THE DEVELOPMENT OF STUDENT WORKSHEET ORIENTED TO DIRECT INSTRUCTION WITH CONCEPT MAPPING STRATEGY ON STOICHIOMETRY MATTER

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Abstract
The aims of this learning to know the feasibility of student worksheet and student responses to the worksheet which is oriented to direct instruction with strategy of concept mapping on stoichiometry matter of grade X-SMA. The kinds of this learning is development research and it use 4-D as development model. The subject of this learning in limited trial test is 16 student of grade XI IPA-7 SMAN 1 Tuban. Instrument which use to assess the feasibility of this worksheet are review paper and validation paper and also questionnaire of student responses. The result of this learning show that the student worksheet is feasible to use because it get percentage on the criteria of matter / content, presentation, language, graphic and the conformity to the rules of concept maps respectively 82,29%, 76,67%, 78,57%, 81 % and 78,33 % and student response is 83,04%.
Keyword *: student worksheet, direct instruction, concept mapping, stoichiometry*

Abstrak
Penelitian ini bertujuan untuk mengetahui kelayakan lembar kerja siswa dan respon siswa terhadap lembar kerja siswa berorientasi pembelajaran langsung dengan strategi peta konsep pada materi stoikiometri kelas X-SMA. Jenis penelitian ini merupakan penelitian pengembangan dengan menggunakan model pengembangan 4-D. Subjek penelitian dalam uji coba kelayakan LKS adalah siswa kelas XI IPA-7 SMAN 1 Tuban sebanyak 16 anak. Instrumen yang digunakan untuk menilai kelayakan LKS adalah lembar angket telaah dan lembar validasi serta angket respon siswa untuk menilai LKS ini. Hasil penelitian ini menunjukkan bahwa LKS layak digunakan karena telah mendapatkan prosentase pada kriteria materi, penyajian, bahasa, kegrafisan, dan kesesuaian dengan peta konsep berturut-turut sebesar 82,29%, 76,67%, 78,57%, 81 % dan 78,33 % dan respon siswa sebesar 83,04%.
Kata kunci: *LKS, Pembelajaran Langsung, Peta Konsep, Stoikiometri*

INTRODUCTION

Education is one of the effort to explore the human potential so it will increase the quality of human resources. Based on the law of 1945 and Pancasila, education has the function to develop the ability and to make the nation more prestige on its character and culture as an effort to make the life of nation more intelligent, the aims to develop students potential in order will be faith and piety human to the God, good character, health, bookish, clever, creative, autonomously, and become democratic citizen and responsible.

Based on the result of Trend in International Mathematics and Sciences Study (TIMSS) on 2011, it show that the education quality in Indonesia is lower, it can be prove from the assessment result that Indonesia got average score of 406 with the middle scale of TIMSS is 500. It cause by during the lesson students less in try the analyze problems.

There are many effort which has been done by the government to increase the education quality in Indonesia like increasing the quality of teacher, develop and repair the curriculum, tool and

learning media. There are many kind and function of learning media. Students worksheet is one of the printed media that use as guide in learning which is contain the task that must be done by students on certain topics.

Students worksheet in school or other education institution is the worksheet that only transfer the answer in previous page. So this worksheet is not effective if its implemented in the learning. In doing the worksheet, many teacher ask their student to do in the home as a homework. So it's not effective too because student need the teacher's guidance if they were in difficulty in learn or do their task in those worksheet.

Chemistry is one of the lesson in SMA/MA/SMALB. Chemistry has been thought in the SMA/MA/SMALB not only to increase knowledge of chemistry but also to construct social skill like communication skill. It similarly with Regulation of National Education Minister (Permendiknas) No 26 year of 2006 about the content standard state that curriculum was developed based on many principle.[1].

Direct instruction is designed to increase the mastery of skill (procedural knowledge) and declarative knowledge which is thought step by step [2]. Direct instruction can be used to thought declarative or procedural knowledge. In direct instruction, there are five syntax of it, namely: 1) clarify the goal and establish class; 2) demonstrate knowledge or skill; 3) provide guided practice to the student; 4) check for understanding and provide feedback; 5) Provide extended practice[2]. Direct instruction is also design to introduce student in the lesson in order to explore student interest, raise the curiosity and stimulate their thinking [3].

Stoichiometry is one of the matter in chemistry which are thought in grade X. Stoichiometry is one of the application matter because student should be able to apply the formula of chemistry when they do the problem about chemical calculation. Based on the questionnaire

which are disseminate in the student of SMA N 1 Tuban state that 34,83% student are in difficulty in understanding stoichiometry matter. It cause by teacher were less in explain stoichiometry matter and the guidance from teacher were also less when they did the problem in stoichiometry matter.

There are 72,41% students state that its very needed a worksheet in learning because it can help students in learning and understanding a matter. Desirable worksheet from the student are worksheet which are made based on the school condition, so this worksheet can be effective if it use in learning.

Beside of implementation of worksheet which are appropriate with the school condition, implementation of leaning strategy which are suitable in learning were also needed. It cause by learning strategy which are appropriate with the matter and students character, so those worksheet can be effective in increase understanding of students.

One of the learning strategies that can be used in learning is a concept map. Concept map is a graph model which is used to organize and represent knowledge, include concepts and usually described in a cycle or a box, and relationships between concepts indicated by a line which shows the relationship between the two concepts, and the words that are on the line showed the proposition shows the relationship between the two concepts [4]. So the use of concept maps strategy is expected to help students in meaningful learning because with concept map students can illustrate the important concept and then linked with other concepts without it accompanying words. Based on a questionnaire were disseminate to the students at SMAN 1 Tuban as much as 55.17% state that the strategy of concept map has already been used in the learning.

Learning strategies appropriate to the character of the material and students of course it can support the process of meaningful learning. Meaningful learning is part and packet of high-level

thinking. Thinking can happen when we know the correlation between two or more idea, new and old [5]. Students with meaningful learning can bring knowledge in long-term memory.

This learning is focused on the development of student worksheets prepared in accordance with the conditions of the school and students. In this learning developed students worksheets oriented to direct instruction using concept maps strategy in the stoichiometry matter for grade X senior high school. Its expected that after using the student worksheet students had no difficulty in understanding stoichiometry matter as student worksheets have been prepared using the direct instruction so that the steps in the calculation are given in step by step. And the use of concept maps strategy is expected to help students to meaningful learning because students are able to connect related concepts.

METHOD

This learning is include in development research. This learning was developed using 4-D development model, which includes the step of Define, Design, Develop, and Disseminate, but in this learning was limited to the development step only, whereas disseminate step is not done.

The research instrument used is a review paper, validation paper, and test instrument for students, and also student questionnaire responses. Review paper used to collect suggestions from experts for the perfection of this student worksheet. Validation paper used to assess the feasibility of the student worksheet which is developed. Paper student questionnaire responses were used to assess students' response to the student worksheets developed. And also a test instrument include in pre-tests and post-tests were used to determine the increasing score and effectiveness of student worksheets were developed. The data collection technique used was the questionnaire method is questionnaire

validation and student questionnaire responses.

Data validation results of the worksheets analyzed by quantitative description that includes in feasibility aspects of matter or content, language, presentation and graphic And to interpret the data in the table of Likert scale as follows :

Table 1 Likert Scale

Assessment	Scale of grade
Very less	0
Less	1
Enough	2
Well	3
Very well	4

[6]

Then the interpretation of the Likert data table scale was calculated to yield percentage by using the following formula:

$$P(\%) : \frac{the\ scrore\ on\ data\ collection}{criteria\ score} \times 100\ \%$$

When

$P(\%)$ = percentage of got grades

Criteria score = highest score x amount of aspect x amount of validator

The results of the calculation of validation analysis then it interpreted by the following table.

Table 2. Interpretation of Worksheet Assessment

Percentage (%)	Category
0-20	Not feasible
21-40	Less feasible
41-60	Feasible enough
61-80	Feasible
81-100	Very feasible

[6]

Based on the result of interpretation Table 2, worksheets that fulfill the feasible criteria as the learning media when acquiring a percentage of $\geq$ 61%.

Analysis of the results of students' responses is done by giving student questionnaire responses after students use the student worksheets. Paper student

questionnaire responses were made in the form of preferred answer "yes" and "no". Percentage of student response data obtained and calculated by the Guttman scale as follows:

Table 3. Table of Legibility Interpretation

Answer	Score
Yes (y)	1
No (n)	0

[6]

The data obtained were calculated as a percentage using the following formula:

$$P(\%) = \frac{the\ scrore\ on\ data\ collection}{criteria\ score} \times 100\ \%$$

Where:

Criteria score = highest score x amount of aspect x amount of respondent

The percentage can be interpreted as in Table 2 and worksheet is feasible if the percentage gain ≥ 61%.

Before the students in a groups in practice in making concept maps the students was given a pre test to make a concept map. Training on the use of concept maps strategy in groups has the aim that students can help each other to understand the material and create a concept map because group were composed of four students that has heterogeneous capability. To assess the students' concept map used the assessment rubric of concept maps as follows:

Table 4. Assessment Rubric of Concept Mapping

SCORE	ASPECT
1	Concept
	Amount of maximum concept 17
	17 x 1 = 17
1	Proposition
	Amount of maximum proposition 18
	18 x 1 =18
5	Level
	Each level has score 5, it has 4 level
	I : there are 3 concept score 5
	II : there are 5 concept score

Continue of Table. 4

SCORE	ASPECT
	5
	III : there are 4 concept score 5
	IV : there are 4 concept score 5
	If wrong in put the concept in right level score 0
10	Cross link
	There are 3 cross link
	3 x 10 = 30
1	Example
	There are 4 example
	4 x 1 = 4

$$Student\ score = \frac{Collected\ point}{total\ point} \times 100$$
$$= \frac{x}{89}\ 100$$

After students practice in make a concept map in groups, the next stage is students practice independently in making concept maps.

ANALYSIS

Limited trial test conducted at SMAN 1 Tuban of 16 student at a grade XI with heterogeneous capabilities. Data collection was conducted two meetings on December 15 and February 18, 2014.

Feasibility assessment given by the validator will be shown in the following table [6]:

Table 5. Result of Validator Assessment

Aspect	Percentage	Criteria
Matter	82,29%	Very feasible
Presentation	76,67%	Feasible
Graphic	81,00%	Very feasible
Language	78,57%	Feasible
Conformity to the rules of concept maps	78,33%	Feasible

Based on the Table 5, worksheet is feasible to use if the review from conformity of the contents of the curriculum used that is 2013, the basic competency , learning indicators. Because the material contained in the worksheets can not be separated from the existing curriculum. Learning indicator is written correctly so it can assist students in learning of a particular matter, especially on the stoichiometry matter. The material in worksheet systematically arranged and includes the truth of concept. If viewed from the presentation aspect is its feasible to use. Due to these worksheets are prepared in accordance with the conditions and needs of the students which include the level of student thinking, worksheet look attractive, and the number of colors that makes the students do not get bored and stimulate learning. If viewed from the graphic aspect, worksheets developed is very feasible to be tested. This is because the worksheet rendered images and animations in accordance with the characteristics of the material and students. Assessment of the language aspect of worksheet is feasible to be used because it has been get a percentage of 78.33%. The language used in these worksheets is accordance with the development of learners. Basic term of worksheet adjusted in chemical terms. Conformity with the rules of concept maps worksheet get an assessment of 78.33 % and its said worth for the trial. The use of color variation is needed because different colors can be known location of concepts at different levels. The present of conjunctive linking students to demonstrate an understanding of the concepts and other concepts. The concept is placed at different level to demonstrate the ability of the students in sort the concepts, including the concept that is important / special to the general concept. Cross-link demonstrated the ability of students to think critically because the students were able to find a relationship with the concept at a level before or afterwards.

Here are presented the data score of the pre-test and post-test in chemical calculations.

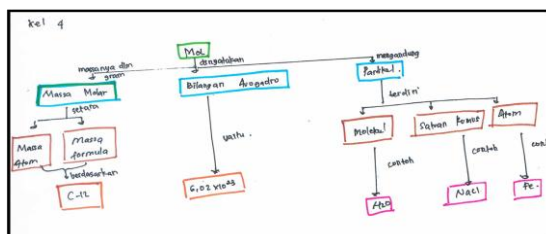Table 6. Data of Students Score in Making Concept Mapping in First Cycle

No	Students	Score	Mastery
1	AIA	49	Not master
2	AEA	36	Not master
3	AOA	51	Not master
4	AAA	43	Not master
5	AAB	57	Not master
6	AAE	27	Not master
7	AAO	51	Not master
8	AAT	27	Not master
9	AAV	45	Not master
10	AAR	36	Not master
11	AAD	66	Not master
12	AOD	60	Not master
13	AIH	55	Not master
14	AED	36	Not master
15	ABS	60	Not master
16	ANS	49	Not master
Amount of master student		0	

According to the Table 6, before teacher training in make a concept map, students do not understand the nature of concept maps and how to make a concept map correctly. In practice in making concept map teachers use direct instruction model so the teachers can train it step by step.

After students practiced in make concept maps in groups the next stage is to create a concept map independently. Here are presented example of the results of a concept map which are making by students.
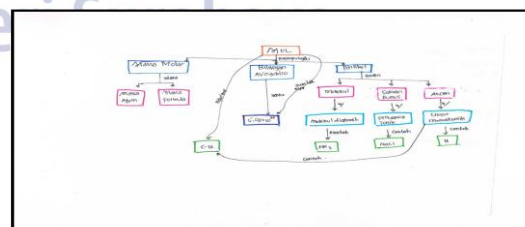
(excellent category)

(medium category)
Picture 1. Students Concept Map

With the graph of concept mapping which is drawn by students, it can be know the ability of student in understanding the matter especially on stoichiometry matter.

Table 7. Data of Students Score In Making Concept Maps Second Cycle .

No	Student	Score	Mastery
1	AIA	70	Not Master
2	AEA	80	Master
3	AOA	65	Not Master
4	AAA	68	Not Master
5	AAB	80	Master
6	AAE	60	Not Master
7	AAO	84	Master
8	AAT	60	Not Master
9	AAV	84	Master
10	AAR	56	Not Master
11	AAD	85	Master
12	AOD	80	Master
13	AIH	84	Master
14	AED	58	Not Master
15	ABS	65	Master
16	ANS	70	Not Master
Amount of Student Master		8	

The combination between direct instruction and the use of concept map strategies proven to improve student scores. This is because the implementation of the test, students are trained and guided to understand the stoichiometry matter by using direct instruction model. And the use of concept map strategies can be used to solidify students' knowledge so that the material that was submitted was not wasted and it will be a meaningful knowledge.

After the students have carried out do the task on worksheets, the student questionnaire responses given. The results of the questionnaire were distributed to

students at 83.04%, so this worksheets is include in very feasible to use. Student worksheet is appropriate with needed of students and can make it increase their motivation in learn.

CONCLUSION

Based on the result of this research and data analysis can be conclude that :

1. Developed worksheet is feasible as a learning media and it has percentage in each aspect of 82,29% in content, 76,67% presentation, language 81,00%, and 78,57% in graphic on good category.
2. Conformity of worksheets with rules concept map get percentage of 78,33% an good category.
3. Questionnaire responses of students show the positive responses and get percentage of 83,04% on strong category.

SUGGESTION

1. Students are practiced to make a lot of concept maps in order to get maximum results.
2. Developed Worksheet tested in any students that already taking the material, further research should be if held for students who do not go through the material.

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