

Mind Maple Lite Software : Improving Students' Learning Outcomes and Stimulating Metacognition in The Subject of Nutrition Science

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Abstract—This study aimed to determine the validity, the practicality, and the effectiveness on the development of learning tools using software of Mind Maple Lite metacognition-based on meta lesson nutrition science. This research was 4-D model from Thiagarajan by using the intact-group comparison design on students of Vocational High School in Surabaya, Indonesia. The validity of learning showed that the syllabus fulfilling validity was very good criteria. They are 1) implementation of teaching was very good criteria, 2) Student Worksheet criteria was very good, 3) practicality of learning in the implementation of teaching was done very well and 4) an average students' responses was responded well. The effectiveness of learning consisted of learning outcomes and metacognition abilities. Learning outcomes using mind maple lite metacognition-based software were better than those using power point media on nutrition subject. While metacognition ability using mind maple lite media metacognition-based software was better than using power point media on nutrition subject.

Keywords—mindmaple lite software; metacognition; nutrition science

I. INTRODUCTION

Instructional materials are the specific items used in the lesson. It may give influence on the students' learning. Learners will remember the materials, if they are created, integrated, and presented in the manner that allowing them to have the needed impact [1]. Learning is inseparable from learning tools. Learning tools are a set of media as it is used by teachers and students in learning process, as well as it is prepared by the teachers in face to face learning in the classroom [2]. Learning media evolves by the time. It is a media applied to help transferring information to the students in order to avoid misinterpretation. The Development of Science and Information and Communication Technology (ICT), provides significant changes to the development of learning process. The development of science and technology encourages various the updated of learning process. As one of the efforts to improve the quality of education, it requires various breakthroughs, in terms of curriculum development, learning innovation and the fulfillment of educational facilities

and infrastructure. Teachers are required to make the learning to be more innovative that encourages the students in learning optimally in self-study or in classroom learning [3]. ICT, as today's development of learning, becoming a major requirement. Mind Maple Lite software is one of learning medium using ICT in the form of making mind map with the help of software installed in computer.

Nutrition science is one of the subjects in vocational high school Department of Culinary that has many concepts and terms. It is grouped based on several things including function, the amount needed by the body, source, the impact of deficiency and hyper nutrients [4]. Based on the result of interview with a science subject teacher on X grade of Culinary skill program at Vocational High School 6 Surabaya, student's learning achievement of Vocational High School of Catering for nutrition subject is still on below average. The implementation of nutritional learning is done by expository method. In this case, teachers explain the materials in front of the grades by using powerpoint, however, they still not fully understand about its concepts and terminologies of nutrition science subject. It can be seen from the result of students' learning. This data reinforces the conclusion that the quality of learning outcomes and learning process of students at vocational high school culinary of 6 surabaya, is still not as the expected. In this study, the development of devices are implemented on the subject of nutrient science.

For students, it is important to have metacognition due to its ability that connected to the strategy on how the students learn and think to the notion of 'thinking'. Metacognition plays an importantly in the roles of communication, self-control, memory, problem solving and personality development [5]. In the previous study, the relationship of mind map and metacognition was done by Adodo. His study shows that mind-mapping strategy, as a Self-Regulated Learning, help the students to improve their performances in the basic science and technology and to employ in the grade class as the better approach to be taught. It can be concluded that mind map can help students improving their metacognitive skills [6].

In the vocational schools, nutrition science is known to be loaded with many concepts and terms. So, creating mind map by applying Mind Maple Lite Software is very synergistic for students' learning strategy which based on their metacognition. Mind Maple Lite metacognition-based software is expected to be developed since it provides new learning resources for students, especially in Vocational High School of 6 Surabaya.

Mind Maple Lite software is a new learning resource. It is because this media is still applied powerpoint media during the learning process. To extend students' reading comprehension, mind mapping strategy is the solution that can be utilized in teaching. In addition, it is influential to enhance students in their reading comprehension [7].

The type of this research is development research (research and development). It is aimed to develop learning device using Mind maple Lite software metacognition-based. The learning tool used is piloted in the graderoom which is purposed to improve students' learning outcomes and metacognition abilities. Developed tools include Learning Implementation Plan, Student Worksheet and Test Results Learning. Development of device refers to 4-D model proposed. The purpose of this stage is to define the terms of learning. Stage is conducted by using objective analysis within boundaries of subject matter to develop the device. There are five main steps in this phase: 1) front end analysis, 2) student analysis, 3) task analysis, 4) concept analysis and 5) formulation of learning objectives.

II. METHODS

A. Assessment of Media Validity

Assessment of media validity was carried out by three experts consisting of media expert, educational expert, and material expert. Experts will fill out a validation questionnaire of learning devices with a scale description in Table I.

TABLE I. LIKERT SCALE [8]

Assessment Criteria	Scale
Very Valid	5
Valid	4
Valid enough	3
Invalid	2
Very Invalid	1

After having validation, the result is obtained and the analysis is done by looking at to the assessment that made by validator. Analysis is done by calculating an average of each indicator, and then it is converted into a value of interval form

$$\text{.Score's Interval} = \frac{\text{highest score} - \text{lowest score}}{\text{total grade}} =$$

$$\frac{5-1}{5} = \frac{4}{5} = 0.8$$

1.0 s/d 1.8	: very invalid
> 1.8 s/d 2.6	: invalid
> 2.6 s/d 3.4	: valid enough
> 3.4 s/d 4.2	: valid
> 4.2 s/d 5.0	: very valid [8]

B. Analysis of learning implementation.

Observation of the implementation of learning is done by two observers who have been trained to provide an assessment. Assessment is done by filling the checklist in Likert scale scoring column as presented in Table II.

TABLE II. LIKERT SCALE [8]

Assessment Criteria	Scale
Good (done, precise and systematic)	4
Good enough (done, but not quite right)	3
Less good (done but not finished)	2
Not good (not done at all)	1

The result of observer's rating is summed and averaged by matching the interval as follows:

$$\text{Interval Score} = \frac{\text{highest score} - \text{lowest score}}{\text{total gradees}} = \frac{4-1}{4} = \frac{3}{4} = 0.75$$

Note :

1.00 s/d 1.75	: Bad
> 1.75 s/d 2.50	: Not Good
> 2.50 s/d 3.25	: Pretty Good
> 3.25 s/d 4.00	: Good [8]

C. Analysis of learning outcomes.

Analysis of learning outcomes is the analysis of cognitive learning outcomes, psychomotor and affective. Cognitive tests are performed by giving post-test problems. Problem made with number of items about 38 items. Calculation of given score is as following:

$$N = \frac{JB}{\sum S} \times 100$$

information :

N: Score post-test

JB: Right answer

$\sum S$: total of test items

Psychomotor test analysis was conducted on student practice by using 12 criteria of assessments aspect. Here is formula to know the psychomotor value of students:

$$\text{Average value of all aspects} = \frac{\sum \text{average value each aspect}}{\sum \text{all aspect}}$$

Average value of all aspects can be described as follows:

Very good	: 90 ≤ score ≤ 100
Good	: 75 ≤ score ≤ 8
Enough	: 60 ≤ score ≤ 74
Bad	: 40 ≤ score ≤ 59

Very Bad : $0 \leq \text{score} \leq 39$

Affective test analysis is implemented by assessing students' spiritual and social attitudes during the learning process. Here is the following steps to calculate students' affective values:

$$\frac{\text{score}}{\text{maximum score}} \times 4 = \text{final score}$$

The final score of each student is described as follows:

Very Good : $3.33 < \text{score} \leq 4.00$
 Good : $2.33 < \text{score} \leq 3.33$
 Pretty Good : $1.33 < \text{score} \leq 2.33$
 Bad : ≤ 1.33

D. Analysis of student responses

Assessment of students' responses to media is done by students. They fill out students' response questionnaire by looking at Likert scale as presented in Table III.

TABLE III. LIKERT SCALE [7]

Assessment Criteria	Scale
Very good	5
Good	4
Pretty Good	3
Bad	2
Very Bad	1

The results of students' responses are obtained and by looking at to the assessment made by students. The analysis is done by calculating an average of each indicator and it is converted into a value of interval form.

$$\text{Interval value} = \frac{\text{Highest score} - \text{lowest score}}{\text{Number of classes}} = \frac{5 - 1}{5} = 0.8$$

1,0 s/d 1,8 : Very bad.
 > 1,8 s/d 2,6 : Bad
 > 2,6 s/d 3,4 : Pretty Good.
 > 3,4 s/d 4,2 : Good
 > 4,2 s/d 5,0 : Very Good [9]

Average of each indicator can be deduced by matching the interval of values that has already described.

E. Metacognition Capability Analysis

Metacognition ability data is measured by scoring of metacognition on each sub-aspect including declarative knowledge, procedural knowledge, conditional knowledge and evaluation. After obtaining the results of MAI Jr, the analysis of statistical test of learning outcomes done with following the steps of normality test, homogeneity test and hypnosis test [10]

F. Statistical Test Results of Learning Analysis

Students' learning outcomes were obtained based on the two indicators. First, it was based on the grades that did not use computed-based media as the learning media, with metacognitive strategies (control grades). Second, it was based on the grades that use computer-based learning media, with metacognitive strategies (experimental grades). Statistical test of learning result analysis is done by using normality test step, homogeneity test and hyposis test.

III. RESULTS AND DISCUSSIONS

A. Study of Learning Device Validity

Study of validity on the syllabus used has a score of 4.0 for identity and 3.52 for formulation of its contents with very reasonable criteria that are shown in Table 4.2. Teaching Implementation Plan has been designed to be validated by an expert. Teaching Implementation Plan validation results can be seen in table 4.3. It shows that Teaching Implementation Plan on format aspect is purpose to obtain very valid assessment, a good judgement of language and content and minor revision. Developed student worksheet is validated by two experts. The result shows that student worksheet is feasible to be used as a learning tool. In term of validation, the results of learning are content and construct, in which the content of validator scoring result of 3.88. The results of multiple choice of THB assessment have developed by the researchers. In this case, it is feasible to be implemented in the learning process. In term of construct validation, it includes reliability, distinguishing power and difficulty.

The result of reliability calculation shows a high degree of reliability that is 0.91. The consistency problem occurred reminds good. It is related to the problem applied in a small test/limited trial that result the same to large grade trials. Differentiating power test of post-test grain analysis obtain 34 items of very good category because power distribution is index > 0.40, while 6 is on question of number 12, 17, 22, 26, 34 item of bad category because of its power difference index ≤ 0.20 . Distinguishing power is the ability of a matter to distinguish between clever students and less intelligent [9]. Problem-level difficulty test shows that they are 7 easy questions that has index criteria > 0.75. Furthermore, they are 23 problems of medium category has index $0.25 < p \leq 0.75$. Problem within difficult category is 10 questions. Problem level of difficulty is an opportunity to have a correct answer in a particular level of ability [11].

B. Practicality Study

1) Implementation of Teaching Implementation Plan

In summary, results obtained based on the observation in Teaching Implementation Plan indicate that assessment used by two observers, using Mind Maple Lite software metacognition-based which has good criteria. It can be concluded that Teaching Implementation Plan is done well, applied appropriately and systematically; and on time. Based on results obtained, it can be concluded that teacher has been implemented all syntaxs in Teaching Implementation Plan.

2) Student Response

Questionnaire of students' response of learning activities are given to students, after learning process at last meeting. Applying Mind Maple Lite software is something new to students. This shows that the consideration of choosing mind mapping strategy is to increase student learning strategy in order to achieve the result of questionnaire of students' response. The using of computers during class by teachers has also a positive impact on the development of learner's affective domains [12].

C. Study on the Effectiveness of Learning

1) Learning Outcomes

Result of learning analysis showed that student's learning outcomes using Mind Maple Lite metacognition-based software media is better than those who using power point media on nutrition subject. This is line with statement of mind mapping excellence. Maximizing performance of brain can be done by improving knowledge of management performance. In this case, more ideas and information are interconnected that can be presented as well. Making mind mapping using images and colors can spur the creativity [13].

Metacognition of ICT has been done by using web-based to measure the capacity of students in self-assess understanding (learning), student regulation of learning (level of trust), class dynamics (reactions) and instructor methods. Results of the research are to evaluate how students regulate the learning and improve the ability to self-assess understanding that to be more critically [14].

One of main concerns of educational system is how to create and implement an environment which places the student's experience in the central. It doesn't refer to ask the student to read homework, or just engage student in pairs or group work activities. Student-centered activities are core of educational process; it is equivalent to an effectively education [15].

2) Metacognition Skills

Metacognition ability is the ability to access knowledge and manage the cognitive development. It is divided into two things; knowledge and regulation metacognition. Questionnaire of MAI-Jr. is filled by 30 students. The results obtained that 25 students categorized ok, super 3, developing 2. "Developing" category means to develop metacognitive ability. "OK" category means being able to perform metacognitive abilities for learning process. "Super" means being able to perform metacognitive abilities for learning process well and it applies to any conditions encountered though the subjects.

Metacognition is "thinking about one's own thinking". There are two aspects of metacognition: reflection-thinking (what we know) and self-regulation- managing (how we learn). By putting together, these processes are considered as an important aspect of learning and development. Developing the metacognitive abilities is not simply as becoming reflective learners, but it is about acquiring the specific learning strategies as well [16].

Mind Mapping has positively impacted on cognitive and affective aspects of student's science learning. The majority of students report that mapping can enhance into learning in a variety ways, both cognitive and affective domains. Particularly, appreciated creative facets of scheme and assistance gave the students to understand the concepts and ideas. Improving confidence and to be more positive attitudes towards learning were also apparent [17]

The method used to uncover student's thinking is explored within the context of an ongoing, multi-year intervention designed to promote development of students' thinking dispositions, specifically on meta-strategic knowledge.

It is also presented the development a concept-map instrument that used by teachers in the classroom. Indeed, an analytic framework to interpret student's responses Results suggest that students' conceptions of thinking not only can be improved by the age, but also it can be substantially developed through a classroom culture. The thinking is modeled and has rich opportunities. A concept of map instrument is proved to be a robust instrument for uncovering student's thinking [18].

IV. CONCLUSIONS

Syllabus of learning device using Mind Maple Lite software metacognition-based in the subject of nutritional science is feasible to be implemented in learning activities. Based on result of validator assessment summary, it can be concluded that developed syllabus fulfills validity and quality requirements covering an average value of 3.81 in experimental grade and 3.74 in control grade with has very good criteria. Teaching Implementation Plan using Mind Maple Lite software metacognition-based in the science of nutrition is feasible to be implemented with minor revision in the learning activities. Based on result of validator assessment summary, it can be concluded that developed Teaching Implementation Plan qualifies validity and quality covering an average score of 3.52 in experimental grade 3.48 in control grade with has good criteria. Student Worksheet using Mind Maple Lite software metacognition-based in the subject of nutritional science is feasible to be implemented in learning activities. Based on result of validator assessment summary, it can be concluded that developed student worksheet validity and quality requirements covering an average value of 3.86 with has very good criteria. Learning Outcome Test using Mind Maple Lite software metacognition-based in the subject of nutritional science is feasible to be implemented in learning activities. Based on results of validator assessment summary, it can be concluded that compiled Learning Outcome Test fulfills validity and quality requirements covering an average value of 3.88 with has very good criteria. Test item shows test reliability value of 0.91, it can be concluded that item is gratified as a high degree of reliability. The instrument reliability criterion is ≥ 0.80 . Differentiating power of test on post-test grain analysis find 34 items in the category of very good because it has difference in power index > 0.40 . Whereas on 6 is number of 12, 17, 22, 26, 34 on bad category because it has distinguishing power index $\leq 0, 20$. There are 7 easy category problem because it has index criteria $> 0,75$.

Furthermore, there are 23 problems of medium category because it has index $0,25 < p \leq 0,75$.

Teaching Implementation Plan has an average of 3.82 in the experimental grade and control grade which means that learning is done very well. Student responses in experimental grade have an average of 86%. It indicates that they respond well regarding to the learning by using Mind Maple Lite software, on nutrition science subjects. Students' responses in control grade have an averaged of 42% indicating that they respond well to the learning by using power points.

Learning outcomes using Mind Maple Lite media metacognition-based software is better than those using power point media in nutritional science subjects. This is proven by t-test which has a 0.05 significance of 0.000. Metacognition ability in the form of MAI Jr. using media software Mind Maple Lite metacognition-based is better than those which use power point on nutrition science subjects. This is proven by t-test which has a 0.05 significance of 0.000.

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