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Identification of gaharu tree (*Aqualaria malacensis*) and gaharu oil distillation process as the local content included in 21st century curriculum on the subject of high level botany

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Abstract. Gaharu tree (*Aquilaria malaccensis)* is the most potential type of gaharu tree. Based on the subject of high level botany as included in the 21st century curriculum, students are encouraged to observe any local wisdom, including the identification of gaharu tree. The pu r- poses of this study are to recognize students' concept mastery of gaharu tree identification and students' performance of gaharu oil distillation process. The data were analyzed quantitatively. Forty students of Biology study program who are taking high level botany subject participated in this study. They were divided into two classes: twenty one students of class A and nineteen students of class B. The result showed that the concept mastery of gaharu tree identification for both classes were good. Class A obtained 85.71, while class B was 94.74. For distillation process activity, the mean score for class A was 87.3 and class B was 88.9. Based on the results, it can be conclud- ed that students' mastery concept of gaharu tree (*Aqualaria malacensis*) identification and students' performance of gaharu oil distillation process have good criteria. These could be used as the learning activities in the local content included in 21st century curriculum on the subject of high level botany.

1. Introduction

A 21st century competency framework in the learning process focuses on : (1) life and career skills which consist of: 1) flexibility and adaptability, 2) initiative and independence, 3) social and cultural skills, 4) productivity and accountability, 5) leadership and responsibility skills; (2) learning and innovation skills which consist of: 1) creativity and innovation, 2) critical thinking in solving problems, 3) communication and collaboration skills; (3) information media and technology skills which consist of: 1) in- formation literacy, 2) media literacy, 3) information and communication technology [13].

This framework suggests that in learning process, increasing knowledge is not only achieved through learning core subjects but it must also be equipped with other skills such as creative-critical thinking, strong characters (responsible, social, tolerant, productive and adaptive). In addition, technology, collaboration and communication are also essential to support the learning process [9].

Trilling and Hood suggests that the main concern of education in the 21st century is to prepare for life and work for the community. The time came glanced briefly at wide-angle view of the main roles will be played by learning and education in a knowledge based society can do with knowledge and not what a unit of knowledge they have [10]. Furthermore, Duncan in Riley [8] states that in the 21st century, students must be given and ready to use technology tools, they must be collaborators in continuous learning for knowledge and acquire new skills along with their students.

Learning curriculum at High Level Botany lectures highlight local knowledge to use forest products in this gaharu tree. Gaharu (Aquilaria malaccensis) is a major forest products traded and is a product that is integrated with international markets . In this case the need to provide supplies to the students to maintain and preserve existing forests and has the ability to use the forests of raw materials into finished materials. Ridwan [8], the cultural dimension of local knowledge, including: 1) local knowledge, 2) local skills, and 3) local sources.

The redesign of curriculum aims to prepare students for their successful future and represent contextual condition dealt with the local wisdom. The redesigned curriculum develops around Semester Learning Planning, teaching materials, student activity work- sheet and evaluation sheet.East Kalimantan's forest is well known for its rich natural resources and high biodiversity. Forest exploitation is associated with the utilization or the excessive use of forest resources which leads to the damage of the surrounding environment and the loss of welfare living beings. Uncontrollably exploited forest may be deleterious to all living creatures on earth. The area of East Kalimantan's forest in 2012 was approximately 14.981.978 but it de- creased to 8.526.287 in 2013. There are six types of East Kalimantan's forest: protection forest, reservation and travel forest, limited production forest, permanent production forest, convertible forest and education/research forest [1]. Dwinanto [3] further revealed that after the split between East Kalimantan and North Kalimantan, forest area in East Kalimantan has reduced and now remains only 8 million hectares. Therefore, for- est exploitation is selected to be one of many ways to utilize the forest products.

Excessive forest exploitation brings great disadvantages in many aspects. It could reduce the amount of oxygen production, deteriorate the forest function as land cover during rainfall, obstruct the surface water runoff which may cause flood and disrupt the sustainability of animal and plant life. If it continues, desertification process will possibly occur sometime in East Kalimantan. Thus the principles of sustainable forest management should actually be applied. The negative impacts of this forest exploitation can dam- age the forest ecosystem, environment and other living creatures unless several concrete efforts are made to mitigate this situation. Gaharu (*Aquilaria malaccensis*) is a primary forest product to trade and integrated with international market. The high price and market demand lead gaharu to be exploited continously. Due to the exploitation, the number of gaharu trees becomes very scarce. The exploitation of gaharu has risen sharply in East Kalimantan as a result of high price and market demand [10]. To this day gaharu is the only non-timber forest product which can be traded.

Learning from these facts, students are encouraged to maintain and preserve the existing forests as well as to effectively utilize raw forest materials into finished products. In accordance with these, to highlight the local wisdom in the curriculum of High Level Botany Course is able to increase the ability of biology teacher candidates in solving problems, to support them to participate actively in research and to do experiment. They are also responsible to develop autonomous learning and actively participate in the learning process through asking questions and discovering solutions in research.

As teacher candidates, students should prepare themselves to have not only teaching skill but also entrepreneurial skill according to existing knowledge, natural resources and contextual local condition that contribute to: 1) environment-oriented development, and 2) forest material production throug

utilizing raw forest materials into finished products.

Gaharu tree belongs to the Spermatophyta division, Angiospermae sub division, and Dicotyledoneae class. Barden [2] argues Gaharu tree has a trunk slippery surface, a single leaf in green with wavy edges of the leaves, hairy stalks and inflorescence at the end. It is categorized as non-timber forest commodity which has high selling price in East Kalimantan. The price is also more expensive than other non-timber forest products. As a valuable forest commodity, gaharu has been used as a basic ingredient for perfumes, incenses, cosmetics and medicines. It is also categorized as one of the multifunctional non-timber forest commodities [1 1] . The most dominant gaharu tree species commonly originates from *Aquilaria malaccensis*. *Aquilaria malaccensis* is mainly exported to many different counanggap tries such as Middle East, Taiwan, Korea, and Japan and used as a basic ingredients for incenses, air fresheners and cosmetics. The types of tree species that produce gaharu belong to family of *Thymeleaceae, Leguminoceae, and Euphorbiaceae*.

Furthermore, the types of tree species producing gaharu belong to genus Aquilaria (*Aquilaria malacensis, Aquilaria hirta, Aquilaria microcarpa, Aquilaria bonensis, Aquilaria becariana* and *Aquilaria agalocha*) which could produce high-quality-exported gaharu. The characteristics of wounding trees in search of gaharu are woods or others parts of trees producing gaharu and strong aromatic damar characterized by rather blackish-dark color.

Gaharu has high economic value and was traded by Indonesians in Dutch colonial times from 1918 to 1925 with ± 11 ton/ year vol- ume. After Independence Day, the export of gaharu increased year by year. From 1983 to 1987, the volume of exported gaharu was ± 103 ton/year. Meanwhile, from 1990 to 1998, the volume of ex- ported gaharu reached ± 165 ton/year. Last in 2002, the volume of exported gaharu was ± 446 ton/year.

The demand of foreign countries for gaharu commodity increases every year. This causes the frequency of gaharu exploitation also increases. However, people may not be able to recognize which trees contain gaharu and they only cut the trees down speculatively. Consequently, no containing gaharu tree species becomes scarce and endangered. Considering the increase of market demand every year, therefore Gaharu plantation becomes an urgent need. The idea of opening gaharu plantation is important to be taken into account as this action will not only promote the conservation of this valuable commodity but also improving local people's income especially in East Borneo in which forest and spaces are still available for gaharu plantation.

Gaharu oil is produced through a distillation process. The process itself covers handling solid products, preparing raw materials, as well as take care the condition of the materials in order to maintain the quality of the oil which will be produced. There are steps to follow in producing gaharu oil using water distillation, firstly gaharu is soaked in water and put in a container to evaporate the water content until the oil appears on the surface of the container. Then the aromatic compound will be collected separately. The common gaharu distillation process is the vapor or water distillation in order to extract the oil from gaharu [6] . The purposes of this study are to recognize students' concept mastery of gaharu tree identification and students' performance of gaharu oil distillation process.

2. Method

The research design was descriptive qualitative.

Procedures

There were several steps involved. Firstly, arranging learning administrations which consisted of planning stage: Semester Learning Planning, teaching materials, and student activity worksheet. Secondly, implementation stage divided into implementing learning activity based on Semester Learning Planning and student activity worksheet. To comprehend students' conceptual mastery

in identifying gaharu tree (*Aqualaria malaccensis*), the field practice was conducted in Bukit Bangkirai Samboja. The next activity was observing the other detail parts of gaharu tree especially its roots in the class. Observation sheet was prepared to evaluate students' performance and observe students' activity during gaharu oil distillation process. Thirdly, in the evaluation stage, the *post-test* was employed to measure students' conceptual mastery. Forty students who were taking High Level Botany Course subject participated in this study. They were divided into two classes: twenty one students of class A and nineteen students of class B.

Data analysis

The data were analyzed using descriptive qualitative analysis. To identify students' conceptual mastery, the following formula is used:

$P = \frac{\sum A}{\sum N}$ x 100% .....[6]

where:

P = the percentage of indicator completeness

∑A = a number of students who correctly answer the question for each indicator

∑N = maximum score for each indicator

Futhermore, the result of calculation, N-Gain is then converted with the following criteria.

Table 1. Criteria of *normalized gain* [13].

Score *N-Gain*	Criteria of *Normalized Gain*
$N - Gain > 0{,}70$	High
$0{,}30 \leq N - Gain \leq 0{,}70$	Moderate
$N - Gain < 0{,}30$	Low

An index of the sensitivity of the items are basically a measure of how well items that differentiate between students who are receiv- ing students who had not received the lesson. Some items were said to be sensitive to learning if S ≥ 0,30. To calculate the sensitivity of items, use the following formula. This following formula is used:

$S = \frac{Ra-Rb}{T}$ ..... [5]

Descriptions:

S = Sensitivity

Ra = The number of students who answered correctly in the post- test

Rb = The number of students who answered correctly in the pre-test

T = The number of students who took the test Meanwhile, to analyze students' performance of gaharu oil dis- tillation process, this following formula is used:

The percentage was calculated with simple percentage formula as follows:

$P = \frac{f}{N} \times 100\%$

where: *P* = students' score

f = students' frequency

N = number of students

From the calculation of quantitave data, the data were analyzed and transformed into qualitative data based on percentage criteria as depicted in Table 2.

Table 2. Percentage criteria of interpretation interval [14].

Mean Score	Criteria
75% ≤ x ≤ 100%	Excellent
65% ≤ x < 74%	Good
55% ≤ x < 64%	Fair
0% ≤ x < 54%	Poor

3. Result and Discussion

Conceptual mastery of gaharu tree (Aqualaria malacensis) identification

The assessment of learning outcome focused on the extent of students' conceptual mastery of identifying gaharu tree (*Aqualaria malacensis*). Students' conceptual mastery was obtained from both pre-test and post-test. The purpose of administering pre-test was to measure students' initial ability prior learning. Meanwhile, post-test was given to measurestudents' ability after learning. The results of both tests were used to calculate the conceptual mastery of completeness achievement using learning assessment criteria namely ≥ 3 number (letter B) included as good category or equals with ≥ 75 number. These criteria was in accordance with National Standard for Higher Education (SNPT).

Conceptual mastery of class A. The results of completeness analysis of conceptual mastery are provided on Table 3.

Table 3. Item completeness of conceptual mastery of gaharu tree identification in class A.

Item Number	*Pre Test*		*Post Test*		Sensitivity	
	%	Inf	%	Inf	SI	Inf.
1	64	NC	83	C	0,76	S
2	58	NC	85	C	1,05	S
3	62	NC	85	C	0,90	S
4	79	C	95	C	0,67	S
5	71	NC	86	C	0,57	S
6	65	NC	80	C	0,57	S
7	68	NC	85	C	0,67	S
8	67	NC	74	NC	0,29	NS
9	60	NC	67	NC	0,29	NS
10	55	NC	76	C	0,86	S
The average percentage	**10**		**80**			

Note: % Comp= Percentage of Completeness, NC = Not Com- plete, C = Complete , SI = Sensitivity Index, S = Sensitive, NS = Not Sensitive

Based on Table 3, it can be found that in the results of class A's *pre-test*, the percentage of completeness for two items concerning concept mastery of identifying gaharu tree (*Aqualaria malacensis*) was approximately 10%. On the other hand, eight items in the *post test* showed the average completeness percentage of 80%. The sensitivity of each following item 1,2,3,4,5,6,7, and 10 is good. On the contrary, number 8 and 9 were categorized as not sensitive items. Gronlund in Ibrahim [5] explain that one item is sensitive to learning if S ≥ 0.30. Finally, both *pre-test* and *post test* scores were used to determine N-Gain of each student as can be seen on Table 4.

Table 4. The result of students' conceptual mastery of gaharu tree (*Aqualaria malacensis*) identi- fication, percentage of completeness, and n- gain of class A.

Student Number	***Pre-Test* Score**	**Inf.**	***Post-Test* Score**	**Inf.**	**N-Gain**	**Information**
1.	70	NC	90	C	0,67	Moderate
2.	65	NC	80	C	0,43	Moderate
3.	67,5	NC	85	C	0,54	Moderate
4.	62,5	NC	77,5	C	0,40	Moderate
5.	67,5	NC	82,5	C	0,46	Moderate
6.	65	NC	82,5	C	0,50	Moderate
7.	70	NC	90	C	0,67	Moderate
8.	65	NC	85	C	0,57	Moderate
9.	75	NC	90	C	0,60	Moderate
10.	65	NC	87,5	C	0,64	Moderate
11.	55	NC	70	NC	0,33	Moderate
12.	67,5	NC	85	C	0,54	Moderate
13.	62,5	NC	77,5	C	0,40	Moderate
14.	67,5	NC	85	C	0,54	Moderate
15.	72,5	NC	85	C	0,45	Moderate
16.	57,5	NC	75	C	0,41	Moderate
17.	67,5	NC	82,5	C	0,46	Moderate
18.	67,5	NC	82,5	C	0,46	Moderate
19.	72,5	NC	90	C	0,64	Moderate
20.	50	NC	67,5	NC	0,35	Moderate
21.	50	NC	60	NC	0,20	Low
% Comp	**0**	**NC**	**85,71**	**C**		

Note*: Inf. = Information, Comp = Completeness, C = Complete, NC = Not Complete*
It is shown in Table 4 above that the classical completeness of students in Class A seen from the result of pre-test and post-test reached 85.71% with the gain score 48.86. Based on this result, it can be assumed that the learning process which was conducted in Class A could improve the conceptual mastery of the students in identifying Gaharu tree (*Aqualaria malacencis*).

Conceptual mastery of class B. The result of completeness analysis in relation to conceptual mastery can be seen in Table 5 below:

Table 5. Item completeness of conceptual mastery of gaharu tree (*Aqualaria malacencis*) identification in class B.

Items	Pre Test		Post Test		Sensitivity	
	% Comp.	Inf.	% Comp.	Inf.	S I	Inf.
1	64	NC	80	C	0.63	S
2	70	C	84	C	0.58	S
3	67	NC	86	C	0.74	S
4	79	C	99	C	0.79	S
5	80	C	99	C	0.74	S
6	63	NC	84	C	0.84	S
7	71	C	89	C	0.74	S
8	61	NC	70	C	0.37	S
9	51	NC	75	C	0.95	S
10	51	NC	78	C	0.95	S
Post test of Class B	40		100			

Information (Inf.) *:% Comp. = The Percentage of Completeness NC= Not Complete, C =Complete S=Sensitivity, NS= Not Sensitive*
Based on Table 5 above, it is known there are four (4) items reached the percentage of completeness 40%. The items are focusing on the conceptual mastery of gaharu tree (*Aqualaria malacencis*) identification. On the other hand, the result of post-test conducted in class B shows that all items are classified *Complete* with the average percentage of completeness 100%. The sensitivity of all items was good as an item can be classified into sensitive towards the learning if $S \geq 0.30$ [5]. The scores gained from pre-test and post-test were then used to find out N-Gain of each student as can be seen in Table 6 and for a more detail information please see appendix 2.

Table 6. Score from the mastery test of conceptual identification of gaharu tree (*Aqualaria malacencis*), the percentage of students' completeness, n-gain of students in class B.

Students' Number	Pre Test Score	Inf.	Post Test Score	Inf.	N-Gain	Inf.
1	65	NC	77.5	C	0.36	Moderate
2	72.5	NC	97.5	C	0.91	High
3	65	NC	87.5	C	0.64	Moderate
4	57.5	NC	75	C	0.41	Moderate
5	75	C	90	C	0.60	Moderate
6	60	NC	80	C	0.50	Moderate
7	70	NC	85	C	0.50	Moderate
8	62.5	NC	87.5	C	0.67	Moderate
9	65	NC	82.5	C	0.50	Moderate
10	55	NC	77.5	C	0.50	Moderate
11	72.5	NC	85	C	0.45	Moderate
12	77.5	C	97.5	C	0.89	High
13	70	NC	77.5	C	0.25	Low
14	55	NC	72.5	NC	0.39	Moderate
15	62.5	NC	80	C	0.47	Moderate
16	65	NC	82.5	C	0.50	Moderate
17	80	C	97.5	C	0.89	High
18	70	NC	87.5	C	0.58	Moderate
19	55	NC	80	C	0.56	Moderate
C (%)	**15.79**	**NC**	**94.74**	C		

Note: *Inf. = Information, C= Completeness, C= Complete, NC= Not Complete*

Table 6 reveals the percentage of classical completeness in Class B for the pre-test was 15.79% and 94.74% for the post test. In addition, the average of gain score was 0.56 and it falls into moderate category. From the aforementioned results, it can be concluded that the learning process conducted in class B could improve the students' conceptual mastery of gaharu tree (*Aqualaria malacencis*) identification.

Students' performance in the gaharu oil distillation process

Gaharu oil distillation process is a process designed for the students to do a science experiment which will give them a meaning- ful learning experience. There are several indicators used in evaluating the students' performance, they are as follows: 1= setting up equipments, 2= using thermometer, 3= using pressure gauge, 4= using safety valve, 5= preparing the raw materials of gaharu, 6= conducting the gaharu oil distillation process based on the given procedure, 7= documenting the result or data from the experiment, 8= analyzing the data, 9= drawing conclusion.

The evaluation of students' performance in class A. The evaluation result of students' performance in class A when conducting the gaharu oil distillation experiment can be seen in Table 7 below.

Table 7. The evaluation of students' performance in gaharu oil distillation experiment.

Student's number	Average performance score	Score
1.	3.9	97.2
2.	3.9	97.2
3.	3.7	91.7
4.	3.9	97.2
5.	3.2	80.6
6.	3.7	91.7
7.	3.1	77.8
8.	3.2	80.6
9.	3.4	86.1
10.	3.1	77.8
11.	3.4	86.1
12.	3.1	77.8
13.	3.8	94.4
14.	3.8	94.4
15.	3.1	77.8
16.	3.3	83.3
17.	3.6	88.9
18.	4	4
19.	3.1	77.8
20.	3.6	88.9
21.	3.4	86.1
Average Score	**3.5**	**87.3**

Based on Table 7 above, it is known that the average score of students' performance in class A is 3.5 with the score of 87.3 (Excellent). Based on this result it can be assumed that the students were able to conduct the gaharu oil distillation experiment excellently.

The evaluation of students' performance in class B. The evaluation result of students' performance in class B when conducting the gaharu oil distillation experiment can be seen in Table 8 below.

Table 8. The evaluation of students' performance in gaharu oil distillation experiment.

Student's num-	Average performance	Score
1.	3	80.6
2.	3	97.2
3.	3	97.2
4.	3	77.8
5.	3	91.7
6.	3.7	91.7
7.	3.7	91.7
8.	3.8	94.4
9.	3.7	91.7
10.	3.3	83.3
11.	3.1	77.8
12.	3.8	94.4
13.	3.2	80.6
14.	3.9	97.2
15.	3.3	83.3
16.	3.8	94.4
17.	3.6	88.9
18.	3.8	94.4
19.	3.2	80.6
Average Score	**3.6**	**88.9**

Table 8 shows that the average score of class B students' performance is 3.6 with the score 88.9 (Excellent). Therefore, it is assumed that the students in Class B were able to conduct the gaharu oil distillation experiment excellently.

Discussion

The students' conceptual mastery of gaharu tree (*Aqualaria malacencis*) identification is classified as *Excellent*, this can be proved by the fact that most of the students in class B could explain the structure and characteristics of gaharu tree (*Aqualaria malacencis*). They could identify important information about *Aqualaria* as one type of evergreen tropical forest trees and fast growing species. Its trunk's surface is smooth, whitish, and sometimes has grooves. Leaves are single, 4.5 – 10 cm long and 1.5 – 4.5cm wide, green with white spots and wavy margin, sometimes pubescent and glabrescent beneath, base acute, attenuate or obtuse, apex acuminate, acumen up to 1 cm long, blade elliptical-oblong to oblonglanceolate. Veins in 12-19 pairs, rather irregular, often branched and this can be seen clearly from above. Petiole is 3-5mm long and hairy. This is consistent with a general overview of the structure and properties of Gaharu tree proposed by Barden [2] that the Gaharu tree has a trunk slippery surface, a single leaf in green with wavy edges of the leaves, stalks hairy leaves and inflorescence at the end.

The visible characteristics of a mature *Aqualaria* can be seen from its soft bark, yellowish canopy, falling leaves, swelling, and cankers on the bole. The compounds in gaharu which produce fragrance are guia dienal, selindienone and selina dienol. Drilling the trunk and inserting inoculums' fungi in it are done by people for a commercial reason. Each species of gaharu tree has specific microbe which induces

gaharu production in large amount. Gaharu is made as a result of the response given by tree when microbes entered a wounded tissue. A wound in a wood plant may occur naturally when there is a broken branch or a peeled bark. On the other hand, the artificial wound exists by drilling and sawing. Microbe which enters the wood cells is considered as an unidentified object and causes the cells to produce a phytoalexin compound. The compound is a tree defense reaction towards disease or pathogen. The phytoalexin compound is a brownish aromatic resin which piles up around the xylem and phloem in order to prevent the spread of the wound in other cells. However, if the undefeated infection caused by the microbe, gaharu will not be formed. The wounded area of the trunk will decay.

Data from Table 7 and Table 8 reveal that all students were considered exceptionally capable of conducting gaharu oil distillation process. The students have mastered the skills of setting up the equipments, using thermometer, using pressure gauge, using safety valve, preparing the raw materials of gaharu, conducting the gaharu oil distillation process based on the given procedure, documenting the result or data from the experiment, analyzing the data, and drawing conclusion from the data. The 21st century learning is demanding an improvement in the learning process in order to achieve certain life and career skills, learning and innovation skills as well as information, media and technology skills. The framework of 21st century learning indicates that the goal of learning is not only improving knowledge of the core subjects but also equipping it with critical thinking skills, strong characters (responsible, social, tolerant, productive, and adaptive). In addition, technology, collaboration and communication skills are imperative in maximizing the application of 21 concept [13].

The activities carried out to produce students as prospective teachers managed to live in the future, have the ability to think, creative, able to exploit the natural resources through the development of entrepreneurship, strong character (responsible, social, tolerant, productive, able to provide supplies adaptive) and take advantage of technology and synchronize information and education to the needs of the workforce with the addition of local knowledge and use forest products in this tree aloes. The results of this study can be insight into students to maintain and conserve the forest and has the ability to use the forests of raw materials into finished materials, namely of gaharu into aloes against selling very high. Siagian [9] gaharu (Aquilaria malaccensis) is a major forest products traded and is a product that is integrated with International markets.

4. Conclusion

Referring to the data analysis and discussion, it can be concluded that the students' scores related to conceptual mas- tery of gaharu tree (*Aqularia Malancensis*) identification in class A is 85.71 and in class B is 94.74. Therefore, the scores from both classes fall into *Excellent* category. An- other supporting finding can also be seen from the result of students' performance while conducting the gaharu oil dis- tillation process. The mean score from the performance evaluation in class A is 87.3 and in class B is 88.9. To conclude, students' conceptual mastery of gaharu tree identification and performance in conducting gaharu oil distillation process are considered *Good* and may be proposed as optional learning activities in High Level Botany Course Course as the activities bring in the local content issue and thus in line with the 21st century Curriculum.

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References

[1] Anonymous 2015 *The Development of Forest In Kalimantan*. Kaltimprov go id
[2] Barden A N, Muliken T and Song M 2000 *Heart of the Matter: Agarwood Use and Trade and CITES Implementation for Aquilaria malaccensis* (TRAFFIC Network)
[3] Dwinanto R A 2015 *Forest area remained but its function decline*. Tribun. Samarinda.
[4] Hake R R 1999 *Analyzing Change/Gain Scores* (USA: Departmentof Physics, Indiana University)
[5] Ibrahim M 2005 *Sustainable assessment* (Surabaya: Unesa University Press)
[6] Isaac dan Michael 1981 Model CIPP. www.google.com
[7] Ratumanan T and Laurens 2011 *Learning Outcomes Assessment in Education Unit* (Surabaya: Unesa University Press)
[8] Ridwan N A 2007 Scientific grounding Local Wisdom *Jurnal Studi Islam dan Budaya* **5 (1)** p 27-38
[9] Riley R W 2010 *Educators, Technology and 21st Century Skills*: Dispelling Five Myths A Study on the Connection Between K–12 Technology Use and 21st Century Skills (Walden University) p 1-32
[10] Siagian M 2006 Gaharu exploitation and Threats Subsistence *Buletin Kerabat* **1 (2)** p 1-5
[11] Silva E 2009 *Measuring Skills for 21st-Century Learning* (Washington DC: Phi Delta Kappan) **90 (09)** p 630-634
[12] Sumarna Y 2012 *Aquaculture Producers gaharu tree types* (Bogor: Badan Pengembangan dan Penelitian Kehutanan)
[13] Trilling B and Hood P 2009 Learning Technology and Education Reform in the Knowledge Age *Educationalo Technologi* Wested
[14] Tucson 2009 *The Partnership for 21st Century Skills has Developed a Vision for Student Success in The New Global Economy*. 177 N. Church Avenue, Suite 305 Tucson, AZ 85701 520-623-2466 www.21stcenturyskills.org177 N. Church Avenue, Suite 305 Tucson, AZ 85701 520-623**.**