect of student worksheet developed is considered practical in terms of the response of students to get a positive response of 99,21% with a very practical category supported by observation activities of

student during learning by obtaining relevant activities of 98,75% with a very good interpretation. This indicates that the developed developed of student worksheet meets the criteria of practicality.

3. Effectiveness aspect of student worksheet developed is considered practical from the test of creative thinking skills of learners with a score above minimum learning completeness that is ≥ 76 with the aspect of originality to get the average percentage of 96,67%, fluency 86,67%, and flexibility 86,33% with high category. This shows that the student worksheet that developed have the criteria of effectiveness.

Suggestion

1. In the future research needs to developed student worksheet guided inquiry on other materials, so that the creative thinking skills of student can be training.
2. In the learning process, teachers first motivate student by linking chemicals with real examples in everyday life, so the chance of failure of the students in understanding the concept of chemistry can be reduced even can be resolved.
3. In the study of chemistry especially on acid-base material, teachers can invite learners to utilize the existing materials in nature, so the students are able to connect the concept of the material taught with everyday life. In addition, it is able to minimize the use of materials available in the laboratory.

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