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# THE DEVELOPMENT OF STUDENTS ACTIVITY SHEET (SAS) WITH CHEMO-ENTREPRENEURSHIP ORIENTED ON COLLOID MATTER IN 11th GRADE TO TRAIN CREATIVE THINKING SKILLS

**Dwi Yuni Hartini and *Utiya Azizah**
Jurusan Kimia FMIPA UniversitasNegeri Surabaya
***Email:** utiyaazizah@unesa.ac.id

**Abstract**

The aim of the research is to produce Students Activity Sheet (SAS) with Chemo-Entrepreneurship oriented on Colloid matter in 11th Grade to Train Creative Thinking Skills which is feasible to use. The feasibility are reviewed based on validity, practicability, and effectiveness of students worksheet. This research is development research using Research and Development (R&D) design with one group pretest and posttest method which is limited trial test was conducted to 12 students of 12th grade of SMAN 1 Driyorejo Gresik. The instrument used in this research were review sheet, validation sheet, observation of students activity sheet, students responses and creative thinking tests. Validation result of content criteria was 86.67% in the highly valid category and construct validity reviewed from language criteria, presentation criteria and display suitability criteria with percentage 86.67%, 85.92% and 86.67% in the highly valid category. The SAS practicality in the very practice category with positive responses of students on the content criteria was 100%, language criteria was 91.67%, presentation criteria was 94,44%, graphic criteria was 94.44% and its supported by observation result of students activity which declared that the SAS activity 100% was carried out well during the limited trial process. The SAS effectiveness has shown that N-gain score of students get value ≥0,7 which is 83.33% of students in the high category and 16.67% of students in the medium category.

**Keywords**: SAS feasibility, Chemo-Entrepreneurship, Creative Thinking skills, Colloid.

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## INTRODUCTION

Education is fundamental for everyone. Every human being has the right to get a better education. Education system has regulated in law number 20 of 2003 stated that national education system has function for developing capability and forming the character of faithful and devoted students to God almighty, noble, knowledgeable, creative, independent and a democratic citizen. One of real challenges in educational world nowadays is facing the challenges of 21st century life, known as the knowledge age. In this era, special skills are needed to compete with outside world. These skills are termed as 4C skills (Creative, Critical Thinking, Communicative and Collaborative). This has been regulated in ministerial regulation number 20 stated that each graduate of primary and secondary education units has competencies in three dimensions, such as attitudes, knowledge and skills, in the skills dimension including thinking skills and act creatively, productively, critically, independently, collaboratively and communicatively [1].

Creative thinking skills has the main attraction compared with the other 21st century skills. Creative thinking is defined as a thinking process that leads to new knowledge, new approaches, new perspectives or new ways to understand things [2], while Grieshober stated that creative thinking as a process of obtaining ideas that emphasize aspects of fluency, flexibility, originality, and elaboration in thinking [3]. Based on the Global Creativity Index (GCI) was placed Indonesia at 115 positions from 139 countries [4]. This indicates that the level of creativity of The Indonesian people is very low. It is very important to train creativity or the ability to think creatively in the education system (formal, non-formal, and informal) to develop the quality of children's thinking so that in the process of cognitive development and intelligence to obtain opportunities optimally [5].

Based on the result of pre-study that conducted at SMAN 1 Driyorejo, Gresik on Tuesday, October 2nd, 2018, to students of 12th grade shown that on the indicator aspects of creative thinking skills about 80% of students stated that learning was very rare to practice creative thinking skills. One of the reason is the teacher only focused on delivering the material. According to the result of creative thinking test shown that 46% of students have thought fluently in determining ideas to solve the problem that given, but 41% of students have not been able to think fluently in making

conclusions and advantages of products that produced. In the aspect of flexibility thinking for about 39% of students have not been able to connect the ideas with the appropriate chemistry matter. Elaboration aspects of thinking skills, 40% of students cannot associate the chemistry concept in accordance with ideas and develop experimental design of ideas that proposed. Originality thinking skills shown that 41% of students have not been able to formulate the advantage of ideas and make a conclusion from experiment that conducted. These results indicate that students' creative thinking skills are very low. Therefore, creative thinking skills are needed to be trained to students through appropriate learning strategies.

Chemo-Entrepreneurship approach is deemed appropriate to be used as a learning orientation to train creative thinking skills. Chemo-Entrepreneurship approach is a chemistry approach that links chemistry learning with real objects or phenomena around human life and at the same time obtains opportunities for students to study the processing of a material into a useful and economical valuable product [6]. Based on the research conducted [4], it was found that there was a strong correlation between creativity and entrepreneurship. Another research was conducted [7], the students response was 95% of students interested in learning chemistry after the implementation of Chemo-Entrepreneurship oriented learning on Hydrocarbon material. Based on pre-study results as many as 75% of students have never used chemistry concepts to be applied in daily life and produce a product which has creative and economical value. Therefore, around 69,4% of students agreed about chemistry learning with Chemo-Entrepreneurship oriented.

Learning objectives will be achieved based on learning orientation and the ability to be trained if the teaching materials appropriate too. One of teaching materials that needs to be prepared to support learning process is Students Activity Sheet (SAS). SAS can be defined as printed teaching materials in the form of sheets of paper containing material, summaries, and instructions on the implementation of tasks that must be carried out by students who refer to the basic competencies that are achieved [8]. As many as 69% of students prefer SAS that can teach creative thinking in using chemistry concepts to produce economical product and also contain image and questions.

One of the chemistry material taught in 11$^{th}$ grade senior high school is colloidal matter. Colloid are closely related to daily life, there are lots of colloidal example in daily life such as ink, paint, soap, jelly, and so on. However, in its application, learning process of colloidal matter often uses direct method. As many as 75% of students state that teacher explain directly during colloidal matter learning. Referring to the demands of the 2013 curriculum which is on the syllabus of chemistry subject 11$^{th}$ grade written on basic competencies 3.15 which is classifying various types of colloidal systems, explaining colloidal properties and their application in daily life and basic competencies 4.15 is making food or other products in the form of colloid or involving the principle of colloid. Thus, learning should be able to apply the expected criteria in accordance with basic competencies. Therefore, in order to solve this problem, Chemo-Entrepreneurship oriented learning can be applied in the teaching process with form of SAS to train students' creative thinking skills.

## METHOD

This research is development research which use Research and Development (R&D) [9], such as 1) Potential and problems, 2) Data collection, 3) SAS design, 4) Review of SAS, 5) Validation of SAS, 6) Revision of SAS, 7) Limited trial. In this study limited to the limited trial phase which will be tested on 12 students of 12$^{th}$ grade at SMAN 1 Driyorejo, Gresik using the experimental method One Group Pretest and Posttest design. The instrument that used are SAS review sheet, validation sheet, students activity observation sheet, students response sheet and creative thinking skills test sheet. The data collection method through questionnaire methods, observation methods, interview methods, and test methods. After reviewing SAS content obtained criticism and suggestions from reviewer that is one chemistry lecturer and one chemistry teacher at SMAN 1 Driyorejo, Gresik. Then, the criticism and suggestions were followed up to improve the SAS. The next stage is SAS validation in terms of content validity and construct validity given to three validator which are two chemistry lectures and one chemistry teacher giving assessment scores in the range of 1-5 in accordance with the validation sheet. The validity of SAS is calculated using a formula:

$$\text{Validity (\%)} = \frac{\sum total\ score}{\sum criteria\ score}\ x\ 100\%$$

Σ criteria score = highest score for each item x number of item x number of validators

The percentage of data scores from validation result was determined using a Likert Scale. The results of the assessment of the validity scores that have been obtained are interpreted using the validity criteria as in Table 1 which is SAS stated valid if get minimum valid criteria.

Table 1. Score interpretation criteria

| Percentage | Criteria |
|---|---|
| 0% – 20% | Invalid |
| 21% - 40% | Less Valid |
| 41% - 60% | Valid Enough |
| 61% - 80% | Valid |
| 81% - 100% | Highly valid |

[10]

Based on Table 1 above, SAS that developed stated valid when each content validity and construct validity get percentage ≥ 61% [10].

The next stage is do limited trial test stage when the SAS decalared valid reviewed from content and construct validity. At this stage get the data of practicability and effectiveness of SAS that developed.

The practicability of SAS reviewed from the result of 12 students responses as trial subject and also supported by the observation of students activity during the limited trial process. The percentage of students responses and students activities observation were analyzed using the Guttman scale using the following formula:

$$P = \frac{F}{N} \times 100\%$$

Description:
P : Percentage of students responses
F : Frequency of "Yes" or "No" answer
N : Number of respondens

Then, it is interpreted according to what is shown in Table 1. Based on the interpretation criteria of the score, the SAS can be stated practice if it gets a percentage ≥ 61% in practice or very practice category.

The effectiveness of SAS was analyzed based on the result of students' creative thinking skills test. SAS is declared effective if N-gain score of each students get score $0,3 \leq g \leq 0,7$ in the medium category or $0,7 \leq g \leq 1$ in the high category [11]. To use the N-gain score analysis, the data must be in normal distribution, so it can tested by Kolmogrov Smirnov test , the data stated in normal distribution if Asymp.Sig value get score ≥ α = 0,05 [12]. The formula to determine N-gain score:

$$Gain = \frac{S_{post} - S_{Pre}}{S_{maks} - S_{pre}}$$

Description:
g (gain): Improvement in students learning outcomes
$S_{pre}$ : Average Pre-Test (initial test)
$S_{post}$ : Average Post-Test (final test)

## RESULT AND DISCUSSION

### Validity of SAS

Validation aims to determine the assessment from chemistry lectures and chemistry teacher on the feasibility of SAS that developed. There were two validity aspect including content validity and construct validity.

From the results of the assessment that has been carried out by three validators such as two chemistry lectures and one chemistry teacher obtained the percentage shown in Table 2.

Table 2. Data of content validity result

| Validity aspect | Percentage (%) | | | Category |
|---|---|---|---|---|
| | SAS 1 | SAS 2 | SAS 3 | |
| Content | 86.67 | 86.67 | 86.67 | Highly valid |

Content validity including conformity of basic competence and indicator to be achieved with the 2013 curriculum, suitability of colloidal material with learning objectives, correctness of learning material substance, suitability of SAS content with Chemo-Entrepreneurship approach, and suitability of SAS content with creative thinking skills criteria.

Based on Table 2 above, each SAS 1-3 gets percentage of 86.67% in the highly valid category, so that the validity of SAS declared valid when reviewed from content validity because each SAS gets a percentage of ≥ 61% [10]. This is because at the potential and problem stages and data collection stages [9], a through analysis has been carried out to obtain data that supports to design SAS. Data collection carried out included analysis of 2013 curriculum which is to formulate the conformity of basic competence and indicators to be achieved with 2013 curriculum, analysis of chemistry 11$^{th}$ grade textbooks to formulate material which is suitable with learning objectives and the correctness of learning material subtances, and also literature study related to Chemo-Entrepreneurship approach and creative thinking skills, making it easier in the process of designing SAS by utilizing data that has been obtained.

The validity of SAS also reviewed from construct validity criteria which refers to the guidelines for preparing teaching materials Construct validity are related to linguistic criteria, presentation criteria and appearance suitability criteria. Based on the result of three validators, the construct validity of SAS is given in Figure 1.

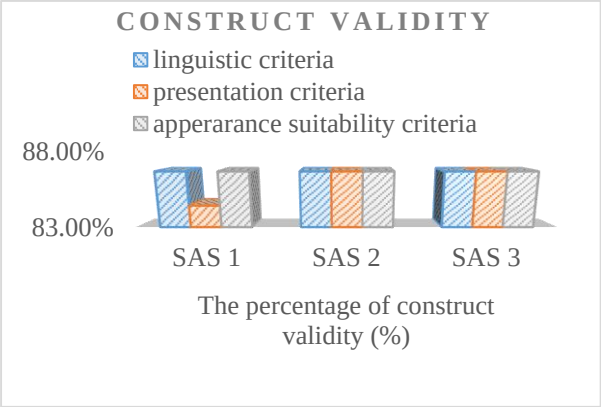


Figure 1. Construct validity result

Based on Figure 1 above, we get the information that each SAS 1-3 reviewed from construct validity can be declared valid because each criteria has percentage ≥ 61%. On linguistic criteria, SAS 1-3 obtained a validity percentage of 86,67%. This is because in the SAS preparation stage has been adjusted to the guidelines of the teaching materials preparation [13], the development of teaching material must pay attention to linguistic component including readability, information clarity, conformity with Indonesian language rules, and use effective and efficient language. The presentation of each SAS 1-3 obtained a percentage of 84.44%, 86.67% and 86.67% in the very valid category. These criteria can be obtained because in designing SAS stage has been adjusted to the guidelines for preparing teaching materials [13] that the presentation component must pay attention to the clarity of the learning objectives to be achieved, the order of SAS presentation giving motivation and attraction and the completeness of the information. The appearance suitability criteria for each SAS 1-3 received a percentage of 86.67%. Thus, it can be concluded that SAS is declared valid because based on content validity and construct validity get percentage of validity ≥ 61%.

**Practicability of SAS**

The practicability of SAS is known through the result of the students responses questionnaire and observation of students activities during limited trial process of SAS that developed. Students responses questionnaire were given to 12 students as limited trial subjects and observation of students activities were observed by three observers which one observer was observed one group. The recapitulation result of students activity observation are given in Table 3.

Table 3. Observation of students activities result

| Nu | Aspect | Percentage | Category |
|---|---|---|---|
| 1 | Observation of students activity in SAS 1 | 100% (Yes) | Very practice |
| 2 | Observation of students activity in SAS 2 | 100% (Yes) | Very practice |
| 3. | Observation of students activity in SAS 3 | 100% (Yes) | Very practice |

Based on Table 3 above, it can be obtained that all activities observed in each SAS were carried out with percentage of 100%. Activities in each SAS were adapted to the Chemo-Entrepreneurship approach to train creative thinking skills to students. It was appropriate with the characteristic of Chemo-Entrepreneurship approach [14] such as focus on value creation, connecting students to the outside world, letting students act on their knowledge and skill, and team based approach, so that it was formulated activities include communicating the phenomena which contained in the SAS, expressing ideas, compiling experimental designs, analyzing estimated production cost and making marketing strategies from colloidal product that produced. This is in accordance with experiment result [4] stated that there is a strong correlation between creativity and entrepreneurship. This is evident from the result of studentss activity observation which shown that component of creativity can be trained through Chemo-Entrepreneurship oriented learning.

The practicability of SAS also reviewed from 12 students response as users of SAS. The recapitulation result of students' response questionnaires are given in Table 4.

Table 4. The result of students' response questionnaires

| Nu. | Aspects | Percentage | Category |
|---|---|---|---|
| 1. | Content criteria | 100% | Very practice |

| Nu. | Aspects | Percentage | Category |
|---|---|---|---|
| 2. | Linguistic criteria | 91.67% | Very practice |
| 3. | Presentation criteria | 94.44% | Very practice |
| 4. | Graphical criteria | 94.44% | Very practice |

Based on Table 4 above, it is known that the content criteria of SAS gets the positive response from the students about 100%. It is shown that the suitability between the SAS with indicator, matter subtances, creative thinking and Chemo-Entrepreneurship make the students interesting to study about colloid matter and apply it in theiru daily life. Futhermore, they can produce a valuable product based on the thinking process which is arranged by themselves. These result shown the same results as previous research [7] which shown that as many as 95% of students are interested in learning chemistry after the implementation of Chemo-Entrepreneurship oriented learning on Hydrocarbon material. This is also supported by the result of students activities observation which shown that in the SAS 1-3, activities that observed 100% were carried out well. In linguistic, presentation and graphical criteria obtained percentage of 91.67%, 94.44%, and 94.44% in the very practice category. This shown that students as SAS users feel facilitated regarding the demands of SAS presentation, the use of language and graphical design because in the previous stage that is validation stage, in terms of construct validity which include three of criteria, the SAS was declared valid based on the result of three validators.

Thus, it can be concluded that SAS is stated to be practical because the result of observation of students activities and students response questionnaires get a percentage of $\geq 61\%$ [10].

**Effectiveness of SAS**

The effectiveness of SAS was obtained from the result of pretest and posttest creative thinking skills that given before and after the use of SAS. The effectiveness of SAS was reviewed from the increasing of individual score using N-Gain score analysis. N-gain score analysis can be used if the data in normal distribution based on the result of Kolmogrov Smirnov test [12]. It can be tested by using SPSS. If the data in normal distribution, it can be calculated using N-gain score formula. In Table 5 below are given the result of normality test for pretest and posttest.

Table 5. Data normality test for pretest and posttest

| Aspect | N | $\alpha$ | Asymp. Sig (2 tailed) | Category |
|---|---|---|---|---|
| Pretest | 12 | 0,05 | 0,539 | Normal |
| Posttest | 12 | 0,05 | 0,497 | Normal |

Based on Table 5 above, it is known that pretest and posttest data in normal distribution, the gain score of every students can be calculated. In Table 6 below is given the result of gain score.

Table 6. N-Gain score analysis result

| Nu. | Name | Pretest score | Posttest Score | *Gain* | Category |
|---|---|---|---|---|---|
| 1. | ASB | 21 | 78 | 0,72 | High |
| 2. | IDHI | 14 | 83 | 0,80 | High |
| 3. | ADM | 18 | 80 | 0,76 | High |
| 4. | FDS | 19 | 76 | 0,70 | Medium |
| 5. | DAP | 20 | 78 | 0,73 | High |
| 6. | AQ | 18 | 78 | 0,73 | High |
| 7. | CNF | 29 | 83 | 0,76 | High |
| 8. | DIS | 17 | 95 | 0,94 | High |
| 9. | MIK | 29 | 79 | 0,70 | Medium |
| 10. | VIPA | 30 | 88 | 0,83 | High |
| 11. | SANJ | 18 | 80 | 0,76 | High |
| 12. | MK | 16 | 90 | 0,88 | High |

The SAS that developed is declared effective if the N-gain score of students gets an assessment of $0,7 \leq g \leq 1$ in the high category or $0,3 \leq g \leq 0,7$ in the medium category. Based on Table 5 above, it was obtained that almost students got N-gain score $\geq 0,7$ with percentage of 83.33% of students in the high category and 16.67% of students in the medium category.

The score increasing in score of studentss in high and medium category indicates that the process of assimilation and accommodation was occured whereas the knowledge that has been possessed by students is assimilated and a new knowledge that received being accommodated, the result is a new understanding and next stored in long term memory. Based on the result of students responses questionnaire as known that students gave a positive response to the SAS that developed whereas students were interested in learning colloidal material by applying leaning materials that is SAS with Chemo-Entrepreneurship oriented to train creative thinking skills. The enjoyable and memorable learning process will make it easier to save knowledge gained in long term memory, according to information processing theory state that the information processing starts when a

stimulus is received by studentss, there is perception stage to give response to the stimulus, then the information is entered into short term or long term memory, the repetition makes the information is easier to remember than in short term memory, so it is easier to call back if needed in certain situation [15].

The result of this research was appropriate with the previous research which is stated that learning with Chemo-Entrepreneurship oriented can increase the creativity of students [16] and the other result of previous research [17] stated that implementation of Chemo-Entrepreneurship learning on Solubility and $K_{sp}$ material can increase the creativity of students with N-gain score 0,62.

Based on analysis and discussion above, it can be concluded that the SAS that developed is declared effective because N-gain score of students are in the high and medium category.

## CLOSURE

### CONCLUSION

Based on the suitability between the results of research, problem formulation and data analysis, it can be concluded that SAS with Chemo-Entrepreneurship oriented on colloid material in class XI SMA to train creative thinking skills are declared feasible to use as learning materials because appropriate with the following feasibility criteria:

1. SAS was declared valid reviewed from content validity and construct validity. In content validity, each SAS 1-3 got percentage 86.67% in very valid category. In construct validity reviewed from linguistic criteria, each SAS 1-3 got percentage 86.67% in very valid category, the presentation criteria each SAS 1-3 got percentage 84.44%, 86.67%, 86.67% in very valid category and the appearance suitability criteria, each SAS 1-3 get percentage 86.67% in very valid category.
2. SAS was declared practice reviewed from students response result and observation of students activity. In the content criteria got positive students responses 100%, the linguistic criteria got positive responses 91.67%, the presentation criteria got positive responses 94.44% and the graphical criteria got positive responses 94.44% in very practice category and it was supported by students activity observation which is shown in trial process of SAS 1-3, 100% activity was carried out well.
3. SAS was declared effective because *N-gain score* of 16.67% students in medium category and 83.33% of students in high category.

### SUGGESTION

1. Development of SAS with Chemo-Entrepreneurship oriented on colloid material in 11$^{st}$ grade to train creative thinking skills was limited to the limited trial phase. Therefore, it is recommended that further research apply SAS to the extensive usage testing phase.
2. SAS with Chemo-Entrepreneurship oriented to train creative thinking skills can be developed in other materials so that students' creative thinking skills can be further honed.
3. Further research can be focused on training creative thinking skills in the components of elaboration thinking of students in order to obtain maximum improvement because in this study the results shown that the level of creative thinking in the component of students elaboration thinking was lower than the others.

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