

## VALIDITY OF PHOTOSYNTHESIS TOPIC STUDENT WORKSHEET BASED ON KNOW WANT LEARNED (KWL) STRATEGY TO FACILITATE STUDENTS' METACOGNITIVE SKILL OF 12<sup>TH</sup> GRADE SENIOR HIGH SCHOOL

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### Abstract

Metacognitive skill is one of the skills needed in community 4.0. This development research was aimed to produce valid student worksheet based on Know Want Learned (KWL) strategy for photosynthesis topic to facilitate students' metacognitive skill. The student worksheet consists of three main phases of learning activities, namely Know, Want, and Learned phase which help to facilitate students' metacognitive skill. This development research used ADDIE development model. The research stage was begun by students, school curriculum, concept, and task analysis than continued with design and development of student worksheet stage in Biology Department, Mathematics and Natural Sciences Faculty, Universitas Negeri Surabaya. The student worksheet was then implemented to fifteen 12<sup>th</sup> grade students of MAN 5 Jombang. The data of student worksheet validity obtained from the validation of an education expert, a plant physiology expert, and a biology teacher that were analyzed based on mode. The validation result showed that the student worksheet was very valid with mode of 4,00. Based on these results, it can be concluded that the student worksheet was worthy to be used in facilitating student metacognitive skill.

**Keywords:** Validity of student worksheet based on *Know Want Learned* (KWL), metacognitive skill, photosynthesis.

### INTRODUCTION

Living in the era of society 4.0, requires a person to become superior human resources. To produce superior graduates, facilitating of skills can be done through education in schools by implementing the revised 2013 curriculum. One of the revised 2013 curriculum integration is the development of HOTS or higher order of thinking skills. According to Widodo (2013), higher order of thinking skills include critical, logical, reflective, creative, and metacognitive thinking. This was suitable with the statement of Griffin et al. (2012) that another skill that must be facilitated and mastered by students as superior human resources in the future is metacognitive skill.

The metacognitive term was introduced by Flavell in 1976. Metacognitive is an activity of "thinking about thinking" or the activity of consciously controlling the cognitive processes within oneself. According to

Elsina (2010), metacognitive activities require students at each stage undertaken. Students are expected to be active in planning, controlling activities, skilled in predicting, monitoring and evaluating. In the process of teaching and learning activities in class, the revised 2013 curriculum has been designed to enable student-centered learning activities in it. It was expected that students' metacognitive skills can be facilitated so that students become independent learners.

According to the results of student questionnaires and teacher interviews conducted at MAN 5 Jombang show that biology was difficult for students, especially in photosynthesis topic. The result data of national examination from Puspendik Kemendikbud (2019) showed that the photosynthesis topic or carbohydrate anabolism in 2019 obtained a percentage of 34.44% so it was declared incomplete. The photosynthesis topic contains many abstract concepts, because the components involved and their bioprocess cannot be observed directly so students need to be

facilitated in the skill to think highly to understand the topic. An example is metacognitive skill.

In reality, metacognitive skills have not been facilitated, especially in biology subject. This was proven by the results of the pre-research student questionnaire showing that 70% of MAN 5 Jombang, students stated that the way teachers teach was classical or teacher-centered. Based on observations, the learning tools and learning resources were complete, for example student worksheet, but the student worksheet used has not implemented metacognitive strategy. The metacognitive skills can be facilitated using metacognitive strategies that are applied by the teacher while learning. One of strategies is by using the Know Want Learned (KWL).

Students will get many benefits if metacognitive skill can be facilitated. In academic that can be obtained are helping students to become self-regulated learners (Eggen, 2012). By becoming a self-regulated learner student will be responsible for the progress of his learning. Students are also helped to become self-directed learners who are able to direct their learning processes (Shannon, 2008). Facilitating in metacognitive skills will also have a great impact on one's life in the future. Because according to Susantini (2004), metacognitive skills can foster honest attitudes towards students, as well as being able to determine and try to achieve goals. P21 (Partnership for 21<sup>st</sup> Century Learning) has identified independent learning as one of the basic skills in life and career needed to prepare for education and work in the 21st century (P21, 2007; Zubaidah, 2016).

Through the photosynthesis topic student worksheet based on Know Want Learned (KWL) strategy was expected to be a medium for students to practice their metacognitive skills. This skill can be facilitated through 3 main learning phases, namely Know, Want, and Learned. Based on the description stated above, the purpose of this study was to describe the validity of photosynthesis topic student worksheet based on Know Want Learned (KWL) strategy to facilitate metacognitive skill of 12<sup>th</sup> grade senior high school.

## METHOD

The type of research was development of photosynthesis topic student worksheet based on Know Want Learned (KWL) strategy to facilitate metacognitive skill of 12<sup>th</sup> grade senior high school. The assessment instrument used was validation sheets. The data obtained were analyzed by descriptive qualitative. The development model used in this research is ADDIE which consists of analyze, design, develop, implement, and evaluate.

The research began with analyzing students; school curriculum; concept; task, then design and development of student worksheet conducted in October-December 2019 in the Department of Biology, Faculty of Material Science and Natural Sciences, Universitas Negeri Surabaya. There are 3 student worksheets developed with each different topic. 1). Places and components of photosynthesis, 2). Photosynthesis process, and 3). Ingenhousz photosynthesis experiment. The implementation phase used a limited trial on 15 students of MAN 5 Jombang in the even semester of the 2019/2020 school year. The final stage or evaluation of student learning outcomes was carried out in January-February 2020.

The validity of photosynthesis topic student worksheet based on the Know Want Learned (KWL) strategy was obtained from the results of validation by three validators, namely Education Expert, Plant physiology Expert, and Biology Teacher. Data collection techniques using the validation method through assessment activities by three validators using a Likert Scale (Table 1) The data that has been obtained, then collected and analyzed based on the mode.

**Table 1.** Likert Scale

Scale	Category
1	Poor
2	Average
3	Good
4	Very Good

(Adapted from Tuckman dan Brian, 2012)

The results of data analysis that have been obtained are then interpreted using the interpretation criteria of the validity score of the worksheet (Table 2). Photosynthesis topic student worksheet based on Know Want Learned (KWL) strategy developed was stated worthy if the mode obtained was 2.51-4.00.

**Table 2.** Interpretation of Validity Score Criteria of Student Worksheet

Validity Score	Category
1,0 – 1,4	Not Valid
1,5 – 2,4	Average
2,5 – 3,4	Valid
3,5 – 4,0	Very Valid

(Adapted from Ratumanan dan Laurens, 2011)

## RESULTS AND DISCUSSION

The validity of photosynthesis topic student worksheet based on Know Want Learned (KWL) strategy was obtained from the results of the assessment

conducted by an Education expert, Plant physiology expert, and Teacher of Biology MAN 5 Jombang. The aspects assessed by the validator of the student worksheet were content, language, design, KWL characteristic, and characteristic of learning steps facilitating metacognitive skill. The recapitulation of data on the validation result of student worksheet was presented in **Table 3**.

**Table 3.** Validation Result of Student Worksheet

No	Valued Aspect	Score			Mode
		VI	V2	V3	
<b>A. Content</b>					
a)	Learning objectives are arranged operationally	3	3	4	3,00
b)	Correctness of student worksheet material	4	3	4	4,00
c)	Compatibility of LKS with the revised 2013 Curriculum	4	4	4	4,00
d)	Completeness of student worksheet section	4	4	4	4,00
<b>Content Mode</b>					<b>4,00</b>
<b>B. Language</b>					
a)	Use correct Indonesian grammar rules	4	3	4	4,00
b)	The use of sentences that are clear, operational, and easy to understand	4	4	4	4,00
<b>Language Mode</b>					<b>4,00</b>
<b>C. Design</b>					
a)	Cover design and material used are appropriate	3	3	3	3,00
b)	Pictures are relevant and help students to work student worksheet	3	4	4	4,00
c)	Paper size, font size, and color of student worksheet used are appropriate	4	4	4	4,00
<b>Design Mode</b>					<b>4,00</b>
<b>D. KWL Characteristic</b>					
a)	Available <i>Know</i> phase (writing prior knowledge that students already have)	4	4	4	4,00
b)	Available <i>Want</i> phase (arrange the questions that student want to learn)	4	4	4	4,00
c)	Available <i>Learned</i> phase (writing the final knowledge that has just been obtained from the learning process)	4	4	4	4,00
d)	Available self and group columns	4	4	4	4,00
<b>KWL Characteristic Mode</b>					<b>4,00</b>
<b>E. Characteristic of Learning Steps Facilitating Metacognitive</b>					

No	Valued Aspect	Score			Mode
		VI	V2	V3	
<b>Skill</b>					
a)	Student worksheet facilitates monitoring skill: writing prior and final knowledge	4	4	4	4,00
b)	Student worksheet facilitates monitoring skill : comparing prior and final knowledge	4	4	4	4,00
c)	Student worksheet facilitates monitoring skill: determining the level of confidence	4	4	4	4,00
d)	Student worksheet facilitates evaluating skill: self-assessment	4	4	4	4,00
<b>Characteristic of Learning Steps Facilitating Metacognitive Skill Mode</b>					<b>4,00</b>
<b>Validity Score Mode</b>					<b>4,00</b>
<b>Category</b>					<b>Very Valid</b>

Explanation :

V1 : Validator 1 (Educational expert)

V2 : Validator 2 (Plant physiology expert)

V3 : Validator 3 (Biology teacher)

Based on the recapitulation of student worksheet validation results in **Table 3**. It was known that the result of mode on the content was 4.00; the language was 4.00; the design was 4.00; the KWL characteristic was 4.00; and the characteristics of learning steps facilitating metacognitive skill was 4.00 so the validity mode overall was 4.00. If the validity mode was interpreted based on the criteria of the validity score of student worksheet, the category was very valid (Ratumanan and Laurens, 2011).

**a) Content**

The validity assessment of the content consists of formulating operational objectives, correctness of the student worksheet material, compatibility of the student worksheet with the revised 2013 curriculum, and completeness of the student worksheet section aspects. The formulating operational objectives got mode of 3.00. That was because the learning objectives formulated only contain audience, behavior, and degree without conditions.

The correctness of the student worksheet material got mode of 4.00. That was because the material or summary presented in the student worksheet was appropriate with the concept, the images and information used were appropriate with the concept, the biological terms used was appropriate with the concept, and the concept of photosynthesis presented was correct.

The compatibility of the student worksheet with the revised 2013 curriculum aspect got mode of 4.00. This was because the student worksheet developed using basic competencies based on revised 2013 curriculum, support the achievement of the 2013 revised curriculum, and the material of student worksheet was appropriate with main competencies and basic competencies.

The completeness of the student worksheet section aspects got mode of 4.00. This was because the parts of student worksheet that had been developed were complete, such as there are front page, topics to be studied, learning objectives, general instructions for work, summary of material, tasks for students, and bibliography. Based on the result, overall the content component obtained mode of 4.00 with a very valid category (Ratumanan and Laurens, 2011).

Photosynthesis topic student worksheet based on KWL strategy was developed with good design from the construction and content, so that student worksheet developed was stated valid in terms of validity. According to Nieveen (1999), the validity of a product developed can be seen based on two main aspects, namely construction or physical aspects and content aspects.

#### **b) Language**

The validity assessment of the language component consists of the correctness of grammatical rules Indonesian used and the use of clear, operational, and easy to understand sentences. The aspect of correctness of grammatical rules Indonesia used got mode of 4.00. That was because the writing was appropriate with PUEBI (general spelling guidelines of Indonesian), the grammar used represents the contents of the message to be conveyed, the style of language does not cause multiple meanings, and does not contain SARA elements. According to Aryusmar (2011), good Indonesian is a language that keeps in mind the rules that apply.

The aspects of using clear, operational, and easy to understand sentences got mode of 4.00. That was because the sentences arranged were not convoluted, the language used was clear, and sentences in student worksheets were commonly used, making it easy for students to understand. This was suitable with the statement of Aryusmar (2011) who argues "that language is said to be straightforward if it is able to convey meaning directly by avoiding convoluted language".

#### **c) Design**

The validity assessment of the design component consists of the suitability of the cover design and the material used, the relevance level of the image in helping students to work on the student worksheet, and the suitability of the paper size, font size, and color of the student worksheet aspects. The suitability of the cover design and the material used got mode of 3.00. This was because the title matches the material, color; the location of the image; and the text was good combination, complete cover identity, but the student worksheet cover image was too crowded.

The mode of the relevance level of the image in helping students to work on the student worksheet aspect obtained was 4.00. That was because the picture according to the material, the images used were clear or not blurry, and the image descriptions were correct; clear; and easy to understand.

The suitability of paper size, font size, and color of the student worksheet aspect obtain was 4.00. This was because the student worksheet paper size used was suitable, the student worksheet font size was suitable, and the student worksheet color composition was appropriate. This was suitable with the statement of Dewi and Arini (2018), stated that an interesting presentation in the preparation of teaching materials will affect readability.

#### **d) KWL Characteristic**

The validity assessment of the KWL characteristic consists of the availability of the Know phase (writing prior knowledge that students already have), the availability of the Want phase (arrange the questions that student want to learn), the availability of the Learned phase (writing the final knowledge that has just been obtained from the learning process), and availability of self and group columns.

The aspect of the availability of the Know phase, the Want phase, and the Learned phase, as well as the availability of self and group columns got mode of 4.00. This was because in the student worksheet developed there were the main phases of Know, Want, and Learned in the learning phase which were arranged in order. According to Fengjuan (2010), the KWL strategy consists of 3 main learning phase, namely Know (writing information that students already have), Want (making questions about something that students

want to know), and Learned (writing information that students have learned).

The aspect of the availability of self and group columns got mode of 4.00. That was because the student worksheet developed, available columns that can be filled independently or in groups. The self column available in the Know and Want phase. With the self column in the Know phase, students can be facilitated to write their prior knowledge independently, besides students were also facilitated to arrange questions about something they want to know through the Want phase. The group column was in the Learned phase. With the group column was in learned phase, it would stimulate students to carry out discussions to answer questions that have been previously prepared.

#### e) Characteristics of Learning Steps Facilitating Metacognitive Skill

The validity assessment of the characteristics of learning steps facilitating metacongntive skill consists of the student worksheet facilitating students' monitoring skills by writing prior and final knowledge, comparing prior and final knowledge, and determining the level of confidence. The student worksheet facilitating students' evaluating skills by conducting independent assessment.

The student worksheet aspect facilitating students' monitoring skills by writing prior and final knowledge got mode of 4.00. That was because in the student worksheet developed, there were Know and Learned columns to write prior and final knowledge. The aspect of comparing prior and final knowledge obtain was 4.00. That was because in the student worksheet also facilitated column to compare answers from the Know and Learned column. The aspect of determining the level of confidence got mode of 4.00. That was because at the end of the Know and Learned columns there were column that contains the level of confidence in the answers that have been written in the Know and Learned columns.

The aspect of student worksheet facilitating the students' evaluating skills by independently evaluating got mode of 4.00. That was because at the end of the student worksheet there was a teacher and student assessment column. Student was given the opportunity to assess the learning

outcomes and then deviation was calculated with the teacher's assessment.

Monitoring and evaluating skills were chosen as indicators of metacognitive skills because these skills were very important to be facilitated. According to Tacassu in Hasbullah (2015) states that metacognitive is part of planning, monitoring, and evaluating. This skill is considered very important because it is necessary for students to instill the nature of always being aware of their mistakes and continuously trying to improve themselves.

Overall these results indicated that the photosynthesis topic student worksheet based on KWL strategy that had been developed was appropriate based on the content, language, design, KWL characteristics, as well as the characteristics of learning steps facilitating metacognitive skills, in addition the student worksheet developed has met requirements for preparation of good student worksheet, consisting of didactic requirements; construction requirements; and technical requirements (Widjajanti, 2008). According to Depdiknas (2004), well-developed student worksheet are appropriate as a medium for achieving learning objectives.

#### CONCLUSION

Based on the results of development research that had been carried out it could be concluded that the photosynthesis topic student worksheet based on KWL strategy to facilitate students' metacognitive skill of 12<sup>th</sup> grade senior high school was declared very valid based on the results of validation by education expert, plant physiology expert, and biology teacher. Therefore, the student worksheet developed were worthy to facilitate the metacognitive skill of 12<sup>th</sup> students.

#### SUGGESTION

Some suggestions related to this research were similar research need to be conducted to apply the develop students worksheet in larger scale and similar research need to be conducted to apply the different complex topics.

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