

The Development of Biology Learning Tools with Project Based Learning (PjBL) Model to Improve The Sustainable Reserve Food Garden (SRFG) program of grade X students in SMAN 1 Singosari

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Abstract

SRFG (Sustainable Reserve Food Garden) is a program has an important role to achieve self sufficiency food in community. This research and development has aims to development of learning tools with Project Based Learning (PjBL) model to improve SRFG program for grade X students . Test development product consists of validity test, practicality test and effectiveness test. Procedure of development adapts model of development Thiagarajan (1974) which only consists of 3 steps: 1) define; 2) design; and 3) develop. The results of validation test showed that learning tools is very valid because the average percentage of assessment over 85%. The result of practicality test showed that learning tools is very practical because it can be applied in the class and the average percentage of practical level is 95.3%. The results of effectiveness test showed that learning tools is very effective because of increase in test scores, the average percentage of student activity is 91.2%, the products has positive respond by 81.1% of students and teacher.

1. INTRODUCTION

The implementation of the curriculum in 2013 is direct to demanding for developing attitudes, knowledge and skills in students (Hosnan, 2014). The methods to increase quality students is actualizing the character education. Wisudawati and Sulistiyowati (2013) The character education can make efforts to change attitudes carried out by various society that aim to increase knowledge, skills and awareness about the environmental problems (Wisudawati and Sulistiyowati, 2013). The environmental problems in urban areas is reduction of agricultural. This problem can be solve with SRFG (Sustainable Reserve Food Garden) program. The principle of SRFG program was used and designed field for diversification of food based on local resources. The SRFG program can be introduced the student in school to increase the environment awareness.

The application of learning to support of the SRFG program in the school can be done with the learning model PjBL because the PjBL model enables students to collaborate with teachers. When students

learn in teams, students will find the skills to plan, organize, negotiate and make a deal about the things that will be done (Sani, 2014). The PjBL model application study is needed to improve the achievement of learning objectives primarily related to the SRFG program at the school. The results of the analysis show that the implementation the SRFG program can be performed on material changes in the environment / climate and recycling of waste on the high school class of X contained in KD 1.1, 1.2 KD, KD 1.3 (spiritual attitude); 2.1 KD, KD 2.2 (social attitudes); KD 3:10 (knowledge); and KD 4:10 (skills).

The school can be applied the SRFG program is SMAN 1 Singosari. The school environment is very suitable to be applied for SRFG program because it has a large area and far from pollution. The application of SRFG program on teaching and learning activities require a learning tools. The development of research conducted with the aim to produce and test the products in the PjBL model learning tools supporting the government's program for students of class X IPA. Test product

development consists of test validity, test the practicality and effectiveness testing tools developed learning.

2. RESEARCH METHODS

This type of research is the development of research that adopts the 4D model developed by Thiagarajan (1974), which is limited to the stage of development (develop). Stage after stage of development is spreading (disseminate). Phase dissemination in the 4D model is not conducted on this development research activities. This is because the dissemination phase post-research more focused on activities by disseminating the results of research products. The 4D model have been done in development research for the development procedure is more detailed and systematic order. Learning tools developed include the syllabus, lesson plan, student worksheet and assessment.

Learning tools development procedures in the research is the definition phase (define), design (design), and development (develop). Defining an early stage development activities 4D model by the way of analyzing the needs of product development. This stage is the stage for establishing and defining the terms of the learning. The stage of defining includes: 1) analysis of the front end is made to assess the learning biology in the Curriculum in 2013 is mainly the basic competence, 2) analysis of students conducted to examine the characteristics of students consisting of students' backgrounds and skill levels of students, 3) analysis of the tasks performed by analyze competencies, basic competencies and teaching materials are used to develop a learning tools,

The next stage is the stage of design (design). The design phase is done to design a product that will be developed. The design stage is preparation of reference test, media selection using the PjBL model, permendikbud election in accordance with the format in 2014, and the preliminary design of the support SRFG program. The results of this design stage into the initial prototypes.

The next stage is the stage of development (develop). The development phase aims to determine the validity, practicality, and effectiveness of the products made learning tools. The development phase includes expert validation and test development. At the stage of expert validation, an early prototype test validation by three experts, such as materials experts, learning tools experts and field practitioners. Validator in this study were Dr. Fatchur Rohman, M.Si as the materials experts, Dr. Endang Suarsini, M. ked as the learning tools expert, and Nunik Hidayati, S. Pd as field practitioner. Based on expert validation and field practitioners, the revised learning tools will produce a prototype-2.

In this trials conducted development tests validated product development and revision. How do learning development testing using Action Research through one cycle. The development tests carried out in class X IPA in SMAN 1 Singosari total of 37 students. Stage of development tests conducted to determine the practicality and effectiveness of product learning tools were created.

Data collection instruments consist of sheet validation study, observation sheets, practicality sheet, questionnaire, and test results of learning. Validation instrument is used to obtain the response experts and practitioners in order to know the validity of a learning tools developed products. Aspects of the assessment of the validation sheet is conformity with the principle of the development of learning tools, the learning tools components completeness, appropriateness of content, construction, linguistic and benefit from the learning tools. In addition, the validator provide input and comments regarding the learning tools products. Observation sheet used to find out information about the needs of teachers and students, learning applied PjBL model, and the activities of students and teachers during learning. Practicality sheet used to determine the practicality of the construct and the material of a product of learning. Questionnaire is used to find out information about the needs of students learning tools and student response to learning. Achievement test in the form of pre-test and post-test aims to obtain data on improving student learning outcomes such as cognitive, affective and psychomotor.

Data analysis conducted to determine the validity, practicality and effectiveness learning tools products. The validity of a product learning tools can be done by: 1) calculates the average in each of the expected outcomes of validation by the validator, 2) classifying categories of validity of each criterion validation results by category score validation (1 = not good; 2 = poor; 3 = good; 4 = excellent), 3) compare the average ratings validator with the assessment criteria, and 4) summed up the results of validation. Criteria validation value used in the research development of learning tools are presented in Table 1 (Akbar, 2013).

Table 1 Criteria Values Learning Tool Product Validation

Criterion validity (%)	validity level
85.01-100	Very valid, or can be used with little revision
70.01 - 85	Quite valid, or can be used with minor revisions
50.01 to 70	Less valid, it is advisable not to be used because it needs major revision
1-50	Invalid, or should not be used

The practicality a learning tools can claim to apply the model in the class and the level of adherence to the model in the high category. In addition, the effectiveness of a learning tools determined by average active student activity at a minimum of 40%, there is a trend of increasing test scores, students gave positive responses as much as 50%, and the teacher gives a positive response to the model. Analysis of student responses is done through the following categories (Yamasari, 2010).

$\bar{X} \geq 85\%$	Very Positive
$70\% \leq \bar{X} < 85\%$	Positive
$50\% \leq \bar{X} < 70\%$	Less Positive
$\bar{X} < 50\%$	Negative

3. RESULTS AND DISCUSSION

a. The Results of Validation Experts and Practitioners

The learning tools of Project Based Learning (PjBL) models in support of the SRFG programs product in development research consists of the syllabus, lesson plans, worksheets, assessment instruments of cognitive, affective and psychomotor. Data obtained from the results of validation experts and practitioners in the form of assessment experts and practitioners to the learning tools includes conformity with the principle of the development of learning tools, the learning tools components completeness, appropriateness of content, construction, linguistic and benefits. The results of expert validation is used to obtain data and advice from a validator that is known as valid as learning tools that have been produced at the design stage. Validation of experts conducted by the three validators are subject matter experts, expert learning tools, and field practitioners..

Table 2. Data Validation Results Syllabus by Expert Content

No.	Aspect	The average scores	Category
1	Compliance with the principles of syllabus development	3.9	Well
2	Completeness of components syllabus	4	Very good
3	Feasibility contents	3.7	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole aspects		3.92	Well

Table 2 shows that the average value of the learning tools validation by subject matter experts

on the syllabus at 3.92 to have a good category. Learning software products in the form of a syllabus ready to be applied in learning and require little revision of the syllabus aspects, namely the formulation of basic competencies, indicators and material. Lesson plans validation results by subject matter experts are presented in Table 3.

Table 3. Data Validation Results Lesson plans by Expert Content

No.	Aspect	The average scores	Category
1	Suitability with the principle development lesson plans	3.67	Well
2	Completeness of components lesson plans	4	Very good
3	Feasibility of contents	3.98	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole aspects		3.93	Well

Table 3 shows that the average score of the results of validation of lesson plans matter experts to 3.93. These results indicate that the lesson plans developed have both categories and ready to be applied in learning and require little revision of the PjBL model of instructional design. Student worksheet validation results by subject matter experts presented in Table 4.

Table 4. Data Validation Results Student Worksheet by Expert Content

No.	Aspect	The average scores	Category
1	Feasibility of Contents	3.67	Well
2	Linguistic	4	Very good
3	The views of student worksheet	4	Very good
The average whole aspects		3.89	Well

Table 4 shows that the average score of the results of the validation student worksheet by subject matter experts earned an average score of 3.89. These results indicate that the developed worksheets that have good categories and ready to be applied in learning and require little revision to additional supporting information regarding SRFG program in the form of material, tables and images. Result validation by subject matter expert assessment instruments are presented in Table 5 for the cognitive learning, learning outcomes Table 6 to

Table 7 for the affective and psychomotor learning outcomes.

Table 5. Data Validation Results Cognitive Learning Outcomes Assessment Tools by the Expert Content

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.8	Well
2	Material	3.2	Well
3	Construction	4	Very good
4	Linguistic	4	Very good
The average whole Aspects		3.8	Well

Table 5 shows that the average score obtained from the validation of cognitive learning outcomes assessment instruments by subject matter experts is 3.8 and have a good category. Table 6 shows that the results of the assessment of the subject matter expert affective learning outcomes assessment instruments have an average value score of 3.92 and had a good category. Table 7 shows that the average score obtained from the validation of assessment instruments psychomotor learning outcomes by subject matter experts is 4 and has a very good category. Learning tools in the form of an assessment instrument of cognitive, affective and psychomotor ready to be applied in learning and require little revision of some aspects of the assessment of the material on SRFG program

Table 6. Data Validation Results Affective Learning Outcomes Assessment Tools by the Expert Content

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.89	Well
2	Material	3.8	Well
3	Construction	4	Very good
4	linguistic	4	Very good
The average whole Aspects		3.92	Well

Table 7. Data Validation results for Psychomotor Learning Outcomes Assessment Tools by the Expert Content

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	4	Very good
2	Matter	4	Very good
3	Construction	4	Very good
4	linguistic	4	Very good
The average whole Aspects		4	Very good

Table 8. Results of Validation Data Analysis Expert Content

No.	Learning Media	Average Score	p (%)	Category	Test decision
1	Syllabus	3.92	93.3	very valid	slightly revised
2	Lesson plans	3.93	98.3	very valid	slightly revised
3	Student worksheet	3.89	92.6	very valid	slightly revised
4	Cognitive Learning Outcomes Assessment Tools	3.8	86	very valid	slightly revised
5	Affective Learning Outcomes Assessment Tools	3.92	96.5	very valid	slightly revised
6	Psychomotor Learning Outcomes Assessment Tools	4	100	very valid	slightly revised

Table 8 shows the results of calculation of the percentage of expert validation of the tools materials developed learning shows that learning tools category overall is very valid and requires little revision. This is because the value of a percentage (p) of more than 85%. The results of the data analysis by expert instructional materials to tools stating that the material has generally learning tools suitable for use in learning in SRFG program implementation.

Validation of the learning tools by a learning tools made to look at the suitability of learning about the application software products developed SRFG program with floating rule learning tools. Data from the learning tools in the

form of expert validation assessment score validation, opinions / suggestions, and criticism of the learning tools are arranged product. The results of expert validation learning toolss for products such as the syllabus is presented in Table 9.

Table 9. Data Validation Results Syllabus by Expert Learning Tools

No.	Rated aspect	The average scores	Category
1	Compliance with the principles of syllabus development	3.7	Well
2	Completeness of components syllabus	4	Very good
3	Feasibility contents	3.8	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole Aspects		3.91	Well

Table 9 shows that the results of the validation study syllabus by experts tools have an average score of 3.91 and categories. These results indicate that the syllabus is ready to be applied in learning and require little revision of the syllabus aspects, namely the formulation of basic competencies, learning objectives and learning resources. The results of expert validation learning toolss for products such as lesson plans are presented in Table 10.

Table 10. Data Validation Results Lesson Plans by Expert Learning Tools

No.	Aspect	The average scores	Category
1	Compliance with the principle development lesson plans	3.6	Well
2	Completeness of components lesson plans	4	Very good
3	Feasibility of contents	3.84	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole Aspects		3.9	Well

Table 10 shows that the average results of the validation of lesson plans by a learning tools of 3.9 and has a good category. These results indicate that

the lesson plans is ready to be applied in learning and require little revision of the learning activities in the form of observation and reflection. The results of the learning tools expert validation of the product in the form of worksheets presented in Table 11.

Table 11. Data Validation Results Student Worksheet by Expert Learning Tools

No.	Aspect	The average scores	Category
1	Feasibility of contents	3.86	Well
2	Grammar	4	Very good
3	Views student worksheet	3.5	Well
The average whole Aspects		3.79	Well

Table 11 shows that the results of the validation study student worksheet by experts tools have an average score of 3.79 and categories. These results showed that the student worksheet is ready to be applied in learning and require little revision of the arrangement student worksheet . The results of the validation instrument expert assessment by the learning tools is presented in Table 12 for the cognitive learning, learning outcomes Table 13 to Table 14 for the affective and psychomotor learning outcomes.

Table 12. Data Validation Results Cognitive Learning Outcomes Assessment Tools by the Expert Learning Tools

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.6	Well
2	Material	3.7	Well
3	Construction	3	Well
4	Linguistic	4	Very good
The average whole Aspects		3.6	Well

Table 12 shows that the average score obtained from the validation of cognitive learning outcomes assessment instruments by a learning tools had an average score of 3.6 and either category. Table 13 shows that the average score of the results of the validation instrument affective learning outcomes assessment by expert instructional tools by 3.94 and had a good category. Table 14 shows that the average score obtained from the validation of learning outcomes assessment instruments by an expert psychomotor learning tools is 4 and has a

very good category. Learning tools in the form of an assessment instrument of cognitive, affective and psychomotor ready to be applied in learning and require little revision of some aspects of the assessment, especially about the indicator, manual testing and statements about the test

Table 13. Data Validation Results Affective Learning Outcomes Assessment Tools by the Expert Learning Tools

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.89	Well
2	Material	4	Very good
3	Construction	3.89	Well
4	Linguistic	4	Very good
The average whole Aspects		3.94	Well

Table 14. Data Validation Results for Psychomotor Learning Outcomes Assessment Tools by the Expert Learning Tools

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	4	Very good
2	Material	4	Very good
3	Construction	4	Very good
4	Linguistic	4	Very good
The average whole aspects		4	Very good

The results of calculation of the percentage of expert validation of the learning tools learning tools developed indicate that the overall learning tools category is very valid and requires little revision. This is because the value of a percentage (p) of more than 85%. The results of the data analysis by expert instructional learning tools to tools stating that the rules of software development in general has been well worth learning used for learning in SRFG program implementation

Table 15. Results of Validation Data Analysis Expert Learning Tool

No.	Learning Media	average Score	p (%)	Category	Test decision
1	Syllabus	3.91	95.8	very valid	slightly revised
2	Lesson Plans	3.9	97.2	very valid	slightly revised
3	Student Worksheet	3.79	95.5	very valid	slightly revised
4	Cognitive Learning Outcomes Assessment Tools	3.6	88	very valid	slightly revised
5	Affective Learning Outcomes Assessment Tools	3.94	98.2	very valid	slightly revised
6	Psychomotor Learning Outcomes Assessment Tools	4	100	very valid	slightly revised

Validation of the learning tools by field practitioners was conducted to determine the suitability of learning tools developed by the character and habits of students in the classroom. Data validation results field practitioners can also be used to determine the suitability of the usefulness and applicability in schools in favor of SRFG program. Data obtained in the form of validation assessment scores, opinions / suggestions and criticism by field practitioners. The results of field practitioners validation of the product in the form of the syllabus is presented in Table 16.

Table 16. Data Validation Results Syllabus by Practitioner Courses

No.	Rated aspect	The average scores	Category
1	Compliance with the principles of syllabus development	3.7	Well
2	Completeness of components syllabus	4	Very good
3	Feasibility contents	3.86	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole aspects		3.91	Well

Table 16 shows that the syllabus validation results by field practitioners earned an average score of 3,91 and have either category. Learning software products in the form of a syllabus ready to be applied in learning and require little revision to the level of the depth of material and in accordance with the demands of the environment. The results of field practitioners validation of the product in the form of lesson plans are presented in Table 17.

Table 17. Data Validation Results Lesson Plans by Practitioner Courses

No.	Aspect	The average scores	Category
1	Compliance with the principle development lesson plans	3.83	Well
2	Completeness of components lesson plans	4	Very good
3	Feasibility of contents	3.48	Well
4	Linguistic	4	Very good
5	Benefit	4	Very good
The average whole aspects		3.86	Well

Table 17 shows that the results of the validation by field practitioners have an average score of 3.86. These results indicate that the lesson plans has either category. Lesson plans is ready to be applied in learning and require little revision in linking with SRFG program. The results of field practitioners validation of the product in the form of worksheets presented in Table 18

Table 18. Data Validation Results student worksheet by Practitioner Courses

No.	Aspect	The average scores	Category
1	Feasibility of contents	3.84	Well
2	Grammar	4	Very good
3	Views student worksheet	3.5	Well
The average whole aspects		3.78	Well

Table 18 shows that the average score obtained from student worksheet validation by field practitioners at 3.78 and had a good category. Student worksheet is ready to be applied in learning and require little revision in the application program is sustainable development. The result of SRFG

program validation expert assessment instruments by field practitioners are presented in Table 19 for the cognitive learning, learning outcomes Table 20 to Table 21 for the affective and psychomotor learning outcomes.

Table 19. Data Validation Results Cognitive Learning Outcomes Assessment Tools by Practitioner Courses

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.9	Well
2	Material	4	Very good
3	Construction	3.8	Well
4	Linguistic	3.8	Well
The average whole aspects		3.8	Well

Table 19 shows that the average score obtained from the validation of cognitive learning outcomes assessment instruments by field practitioners have an average score of 3.8 and either category. Table 20 shows that the average score of the results of the validation instrument affective learning outcomes assessment by field practitioners of 3.62 and had a good category. Table 21 shows that the average score obtained from the validation of assessment instruments psychomotor learning outcomes by field practitioners are 4 and had a very good category. Learning tools in the form of an assessment instrument of cognitive, affective and psychomotor ready to be applied in learning and need a revision of the application of SRFG program in the neighborhood.

Table 20. Data Validation Results Affective Learning Outcomes Assessment Tools by Practitioner Courses

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment of learning outcomes	3.56	Well
2	Matter Construction linguistic	3.67	Well
3		3.44	Well
4		3.8	Well
The average whole aspects		3.62	Well

Table 21. Data Validation results for Psychomotor Learning Outcomes Assessment Tools by Practitioner Courses

No.	Aspect	The average scores	Category
1	Compliance with the principles of assessment learning outcomes	3.56	Well
2	Material	3.67	Well
3	Construction	3.75	Well
4	Linguistic	3.5	Well
The average whole Aspects		3.62	Well

Table 22. Results of Validation Data Analysis Practitioner Courses

No.	Learning Media	average Score	p (%)	Category	Test decision
1	Syllabus	3.91	96.1	very valid	slightly revised
2	Lesson plans	3.86	94.3	very valid	slightly revised
3	Student worksheet	3.78	94.6	very valid	slightly revised
4	Cognitive learning outcomes assessment tools	3.8	96	very valid	slightly revised
5	Affective learning outcomes assessment tools	3.62	89.7	very valid	slightly revised
6	Psychomotor learning outcomes assessment tools	3.62	89	very valid	slightly revised

Percentage calculation validation field practitioners towards learning tools developed indicate that the overall learning tools category is very valid and require little revision as a percentage value (p) of more than 85%. The results of the data analysis by field practitioners to learning tools stating that appropriate learning tools developed by the character and habits of students in the field have generally been feasible to use for learning in SRFG program implementation.

b. Product Practicality Test Results

Test the practicality of learning tools is done in order to determine the learning software products developed can be applied or not in the classroom. Number of hours of biology at SMAN 1 Singosari every week as much as 4 hours of lessons. The results of the data analysis implementation learning syntax for teacher learning tools by briefly presented in Table 23 and the results of learning by students keterlaksanaan syntax are summarized in Table 24.

Table 23. Results of Analysis Implementation Learning Syntax by Teachers

No.	Meeting	The average score Observer (%)			
		1 Category	2 Category		
1	Meeting 1	95.8	Very Practical	91.7	Very Practical
2	Meeting 2	95.8	Very Practical	91.7	Very Practical
3	Meeting 3	95.8	Very Practical	95.8	Very Practical
4	Meeting 4	95.8	Very Practical	83.3	Practical
5	Meeting 5	83.3	Practical	90.8	Practical
On average Whole Meeting		93.3	very Practical	90.8	Practical
The average results for implementation learning syntax		92.1		Very Practical	

The implementation learning syntax calculation results by the teacher stated that the average adherence to the syntax of learning the whole meeting by both the observer is equal to 92.1% categorized as very practical. The result of this calculation indicates that teachers can apply the learning syntax PjBL on learning tools made in implementing SRFG program. In addition, teachers also stated that this study can be applied in the classroom based on interviews.

Table 24. Results of Analysis Syntax Keterlaksanaan Learning by Students

No.	Meeting	The average score Observer (%)			
		1 Category	2 Category		
1	Meeting 1	91.7	Very Practical	91.7	Very Practical
2	Meeting 2	95.8	Very Practical	95.8	Very Practical
3	Meeting 3	91.7	Very Practical	95.8	Very Practical
4	Meeting 4	91.7	Very Practical	83.3	Practical
5	Meeting 5	100	Very Practical	90.8	Very Practical
On average Whole Meeting		94.2	very Practical	91.7	Very Practical
The average results		92.9		Very Practical	

Implementation learning syntax calculation results by student learning syntax indicates that the average results of enforceability syntax student has a value of 92.9%. The results of these calculations have very practical because the category has a value score of more than 91%. These results indicate that the enforceability of learning syntax can be followed by students in learning activities.

Table 25. Results of Analysis Practicality Learning Tool

No.	Meeting	The average score Observer (%)			
		1	Category	2	Category
1	Construct practicality	93.8	very practical	100	very practical
2	Material practicality	91.7	very practical	95.8	very practical
On average practicality of each observer		92.7	very practical	97.9	very practical
The average results for implementation learning syntax		95.3		very practical	

The results of the data analysis of the practicality of the tools learning by teachers are summarized in Table 25. The results show the practicality of learning tools that the average value of the practicality of learning software products had a value of 95.3% and has a very practical category. These results indicate that the learning tools developed constructs and very practical material for use in the application of SRFG program in the school environment.

c. Product Effectiveness Results

Test the effectiveness of a learning tool in support of SRFG program known based on the tendency increase in cognitive test scores based on pre-test and post-test, the positive response of students to the learning software products and activities of student activity in the classroom during learning. Development trend of increased test scores seen improved student learning outcomes such as cognitive, affective and psychomotor. Increased progress test scores, especially the cognitive learning can be determined by how do pre-test and post-test for the effectiveness of the results of learning activities on the cognitive learning in class X IPAB showed that the average pre-test score of 71.3 and an average post-test score of 73.6. These results show a trend towards an increase in cognitive achievement of 2.4 based on cognitive test scores. -rata average value of the pre-test and post-test on cognitive learning outcomes summarized in Table 27.

Table 27. Average Value Pre-test and post-test results of Cognitive Learning Students

No.	Material	Average	
		Pre-test	Post-test
1	Changes in the environment / climate and the recycling of waste	71.3	73.6

Results belajar affective presented in Table 28. Results are considered affective learning consists of learning outcomes affective spiritual attitudes and affective learning outcomes of social attitudes. Affective learning outcomes assessment spiritual attitude using the self-assessment and assessment of learning outcomes affective social attitudes using peer assessment. The results on the effectiveness of affective learning outcomes in class X IPAB showed that the average value of affective learning outcomes in the first meeting amounted to 83.2%, amounting to 81.9% 2 meeting, the meeting of 3 by 79.3%, amounting to 84.4% 5 meeting and 5 meeting by 83.1%.

Table 28. Average value of Affective Student Learning Outcomes

No.	Affective value	Value Percentage (%) of each meeting				
		1	2	3	4	5
1	Spiritual attitudes	81.8	81.3	82.3	86.8	86.7
2	Social attitudes	84.7	82.6	76.2	82.1	79.5
The overall percentage of effective learning outcomes		83.2	81.9	79.3	84.4	83.1

Psychomotor learning outcomes assessment based on the assessment of learning outcomes psychomotor observation sheet for 5 meeting are presented in Table 29. Psychomotor learning outcomes assessment shows that the average percentage of psychomotor learning outcomes by 92.8% in the first meeting, the meeting 2 is 85.1% , the meeting 3 is 89.8%, the meeting 4 is 90.6%, and the meeting 5 is 90.8%.

Table 29. Observations Ratings Psychomotor

No.	Psychomotor Values	Value Percentage (%) of each meeting				
		1	2	3	4	5
1	Observation of phenomena	96.5	78.5	86.5	86.8	-
2	Formulate the problem	96.5	81.3	91.9	86.8	-
3	Searching for information	84.5	-	-	-	-
4	Planning the project work plan	100	79.2	87.8	95.8	-
5	Implement the project activities	-	-	100	-	91.9
6	Summing up the results of the project work	96.5	91	91.9	100	-
7	Product design project work	-	100	-	95.9	-
8	Creating a project work report	-	-	-	-	87.2
9	Presenting the results of the project work	82.6	80.6	80.4	78.5	86.1
10	Evaluating learning activities	96.5	91	96.6	86.1	97.9
On average all aspects of assessment of psychomotor		92.8	85.1	89.8	90.6	90.8

Results of student questionnaire responses are presented in Table 30. The overall result of the calculations is the student questionnaire responses students give positive response to the application of learning software products 81.1%. These results indicate that the test product effectiveness in supporting learning tools SRFG program have effective category. In addition, teachers also give a positive response to the product development of the interview.

Table 30. Results of Questionnaire Response Effectiveness Test Students in Learning Tool

Material	Student response	Frequency	Criteria	Percentage of Positive Response
Changes in the environment / climate and the recycling process	$\bar{X} \geq 85\%$ $70\% \leq \bar{X} < 85\%$ $50\% \leq \bar{X} < 70\%$ $\bar{X} < 50\%$	13 17 7 -	very Positive Positive Less Positive	81.1%
total Students		37		

The results of the activities of student activity in the learning activities are presented in Table 31. Results of the activities of students' activity showed that the average results of the activities of student activity amounted to 91.2%. The results of the student activity activity has very effective for application category SRFG program using learning tools developed.

Table 31. Results of Activities activeness Students

No.	Meeting	The average score Observer (%)			
		1	Category	2	Category
1	Meeting 1	88.3	Effective	95	Very effective
2	Meeting 2	95	Very effective	91.7	Very effective
3	Meeting 3	96.7	Very effective	93.3	Very effective
4	Meeting 4	73.3	Less effective	91.7	Very effective
5	Meeting 5	95	Very effective	91.7	Very effective
On average Whole Meeting		89.7	Effective	92.7	Very effective
The average results of liveliness Student Activity			91.2		Very effective

Table 32. Results Product Revision

No.	Expert Assessment Results	Revision
Syllabus		
1	Giving the name of the sub material not related to the theme of the program implementation SRFG	Giving the name of the sub materials are related to the theme of the program implementation SRFG
2	On learning activities, students	On learning activities, students

No.	Expert Assessment Results	Revision
3	simply observe the images alone Learning resources on the syllabus included in Table	observe phenomena in the neighborhood Learning resources on the syllabus is not inserted into the table
LESSON PLANS		
4	KD and learning objectives have not been compiled based on the hierarchy of the thinking of students from simple to complex Reflection activities at each meeting has not done learning activities	KD and learning objectives compiled based on a hierarchy of the thinking of students from simple to complex Reflection activities performed each meeting learning activities
5	Lesson plans has not been linked with the implementation of the SRFG program	Lesson plans have linked the implementation of the SRFG program
6	The current allocation is more adapted to the material time	The allocation of time has been adjusted to the material
7		
STUDENT WORKSHEET		
8	Supporting information on Student worksheet still common and still not linked with the implementation of the program SRFG Extra supporting information about the program is still lacking at student worksheet	Information related to the implementation of programs already supporting SRFG in learning activities in schools Extra supporting information have been done in student worksheet
9	Giving foreword and table image is still no	Figures and Tables have been given the foreword
10	Assignment of making a final report not yet listed in the final report student worksheet and Format	Assignment of the final report generation is already included in the worksheet and format of the final report
11		
Instrument Rating		
12	The images on the test item does not	Pictures are in accordance with the

No.	Expert Assessment Results	Revision
13	meet the reality in Indonesia Statement about the tests have not been informed of data and customized research or literature with the indicators about	reality in Indonesia Statement about tests already exist research or literature and adapted to the indicators about

Revision of product development conducted in order to enhance a learning tools products. Revisions made by shortages during the execution of expert validation test, test the practicality and effectiveness testing phase 4D develop in the model development. The revised product are presented in Table 32.

d. Discussion

Learning tools is one means of supporting the success of learning in the classroom. Implementation of effective learning requires a learning tools in accordance with the spirit of the philosophy and curriculum demands that apply. Learning tools consists of a syllabus, lesson plans, teaching materials and assessment instruments (Akbar, 2013; Yulmaini and Septina, 2008). Agustina (2013) states that the development of learning tools as businesses that utilize well-proven theory to improve the functionality, benefits, and applications learning tools that already exists or produce new learning tools.

The development of learning tools are needed to carry out the implementation SRFG program at the school. Product development in the PjBL model learning tools supports SRFG program such as syllabi, lesson plans, worksheets, assessment instruments kogniti, affective and psychomotor. The final product is produced from the learning tools after the product revision through expert validation phase and stage of development at SMAN 1 Singosari. Learning tools produced in accordance with the demands of Curriculum 2013. The syllabus was developed consisting of KD 1.1, 1.2 KD, KD 1.3 elaboration KI spiritual attitude; KD KD 2.1 and 2.2 elaboration of social attitudes KI, KD 3:10 KI knowledge translation and KD 4.10 KI translation skills to the subject matter changes in the environment / climate and waste recycling. The subject matter syllabus has associated with programs that optimize perkarangan SRFG households in environmental conservation efforts. SRFG program may have an impact on household food security contributions by utilizing materials that already exist in the neighborhood.

Lesson plans is a translation of the syllabus which serves to direct the learning activities of students in achieving the learning objectives. Selection of the learning model in preparation of the

Lesson plans. PjBL is suitable for use in supporting the development of learning tools SRFG program. It's because students become motivated more active in learning, developing creativity of students become teachers as facilitators, teachers evaluate student performance products result from projects carried (Susilowati et al., 2013). PjBL model has great potential to make the learning experience more interesting and meaningful for students (Narhi et al., 2012). Therefore, the model PjBL can foster a caring attitude towards the environment on the application of SRFG program.

Student worksheet is a teaching materials that have been packaged such that students are expected to learn the teaching material independently. Student worksheet need to be developed to serve as a source of student learning, enabling students to understand the material, actively engage students in learning activities, sensitivity training students in associate and apply the material learned in school to solve the problems. Student worksheet contents developed overall title contains worksheets, student identity, KD, learning objectives, basic theory, supporting information, work step, the problems, the work plan of the project, data analysis, conclusions, evaluation of learning activities and assignments. each permasalahan contained student worksheet product in the form of guidance to the students to determine the formulation of the problem and the hypothesis against a phenomenon contained in student worksheet. The phenomenon of the student worksheet consists of: (1) the phenomenon of environmental damage and pollution on agricultural land; (2) waste management in urban; (3) The diverse types of waste causing environmental damage; and (4) lack of public awareness of the activities of the recycling process.

Products developed assessment instrument includes an assessment instrument of cognitive, affective and psychomotor. Cognitive assessment instrument developed in the form of a written test consisting of multiple choice questions and problem descriptions. About the test is divided into two, namely: (1) The first test item for sub material the importance of programs, SRFG and nurseries as early effort SRFG application and (2) about the second test for identification of sub material for manufacturing plants and design of the model vertikultur vertikultur plant design.

Affective assessment instruments developed there are 2 kinds of assessment instruments affective self-assessment and peer assessment affective assessment instruments. Every kind of affective assessment instruments include lattice questionnaire affective appraisal, assessment guidelines and affective assessment questionnaire sheet. Psychomotor assessment instruments developed in the form of observation sheet psychomotor assessment and psychomotor

assessment rubric. Psychomotor assessment indicators measured are student activity when observing the phenomenon; student activity when formulating the problem; student activity while reading a learning resource as a means of gathering information; student activity when planning the project work plan; student activity when carrying out project activities; current student activity records and conclude the work of the project; student activity when a product design project work; student activity when creating a work report of the project; student activity when presenting the work of the project; and activities when evaluating student learning activities.

The 4D model is a model of development which is used as a reference or basis for developing learning tools. This is because the stages of the implementation of shared 4D model is easy to implement, detail and systematically. (Muhimmatin, 2014). The first stage is the stage of defining the five stages, namely the front end analysis, analysis of students, material analysis, task analysis, and formulation of learning objectives. Indicators resulting in the formulation of learning objectives used as a basis for drafting the learning tools with SRFG program that diintegrasikan to material changes in the environment / climate and the recycling process

The design phase of the learning tools consists of four stages: preparation of standard reference tests, media selection, the selection format, and a preliminary draft. At the design stage of a product produced early. The resulting product is a syllabus, lesson plans, worksheets and assessment instruments. After that, the next stage is the stage of development. The end result at this stage is the initial product has been revised based on input from experts and then be tested in the classroom. From the test results obtained by the test results practicality and effectiveness of the learning tools.

The result of this development product in accordance with the eligibility criteria Nieveen (1999). The eligibility criteria assessed on the basis of validity, practicality and effectiveness. The results of the validation test indicate that all products developed learning tools which have been declared invalid by 3 validator very expert, the master material, experts and practitioners learning tools field. Results of the assessment of the syllabus and lesson plans validator indicates that compliance with the principles, components, appropriateness of content, linguistic and benefits very valid category. Validator against student worksheet assessment results indicate that the feasibility of the content, language and appearance have a very valid category. The results of the assessment instruments validator assessment indicates that compliance with the principles of assessment of learning outcomes, materials, construction and language have a very valid category. Criterion validity of the product

according to Nieveen (1999) consists of a validator states that the product is based on a strong theoretical basis, the components are interrelated and consistent product.

Practicability test results showed that the product developed learning tools otherwise very practical. This is because the level of adherence to the syntax as very practical learning; Teachers reported that the software product can be applied in the classroom teaching of the interview; and the value of convenience products have very practical category. Criteria practicality of the product according to Nieveen (1999) is an observer to give consideration that the product can be applied in the classroom; Teachers expressed to apply the product in the class; and the level of adherence to the learning syntax included in the high category.

The test results show that the effectiveness of the learning tools otherwise very effective learning tool. This is because there is an increasing trend of learning outcomes of 2.4 based on test scores; 81.1% of students gave positive responses and the average results of the activities of student activity at 91.2%. Criteria for the effectiveness of the product according to Nieveen (1999) is that there is an increasing trend of test scores; more than 50% of students and teachers responded positively to the model; and average active student activity at a minimum of 40%.

Products developed learning tools has some advantages and disadvantages. The advantages of learning tools developed product is easier for teachers and students to use the model PjBL in implementing SRFG; provide facilities for the assessment of student learning outcomes in terms of affective, cognitive and psychomotor; and easier for students to understand the learning material related SRFG program for product development primarily student worksheet contains information and pictures phenomena in the environment. A shortage of product learning tools is necessary to arrange a good time for the activities on the timely implementation of learning activities,

4. CONCLUSIONS AND RECOMMENDATIONS

The process of biology teaching tools development model PjBL in support of sustainable food program home area (SRFG) using models 4D developed by Thiagarajan (1974), which is limited to stages develop. The resulting product is a learning tools syllabus, lesson plans, worksheets and assessment instruments. Based on the results of the study showed that the development of learning tools generated assessed as eligible in support SRFG program at the school. This is because the learning tools developed meets the eligibility criteria are valid, practical, and effective. Results of the assessment of the syllabus and lesson plans validator

indicates that compliance with the principles, components, appropriateness of content, linguistic and benefits very valid category. Validator against student worksheet assessment results indicate that the feasibility of the content, language and appearance have a very valid category.

Practicability test results showed that the product developed learning tools otherwise very practical based learning syntax keterlaksanaan level as very practical; Teachers reported that the software product can be applied in the classroom teaching of the interview; and the value of convenience products have very practical category. The test results demonstrate the effectiveness of the learning tools that is otherwise very effective learning tools based on existing trend of increased learning outcomes in test scores; most of the students gave positive responses and the average results of students' activity is very high activity.

The advice given with regard to the results of research is the development of more needs to be done to disseminate stage; need to assess the overall aspect of SRFG activities such as the manufacture of biogas, organic fertilizer production, fisheries and animal husbandry; and needs to be disseminated to the introduction of learning tools are developed.

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