

THE SUITABILITY OF WILLIAM'S CREATIVITY INDICATORS WITH THE CREATIVITY-BASED WORKSHEET FOR THE JUNIOR HIGH SCHOOL STUDENTS ON DESIGNING SIMPLE DISTILLATION TOOL

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Abstract

The research concerning students' worksheet in designing simple distillation tool was aimed to construct creativity-based students' worksheet in mixture separation material using simple distillation whose component is in accordance with William's Creativity Indicators. The research method used was evaluation method. This study consists of three-stage activities that include preparation, implementation, and reporting. In the preparation stage, the materials related to the arrangement of the student's worksheet and validation sheet are prepared. In the implementation stage, the researchers validated the worksheet using the validator. The reporting stage contains the analysis of validation results for later drawing conclusions. The instruments used in this research were content validation sheet. Data analysis techniques used in this research are Likert Scale. The results of the research are obtained that the content in the creativity-based students' worksheet when the students activity on designing simple distillation tool categorised highly suitable with the William's creativity indicators. Based on this research, it is expected that science teachers will be inspired by this study to teach mixture separation material using simple distillation.

Keywords: Creativity-based worksheet, Simple distillation tool, William's creativity indicator.

1. Introduction

Nowadays, creativity is one of the skills that are still developed in education [1]. The demands of the current law emphasize that education should not only focus on the knowledge aspect but also on the skills that should be possessed by students, including the skills of creativity [2]. The importance of creativity is

stated on the Act No. 20 the year of 2003 about the National Education System whose point mandates that through education, it is expected that students' potential can be developed to become creative human beings [3].

The activities, which encourage students to be creative, can be developed in learning activities in junior high schools. The learning activity which emphasizes creativity makes it possible for the students to conduct their own research and solve problems in every teaching situation [4]. According to Liu et al., when students are given support to think creatively and critically in Junior high school classroom, they will be encouraged to increase knowledge and achievement in test [5].

Despite the fact that there are many existing research studies, which discussed the same topic; however, there are only a few studies on creativity, which focused on Junior high school-level chemistry materials; including science materials. In an attempt to carry out the learning activity, a learning medium is required. Learning media are beneficial to attract students' attention. Moreover, the delivered learning material will also be more meaningful. One of the learning media that can be used as an alternative is students' worksheet [6, 7].

Based on the regulation of the Ministry of Education of Republic of Indonesia No, 22 the year of 2016 about the standard process of primary and secondary education, the learning activity is required to give five essential learning experiences namely observing, questioning, collecting information, associating, and communicating [8]. These learning experiences are classified as the scientific approach. In relation to this, the proposed creativity-based students' worksheet is using the scientific approach which is suitable with the latest curriculum of Indonesia namely the 2013 curriculum and adjusted with the adapted indicators of creativity as proposed by Williams [9].

Studies on the creativity model have been so far conducted by several researchers. One of these studies is the creativity model developed by Williams, which discusses the creativity indicator. This indicator is then continued to be developed by Munandar, which then become the characteristics of creativity skill and the example of students' behavior, which reflect the characteristics also called as Williams' sub-indicator of creativity. Williams' creativity indicator, which in this study has been adapted, covers fluency, flexibility, originality, elaboration, and evaluation [9].

Simple distillation is one of the mixture separating methods that can be done in schools [10]; however, based on the observation at several junior high schools in Bandung, Indonesia, the experiment of mixture separation using simple distillation cannot be applied due to the limited distillation tools. By using creativity, students can replace the unavailable simple distillation tools at schools with the materials that could be found around the school [11]. Distillation is a method of separating the liquid substances from its mixture based on the difference of boiling point. In the process of simple distillation, a certain mixture is separable if its constituent substances have the difference of high boiling point [12].

This research was aimed to construct creativity-based students' worksheet for the junior high school students on mixture separating material using the simple distillation which is appropriate with the adapted creativity indicator of Williams [9].

2. Experimental Method

2.1. Evaluation research method

This research used evaluation research method. The evaluation of research method is a research method which systematically analysing the data to determine the value or benefits (worth) of a practice (education) [13]. Generally, evaluation research is aimed to design, refine, and test the implementation of educational practices. The participants in this study are one science teacher and four chemistry lecturers at Universitas Pendidikan Indonesia as the validators. This study was located at the faculty of mathematics and science education, Universitas Pendidikan Indonesia from May to July 2017. The instrument used in this research was the content validation sheet to discover the suitability of creativity-based students' worksheet with the creativity indicator of Williams [9]. The participants of the research are 24 students of one junior high school in Bandung, Indonesia, who are divided into three heterogeneous groups (8 students per group).

This research was conducted through three major stages namely preparing, implementing, and reporting stages. In the preparing stage the assessment of the creativity indicator which explained by Williams and the sub-indicator of the creativity which developed by other researcher was done. Based on the results of the assessment process to the creativity indicator by Williams the research instrument can be constructed, which is the content validation sheet [9].

Moreover, in the preparing stage, the creativity-based students' worksheet also constructed based on the basic competencies and Williams' creativity indicator, which has been adapted [9]. In the implementing stage, the draft of the student worksheet was validated to the validators, which consist of four chemistry lecturers and one junior high school science teacher. This validation was done by filling the validation sheet of the suitability of creativity sub-indicators with the statement in the students' worksheet, also the suitability of the statement with the instruction in the students' worksheet.

2.2. Scoring

The first step is scoring every item using Likert scale, which is modified according to the validation sheet. The scoring based on the Likert scale is shown in Table 1. This analysis was used based on literature [14].

Table 1. Validation sheet score based on Likert scale.

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
Positive	4	3	2	1
Negative	1	2	3	4

2.3. Processing the score

The processing score of the content validation sheet about the suitability of creativity-based students' worksheet for Junior high school student on simple distillation material with Williams' creativity indicator is as follows [9]. Processing the score include five stage: (1) Sum the scores from each respondent on every analysed component, (2) Determine the maximum score, (3) Determine

the percentage score for each indicator, (4) Calculate the mean score of the percentage, and (5) Interpret the mean percentage response towards every aspects.

To interpret the mean percentage of response of all aspects, interpretation based on literature was used [15, 16]. The interpretation of the mean percentage is shown in Table 2.

Table 2. Criteria for the interpretation of the score.

Value (%)	Category
0-20	Very weak
21-40	Weak
41-60	Adequate
61-80	Strong
81-100	Very strong

3. Results and Discussion

Prior to discuss about the creativity of student in designing distillation, Figure 1 shows the theoretical explanation about distillation. Distillation is the process for separating the components or substances from a liquid mixture [10]. Distillation uses the principle of additional selective boiling point and condensation process. The main important parameter in the distillation is temperature. However, this temperature must be adjusted to the components' properties [17].

Distillation may result in essentially complete separation, resulting pure liquid components. For some cases, distillation may create a partial separation; but, the distillation can increase the concentration of selected components of the mixture [18]. In industrial chemistry, distillation is a unit operation that is practically universal and crucial. Therefore, distillation is important to be learned since the school.

The discussion concerning the suitability of creativity-based students' worksheet using Williams' creativity indicators is divided into five parts: fluency, flexibility, originality, elaboration, and evaluation. Williams' creativity indicators are used in the research because they are well established [9].

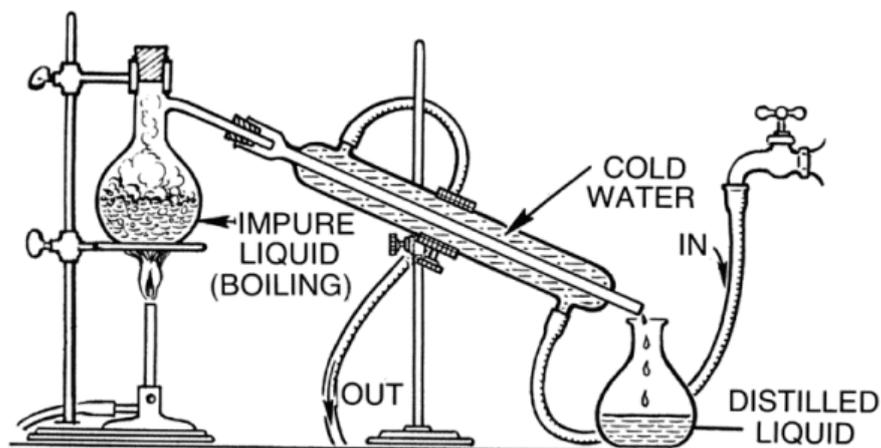


Fig. 1. Illustration of distillation process for school application.
Figure was adopted from reference [19].

3.1. Indicator fluency

The fluency indicator in creativity-based students' worksheet is integrated into the questioning stage of the learning activity. As for the mapping of the creativity sub-indicator chosen in questioning stage, many questions arise. However, rising questions can actually train students to develop the creativity in thinking critically. Overall, the result of the content validation of the fluency indicator, which integrated into the questioning stage, gains the mean score of 92%, which classified as very strong. The interpretation from the suitability aspect has the meaning that the suitability of sub-indicator with the statement in the students' worksheet as well as the suitability of the statement in the students' worksheet with the instruction in the students' worksheet is already very strong.

3.2. Indicator flexibility

The indicator of flexibility in the creativity-based students' worksheet was integrated into the observing and producing stage of the learning activity. As for the mapping of the creativity, sub-indicator in the observing stage is to give various interpretations regarding a certain picture, story, or problem. Meanwhile, creativity sub-indicator chosen in the producing stage is implementing a concept or principle in various ways.

Observing the phenomenal activity can be done by reading, seeing, hearing, or even by listening to a variety of learning resources. Creativity can be seen from the ability to produce new shape in art or machinery or problem solving using new methods.

Overall, the results of the validation of the flexibility indicator, which integrated into the observing phenomenon and producing, gains the mean score of 91%, which is classified as very strong. The interpretation from this suitability aspect means that the suitability of the sub-indicator with the students' worksheet statement as well as the suitability of the statement in the students' worksheet with its instruction that is very strong.

3.3. Indicator originality

The originality indicator in creativity-based students' worksheet was integrated into the questioning, collecting the data and producing stage. As for the mapping of the sub-indicator of the creativity chosen, in questioning stage, it is aimed to think about the problems, which not everybody else does. The creativity sub-indicator selected in collecting the data stage is questioning the old methods and trying to find new methods. Whereas, in the sub-indicator in the producing stage, a process of selecting or creating a certain design occurs [9].

Overall, the results of the content validation of the originality indicator, which integrated into the questioning, collecting the data, and creating product gains the mean score of 89%, which classified as very strong. The interpretation from these suitability aspects is that the suitability of the sub-indicator with the statement in the students' worksheet as well as the suitability of the statement in the worksheet along with the instruction in the worksheet that is already very strong.

3.4. Indicator elaboration

The indicator of the elaboration in creativity-based students' worksheet is integrated into the communicating stage of the scientific approach. The elaboration indicator was developed into several creativity sub-indicators. As for the mapping of the creativity sub-indicator selected in the communicating stage, it is actually used to develop or enrich others' ideas [9].

Overall, the results of the content validation of the elaboration indicator, which is, integrated into the communicating stage gains the mean score of 92%, which is classified as very strong. The interpretation from this suitability aspect is that the suitability of the sub-indicator with the statement in the worksheet as well as the suitability of the statement in the worksheet with the instruction in the worksheet is very strong.

3.5. Indicator evaluation

The indicator of the evaluation in the creativity-based worksheet was integrated into the creating a product and communicating the learning activity. The evaluation indicator was developed into several creativity sub-indicators. As for the mapping of the creativity sub-indicator selected in the creating product, it is used to select different methods. The sub-indicator of the creativity selected in the communicating stage was speaking up an opinion and be being determined about it while possessing a strong rational argument which can be accounted to reach a decision [9].

Overall, the results of the content validation of the evaluation indicator integrated into the creating product and communicating stage gains the mean score of 91%, which is classified as very strong. The interpretation from this suitability aspect is that the suitability of the sub-indicator with the statement in the worksheet as well as the suitability of the statement in the worksheet with the instruction in the worksheet is very strong.

4. Conclusion

The suitability of William's creativity Indicator with the creativity-based worksheet for the junior high school students on designing simple distillation tool, in general, is categorized as very strong. It is concluded that the content in the creativity-based students' worksheet is highly suitable with the creativity indicator.

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