Theoretical And Emperical Validity of Student WorkSheets To Train Eco Innovation In The Study of Food Analysis

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***Abstract*—Research has been conducted on the development of Student Worksheets to practice eco innovation in the food analysis course. This development is motivated by the implementation of the *FMIPA Unesa SD-Dikti* curriculum based on ecopreneurship KKNI. Eco innovation is a part of eco preneurship. The development method uses 4D models which are limited to the developing. The results obtained indicate that the resulting LKM has obtained valid values in terms of theoretical validity. The results of trials on eco innovation assessment tests show students are sufficient in developing new ideas, explaining phenomena, producing a product, reasoning skills, critical thinking skills, creative thinking, and problem solving skills but are good at scientific thinking.**

Keywords—eco innovation, Student Worksheets, food analysis

I. INTRODUCTION

Encouragement of the Ministry of Research, Technology and Higher Education to make curriculum changes in each Higher Education becomes a challenge for *Universitas Negeri Surabaya* (Surabaya State University-*Unesa*) to make curriculum changes. After going through a long and complex process finally, *Unesa* was able to implement a new curriculum called the *KKNI* Curriculum. *KKNI* curriculum (Indonesian national qualification framework) is a framework of work qualification gap that juxtaposes, equalizes, integrates, education and training sectors as well as work experience in the context of providing work competency recognition under work positions in various sectors. *Unesa* has implemented the *KKNI* Curriculum since 2015. The philosophical foundation of *KKNI* curriculum development in *FMIPA* (Faculty of Mathematic and Natural Science) *Unesa*, as stated in the vision of *Unesa* and *FMIPA* is "Excellence in Mathematics and Natural Sciences Education, Solid in Mathematics and Natural Sciences", this curriculum boils down to excellence in Mathematics and Science Education Natural and solid knowledge in Mathematics and Natural Sciences. This is following the mandate carried by *FMIPA Unesa* as one of the Institutions Producing Education Personnel (*LPTK*) which studies education and produces graduates as educators and educational staff characterized by Eco preneurship. Eco preneurship, namely the development of an entrepreneurial spirit that pays attention to the sustainability of the environment. The definition of eco preneurship is developed from eco-innovation, eco-opportunity, and eco-commitment [1].

One of the courses in the chemistry study program is the subject of food analysis. Food analysis subject is one of the elective analytical chemistry courses. The description of the food analysis course is a study of the basic principles of food analysis methods and the quality of the data, in terms of chemical structure, analysis and application including validation, how to analyze macro and micronutrients in various foods with classic methods and modern methods and determination of analysis methods appropriate based on standard methods or supporting journals accompanied by supporting laboratory activities so that students are able to master related concepts, are skilled at using tools, able to collaborate and be responsible and can communicate their knowledge and skills scientifically and their applications in the business sector. This course invites students to be able to think creatively and innovate in making food products and conduct macro and micronutrient analysis contained in these food products. It also developed a thought towards the entrepreneurship of food products that were successfully made. Based on the description, the food analysis is suitable for eco preneurship application.

The application of eco preneurship is in line with the condition of the number of productive ages. The greater the number of productive ages, the greater the number of jobs needed. Employment needs to accupy the largest position in the labor field. That is because the number of entrepreneurs (entrepreneurs) is relatively smaller compared to the number of workers (employees). Until now, the number of entrepreneurs in Indonesia around 400,000 people or 0.18% of the population stated that a country can prosper if there are entrepreneurs of at least 2% of the population [2]. The application of eco preneurship in lecture activities aims to anticipate the productive age population who are not accommodated by employment and develop a conducive business climate that provides opportunities for new entrepreneurs. The essence of entrepreneurship is the act of processing various resources and transforming them into profitable commercial products [3]. Entrepreneurship education in each course is one vehicle to prepare prospective entrepreneurs or entrepreneurs who will prosper in this nation.

The application and development of eco preneurship activities have been carried out at the senior secondary or tertiary level. Some applied it to biology, to chemistry courses, to welding practice lessons at SMK [4-6]. Edutainment is a modern technology in teaching education-

based eco preneurship [7,8]. The development of lectures on food analysis has so far been limited to testing food products by conducting macro and micronutrient analysis of these products and presented for discussion. Students have not been invited to complete a project in the form of food products, have not been invited to think in the direction of commercial products. Lectures also have not invited students to apply in the field of business, have not tried to explore student ideas for innovative food products by utilizing Indonesia's natural resources.

In this study, researchers will test the theoretical and empirical validity of Student Work Sheets (*LKM*) for project-based food analysis courses to train eco innovation. Indicators of eco innovation developed to include the development of new ideas, explaining phenomena, producing a product, reasoning ability, critical thinking skills, scientific thinking, creative thinking, and problem solving skills. This research is important to carry out *FMIPA* curriculum namely *KKNI* based on eco preneurship. Besides that, it becomes one of the means to form new entrepreneurs through food analysis courses.

This research is important because it is a means to implement the Eco preneurship-based *KKNI* curriculum. Besides, it is also a means to train entrepreneurial spirit for students through courses. Students not only understand the material both theoretically and practically but also develop the ability to think creatively, provide challenges to students, the ability to see opportunities due to environmental aspects, but still use commitment to the environment as its foundation. And a willingness to work hard and give energy and time to lecture activities that result in problem solving or environmentally friendly work.

II. METHOD

The device development model according to Thiagarajan, Semmel, and Semmel is a 4D (four D models) model. This model consists of four stages of development, namely Define, Design, Develop and Disseminate. However, only the Define, Design, and Develop phases are accompanied by a limited trial involving 20 students in the implementation of a limited trial. Theoretical validity is determined based on expert judgment, and empirical validity is based on the results of learning tests and student responses [9]. Theoretical validation is said to be valid if it scores 51-75% and is very valid if it is 76-100%. Meanwhile empirical validity is declared valid if it gets a value of 61-80 and very valid if it gets a value of 80-100 [10].

III. RESULTS AND DISCUSSION

Based on the results of the study obtained the results of the study as in table 1. Table 1 shows the results of *LKM* validation. The results of the validation are based on content criteria, presentation criteria and language criteria. Based on the data in table 1 it can be said that the *LKM* developed has been valid according to the content criteria, presentation criteria, and linguistic criteria (theoretical feasibility). Based on the content criteria, it is seen the suitability of *LKM* with *KKNI* curriculum, indicators, course descriptions, student needs, material substance, and with eco innovation indicators. Content criteria are the most important thing in developing an *LKM*. This is because in the *LKM* contains the concept of material and the founding part of the *LKM* in this case eco innovation [11,12]. The material in LKM must be based on curriculum and learning indicators that must be achieved by students [13,14]. Based on the theoretical validation parameters, it can be said that the *LKM* developed received a very decent assessment.

TABLE I. *LKM* VALIDATION RESULTS FOR FOOD ANALYSIS

NO	Criteria	Average score	Score Percentage
1	Content	4	100
2	Presentation	4	100
3	Language	3,87	96,75
Average score percentage			98,92

Eco innovation indicators taken include developing new ideas, explaining phenomena, producing a product, reasoning ability, critical thinking skills, scientific thinking, creative thinking, and problem solving skills. Empirical validity assessment is carried out through the stages of the eco innovation test evaluation test, the results of which are obtained data as in table II.

TABLE II. ECO INNOVATION ASSESSMENT TEST RESULTS

NAME	Test Code					
	1	2	3	4	5	6
ADA	8	10	8	10	10	8
FNS	6	10	6	4	10	2
APD	10	10	8	4	4	8
LEN	8	10	10	10	2	6
SAR	6	10	10	8	10	4
SNR	6	10	8	4	10	6
NL	10	10	10	10	2	10
DW	6	10	8	10	2	6
NS	8	8	8	10	4	8
IN	8	10	8	4	2	4
QA	6	10	8	6	8	10
FS	6	10	8	10	2	6
SN	8	10	8	10	4	8
IH	8	10	8	4	2	6
PEP	8	10	10	4	10	5
YEY	6	10	10	10	2	8
RDWP	8	10	8	10	2	6
SNR	8	8	8	0	10	8
LAP	6	10	6	4	4	10
AJ	6	10	4	10	4	10
NH	6	6	6	4	8	4
DAT	6	10	6	10	4	8
MDR	6	10	8	4	10	10
ES	6	10	6	10	4	6

NAME	Test Code					
	1	2	3	4	5	6
SI	6	10	8	4	4	6
AHW	8	10	10	2	4	6
WODS	6	8	6	10	10	6
AVD	6	10	8	4	8	6

Information:
Problem no 1. Produce a product / development of new ideas / creative thinking
Problem no 2. Thinking scientifically
Problem no 3. Do innovation
Problem no 4. Think scientifically
Problem no 5. Ability to reason / solve problems
Problem no 6. Explain the phenomenon

Each of these questions has been accompanied by a rubric to judge. In questions number 1, 3, 5 and 6 get a value of 10 if students issue new ideas and innovations. Score 8 if issuing a new idea but not innovation or vice versa. A score of 6 if a student issues ideas but is not new and there is no innovation. Score 4 if you get an idea but don't fit the concept. Score 2 is just writing answers and wrong answers. As for questions number 2 and 4, score 10 if true and correct. Problem number 2 there are 5 answers, then each answer gets a score of 2. For question number 4 if it is correct between the answer and the reason for the score 10. Score 8 if the answer is correct but the reason is incomplete. Score 6 if the answer is correct but the reason is incorrect. Score 4 if answering with other answers but still related to the question. Score 2 if answering but the wrong answer.

Based on the data in table 2 looks at the problem of producing a product/ development of new ideas the average student gets a score of 6. It means students answer but not a new idea and there doesn't appear to be any innovation even though there are students who score 8 and 10. For questions number 2 and 4 about scientific thinking, many students get a score of 10. Students are accustomed to thinking scientifically. Likewise with question number 3. Students have been able to come up with new ideas but the innovation has not yet emerged. For problem solving problems (problem number 5) the tendency in the value of can and cannot. Most of the scores that appear are 10 or 2. Meanwhile, for question number 6 about explaining the phenomenon, most students also get a value of 6, which means they cannot explain the phenomenon that occurs in their respective areas to give birth to an innovative idea.

Based on the data in table 2, the average eco innovation ability of students in food analysis courses can be calculated and presented in table 3.

TABLE III. AVERAGE STUDENT ECOINNOVATION SCORES

No	Eco innovation skills	Average student score
1	Produce a product / development of new ideas / creative thinking	7
2	Scientific thinking	8,2
3	Doing innovation	7,9
4	Solve the problem	5,6
5	Explain the phenomenon	6,8

The average score on eco innovation skills is highest on the ability to think scientifically. As a chemistry student, scientific thinking is always done through chemistry learning. This results in the highest score. The ability to think scientifically will carry over to other abilities. Such as the ability to think creatively, the ability to innovate, the ability to solve problems and explain phenomena. Explaining phenomena is part of scientific thinking. There is a relationship between the ability to solve problems with creative thinking. The ability to solve problems requires the ability to meet creativity and a deep understanding of the problems it faces [15]. Other research also states that problem solving is a combination of creative and logical thinking [16, 17]. But the ability of students in creative thinking is lower so that the score on the ability to solve problems is the lowest compared to other parameters. Based on these data it can be said that although students have been trained to think scientifically but have not been trained to solve problems creatively.

Students also fill out questionnaires on responses to the developed *LKM*. Response questionnaire sheets are made in the form of open questions. Student responses to *LKM* eco innovation developed are summarized in table 4. The results of the student response questionnaire were in line with the results of the test where there were students who answered able and those who answered unable. Students generally realize that the *LKM* developed has trained them to be more creative and innovative, but students also realize that they are not yet fully creative and innovative.

TABLE IV. DATA ON STUDENT RESPONSES TO THE RESULTS OF THE DEVELOPMENT OF *LKM* ECO INNOVATION

No	Criteria	Question	Summary of student responses
1	Criteria for developing new ideas or innovations	Are you thinking about new ideas for food products?	Students have thought of several new ideas on food products using natural ingredients. Like making various flavor chips, spicy level chips, banana weevil chips, banana heart floss, jackfruit nuggets and so on.
2	Criteria for the ability to think creatively	Is learning in this subject able to train you to think creatively? Explain your	Students all agree that this learning is able to train students' creative thinking skills through the

No	Criteria	Question	Summary of student responses
		reasons!	manufacture of food products
3	Criteria for scientific thinking	Are you able to develop scientific thinking?	Students say yes they are able, trying, and a little
		Do you understand well the reasons for choosing the analysis method?	Students answer yes, understand the reasons for choosing the analysis method well, understand a little and understand enough
		Do you understand the procedure of food analysis well?	Students answer yes, understand the procedures of the analysis method well, understand a little and understand enough
4	critical thinking skills	Do you feel trained to think critically with the application of this project-based learning?	All students answered that they have been trained in critical thinking
5	problem solving skills	Are you able to solve the problems that you face during the study of food analysis?	Students answer that they are able to finish and have not been able to finish
6	skills to explain phenomena	When given the phenomenon of regional potential, can you explain it well?	The student answers that he is able to explain well and fairly well
7	General conclusion	Does the *LKM* help you be more creative and innovative?	Students believe that *LKM* developed is able to teach creative thinking and innovation

To ensure the student's ability to solve problems, a learning achievement test is conducted. The results of the learning outcomes test can be seen in table 5. The determination of completeness is based on the specified remedial limit of 68. So that values above 68 are considered to have been completed in learning. The results of this test are equivalent to the ability to think scientifically. In the scientific thinking ability test students get an average score of 8.6 out of 10 and on the learning achievement test an average score of 77.6 out of 100 with a 75% completeness. Thus it can be said that the eco innovation *LKM* developed has been theoretically valid, received a positive response from students but has not been able to complete the assessment of eco innovation in a classical way or said to be valid in empirical validation.

TABLE V. TEST RESULTS FOR LEARNING OUTCOMES

Name	Score	Completeness
ADA	71	Yes
FNS	68	Yes
APD	72	Yes
LEN	77	Yes
SAR	67	No
SNR	64	No
NL	75	Yes
DW	64	No
NS	74	Yes
IN	75	Yes
PEP	75	Yes
YEY	60	No
RDWP	74	Yes
SNR	60	No
LAP	72	Yes
AJ	74	Yes
NH	68	Yes
DAT	79	Yes
MDR	72	Yes
ES	62	No
QA	64	No
FS	75	Yes
SN	68	Yes
IH	74	Yes
SI	74	Yes
AHW	68	Yes
WODS	71	Yes

Name	Score	Completeness
AVD	75	Yes
Average value	77,6	
Total Completion : 21 mahasiswa = 75 %		
The number is incomplete : 7 mahasiswa = 25 %		

IV. CONCLUSION

The results obtained indicate that the resulting *LKM* has obtained very valid values in terms of theoretical validity. Based on empirical validation shows that students are sufficient in developing new ideas, explaining phenomena, producing a product, reasoning ability, critical thinking skills, creative thinking, and problem solving skills but are good at scientific thinking. In general it is concluded that the results of the empirical validation of eco innovation *LKM* are valid. In the future, it is hoped that there will be more efforts to complete students' eco innovation abilities.

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