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DEVELOPMENT OF WORKSHEET WITH CHEMO-ENTREPRENEURSHIP ORIENTED ON COLLOID MATTER TO TRAIN CREATIVE THINKING SKILL

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Abstract: The aim of this research is to describe the feasibility of Student Activity Sheet (SAS) that was developed . The feasibility are reviewed based on validity, practicability and effectiveness of SAS. This research use Research and Development 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. Validation result of content criteria was 86,67% in the very 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 very valid category. The SAS practicality in very practical 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 student activity which declared that the SAS activity 100% was carried out well during the limited trial process. The SAS effectiveness shown that each component of creative thinking such as fluency, flexibility, elaboration and originality thinking gets percentage 91,67%, 85,97%, 77,8%, 81,25% and N-gain score of students get value ≥0,7 which is 83,33% of students in high category and 16,67% of students in medium category.

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

INTRODUCTION

Education is fundamental for everyone. Every human being has the right to get a better education. According to education system in UU Nu.20 of 2003 stated that national education system has function for developing capability and forming the character of faithful and devoted student 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 Permendikbud (2016) UU Nu.20 stated that each graduate of primary and secondary education units has competencies in three dimensions, such as attitudes, knowledge and skills, in the skill dimension including thinking skills and act creatively, productively, critically, independently, collaboratively and communicatively.

Creative thinking skill has the main attraction compared with the other 21st century skills. According to Eragameddy (2013), creative thinking is defined as a thinking process that leads to new knowledge, new approaches, new perspectives or new ways to understand things, while Grieshober in Ananda and Azizah (2016), stated that creative thinking as a process of obtaining ideas that emphasize aspects of fluency, flexibility, originality, and elaboration in thinking. Based on the Global Creativity Index (GCI) was placed Indonesia at 115 position from 139 countries (Richard, et all, 2015). This indicates that the level of creativity of The Indonesian people is very low. According to Suryadi (2016), 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.

Based on the result of pre-study that conducted at SMAN 1 Driyorejo, Gresik on Tuesday, October 2, 2018 to student of 12th grade shown that on the indicator aspectc of creative thinking skill about 80% of student stated that learning was very rare to practice creative thinking skills. One of the reason is that teacher are focused on delivering material. According to result of creative thinking test shown that 46% of student have thought fluently in determining ideas to solve the problem that given, but 41% of student 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 student have not been able to connect the ideas with the appropriate chemistry matter. Elaboration aspects of thinking skills, 40% of student cannot associate the chemistry concept in accordance with ideas and develop experimental design of ideas that proposed. Originality thinking skill shown that 41% of student 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 need to be trained to student through appropriate learning strategies.

Chemo-Entrepreneurship approach is deemed appropriate to be used as a learning orientation to train creative thinking skill. According to Supartono in Prayitno,et all (2016), 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 student to study the processing of a material into a useful and economical valuable product. Based on the research that conducted by Richardd, et all (2015), it was found that there was a strong correlation between creativity and entrepreneurship. Another research was conducted by Tania and Azizah (2014), the student response was 95% of student 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 student 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 student agreed about chemistry learning with Chemo-Entrepreneurship oriented.

Learning objectives will be achieved in accordance with the learning orientation and ability to be trained if the teaching materials appropriate too. One of teaching materials that needs to be prepared to support learning process is Student Activity Sheet (SAS). Based on Prastowo (2015), 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. As many as 69% of student prefer SAS that can teach creative thinking in using chemistry concepts to produce economical product and also contain of image and questions.

One of the chemistry material taught in 11th 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 11th 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, leaning should be able to apply the expected criteria in accordance with basic competencies. Therefore, in order to realize this, Chemo-Entrepreneurship oriented learning can be applied to the use of teaching materials in the form of SAS to train students' creative thinking skill.

METHOD

This research is development research which use Research and Development (R&D) design refers to Sugiyono (2013), 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 12th grade at SMAN 1 Driyorejo, Gresik using the experimental method One Group Pretest and Postest design. The instrument that used are SAS review sheet, validation sheet, student activity observation sheet, student response sheet and creative thinking skill 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:

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

Σ criteria scor = 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%	Very less
21% - 40%	Less
41% - 60%	Enough
61% - 80%	Valid
81% - 100%	Very valid

(Riduwan, 2011)

Based on Table 1 above, SAS that developed stated valid when each content validity and construct validity get percentage ≥ 61% (Riduwan, 2011).

The next stage after the SAS was declared valid, is limited trial test stage. At this stage get the data of practicability and effectiveness of SAS that developed.

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

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

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. SAS is declared effective if classically each component of creative thinking gets a percentage ≥ 75% in the high category. The score interpretation criteria for creative thinking skill is given in Table 2 below (Agustini, et all, 2014):

Tabel 2. Score interpretation criteria for creative thinking

Percentage	Criteria
0% – 30%	Very low
31% - 54%	Low
55% - 74%	Normal
75% - 89%	High
90% - 100%	Very high

(Agustini, et all, 2014)

Despite the SAS effectiveness reviewed from each component of creative thinking, it is also reviewed from N-gain score of each student get score 0,3 ≤ g ≤ 0,7 in the medium category or 0,7 ≤ g ≤ 1 in high category (Hake, 1998). To use the N-gain score analysis, the data must be in normal distribution, so it can testes by Kolmogrov Smirnov test using SPSS, the data stated in normal distribution if Asymp.Sig value get score ≥ α = 0,05 (Lutfi and Tjahjani, 2013). The formula to determine n-gain score is given below:

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

RESULTS AND DISCUSSION

A. Validity

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 3 below:

Table 3. Data of content validity result

Validity aspect	Percentage			Category
	SAS 1	SAS 2	SAS 3	
Content	86,67%	86,67%	86,67%	Very valid

Content validity including conformity of basic competence and indicatorc 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 3 above, each SAS 1-3 gets a percentage of ≥ 61%, so that the validity of SAS declared valid when reviewed from content validity. These are obtained because at the potential and problem stages and data collection stage according to Sugiyono (2013), a thorough 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 11th grade textbooks to formulate material which is suitable with learning objectives and the correctness of leaning material subtances, and also literature study related to Chemo-Entrepreneurship approach and creative thinking skill, making it easier in the process of designing SAS by utilizing data that has been obtained.

Construct validity is related to linguistic criteria, presentation criteria and appearance suitability. Based on the result of three validators, the construct validity of SAS is given in figure 1 below:

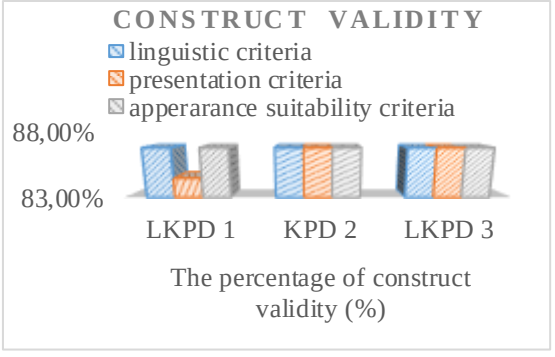

Figure 1. Construct validity result

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 refers to Depdiknas (2008), 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 according to Depdiknas (2008) 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%.

B. Practicability

The practicability of SAS is known through the result of the student responses questionnaire and observation of student activities during limited trial process of SAS that developed. Student responses questionnaire were given to 12 students as limited trial subjects and observation of student activities were observed by three observers which one observer was observed one group. The recapitulation result of student activity observation are given in Table 4 below:

Table 4. Observation of student activities result

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

Based on Table 4 above, it can be obtained that all activities that 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 student. It was appropriate with the characteristic of Chemo-Entrepreneurship approach in Lackeus (2015) such as focus on value creation,

connecting student to the outside world, letting student 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 of Richard, et all (2015) stated that there is a strong correlation between creativity and entrepreneurship. This is evident from the result of students activity observation which shown that component of creativity can be trained through Chemo-Entrepreneurship oriented learning.

The practicability of SAS also reviewed from 12 student response as users of SAS. The recapitulation result of students' response questionnaires are given in Table 5 below:

Table 5. The result of students' response questionnaires

Nu.	Aspects	Percentage	Category
1.	Content criteria	100%	Very practice
2.	Linguistic criteria	91,67%	Very practice
3.	Presentation criteria	94,44%	Very practice
4.	Graphical criteria	94,44%	Very practice

Based on Table 5 above, it can be obtained that SAS received a positive response from the students on content criteria of 100%. This shown the suitability of SAS with indicators, material substance, creative thinking and Chemo-Entrepreneurship approach, making students interested in learning colloidal material by applying it in daily life and producing selling-value products based on the thought process themselves. These result shown the same results as previous research that conducted by Tania and Azizah (2014) 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 student 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 shows that student 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 student activities and student response questionnaires get a percentage of ≥ 61% (Riduwan, 2011).

C. Effectiveness of SAS

The effectiveness of SAS was obtained from the result of pretest and posttest creative thinking skiils that given before and after the use of SAS. From the result of these test, then it was analyzed to determine the percentage of each component of creative thinking and N-gain score of every student. According to Filsaime (2008), the component of creative thinking includes the ability to think fluently, flexibly, elaboration and originally. Based on the calculation result, it was obtained the percentage of the component of creative thinking from pretest and posttest result is given in Figure 2 below:

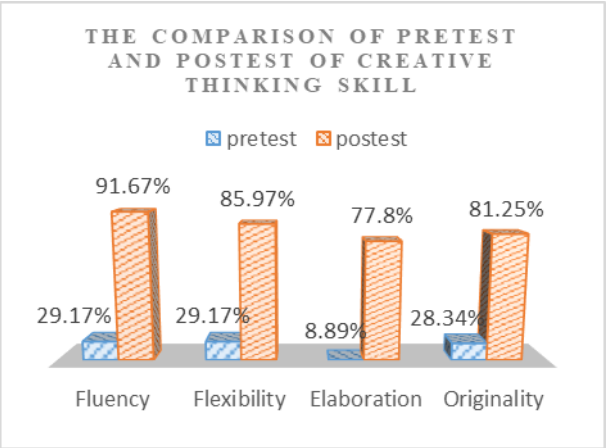

Figure 2. Percentage of pretest and posttest result

Based on Figure 2 above, it is known that the result of pretest and posttest results were increasing on each component of creative thinking skill. In the pretest result shown that students' creative thinking skills were in a very low category, after implementing the SAS that developed shown an increasing in students' creative thinking abilities which is in high or very high category because the result of posttest for each creative thinking component got percentage of ≥ 75% (Agustini, et all, 2015). In a previous research that conducted by Sumarti, et all (2014), it was shown that the use of Chemo-Entrepreneurship oriented modules on colloidal material during learning process can help students to improve their soft skill, whereas in this research, the use of SAS with Chemo-Entrepreneurship oriented on colloidal material can train creative thinking skills.

Fluency thinking skills in the form of the student's ability to find a lot of ideas that related to problems or phenomena that are given and also to analyze the relationship between ideas and material/concept of colloidal matter that have been studied. This is relates to

the characteristic of Chemo-Entrepreneurship which is focus on value creation and letting students act on their knowledge and skills). Flexibility thinking skills in the form of the student's ability in determining the most dominant ideas to solve the problems from various perspective and the flexibility in producing answer and varied interpretations related to phenomena. This is related to the characteristic of Chemo-Entrepreneurship such as letting students act on their knowledge and skill and connecting students to the outside world.

Elaboration thinking skills in the form of student's ability to develop their own ideas by giving detailed steps and developing, adding to, enriching an idea to produce a product. This is related to the characteristic of Chemo-Entrepreneurship which is letting student act on their knowledge and skill. Originality thinking skill in the form of student's ability to make innovative idea, the uniqueness of respon that given related to phenomena. This is related to the characteristic of Chemo-Entrepreneurship such as connecting student to the outside world and letting students act on their knowledge and skill and the four components of creative thinking skills are trained by team based approach through to produce active and enjoyable learning, this is related to the characteristic of Chemo-Entrepreneurship which is team based approach thorough learning in team can occur the diverse creative thinking process because it involves the thinking of several individuals.

The effectiveness of SAS is also 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 (Lutfi and Tjahjani,2013). In Table 6 below are given the result of normality test for pretest and posttest data.

Table 6. Data normality test for pretest and posttest

Aspect	N	α	Asymp. Sig (2 tailed)	Category
Pretest	12	0,05	0,539	Normal
Posttest	12	0,05	0,497	Normal

Based on Table 6 above, it is known that pretest and posttest data in normal distribution, the gain score of every student can be calculated. In Table 7 below is given the result of gain score analysis.

Table 7. 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 high category or $0,3 \leq g \leq 0,7$ in 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 student in the high category and 16,67% of student in the medium category.

The increasing in score of students in high and medium category indicates that the process of assimilation and accommodation was occurs whereas the knowledge that has been possessed by student is assimilated and a new knowledge that received being accommodated, resulting a new understanding and then stored in long term memory. Based on the result of student 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 skill. 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 students, 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 (Slavin,2000).

Based on analysis and discussion above, it can be concluded that the SAS that developed is declared effective because every component of creative thinking got an assessment of $\geq 75\%$ and N-gain score of students are in the high and medium category.

CONCLUSION

Based on the suitability between the result of research, problem formulation and data analysis, it can be concluded that the SAS with Chemo-Entrepreneurship oriented on colloidal matter to train creative thinking skill is feasible to use as learning material during learning process because it has been declared appropriate with feasibility criteria such as

validity, practicability and effectiveness of SAS.

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