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RESEARCH-BASED *KOLEGA* LEARNING MODEL ON BIOLOGY TO GROW THE HABIT OF SCIENTIFIC LEARNING FOR SENIOR HIGH SCHOOL STUDENTS

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Abstract

This research is intended to discover (1) the influence of research-based KOLEGA (*Kontrol Lembar* Keluarga/Family Control Sheet) learning model's implementation to grow students' scientific learning habit and (2) the influence of KOLEGA model to improve students' learning outcome. This research used experiment method with Pretest–Postest Control Group design. The subject of this research was students of XI MIPA Class of SMA Negeri 1 Lasem academic year 2016/ 2017. The data of the research were students' scientific learning habit and their learning outcome. The data were collected from questionnaire, test, and documentation. The sample was taken with purposive sampling. The samples consist of two classes, the experiment class of XI MIPA 4, a class which has been known on having low average result of biology, and the control class of XI MIPA 5. The analysis of the data used descriptive quantitative. The result and discussions showed that: (1) the implementation of KOLEGA can grow students' scientific learning habit. The measurement obtained the data of t_{count} = 291.028, while t_{table} = 2,045. Since $t_{count} > t_{table}$, it can be concluded that the implementation of the design can grow students' scientific learning habit; (2) the implementatio of KOLEGA can increase students' learning result. The experiment obtained the data of t_{count} = 2.037 and t_{table} = 1.671. Since $t_{count} > t_{table}$ (2.037 > 1.671), therefore, Ho is rejected or Ha is accepted.

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INTRODUCTION

Curriculum of 2013 aims to prepare Indonesia's human resources to become an individual and a citizen which is faithful, productive, creative, innovative, and affective as well as able to contribute to the life of the community, nation, and the world. Curriculum development is an important thing to work hand in hand with the continuous development of science, technology, and culture as well as social dynamics in the level of local, national, regional, and global in the future.

Curriculum of 2013 does not only focus on cognitive and affective aspect, but also provide balance space to the psychomotor aspect. In its elaboration, the application of Curriculum of 2013 has been regulated systematically through 5 steps: observing, asking, trying, associating, and communicating. These five steps are also knowns as Scientific Approach. The recent rule of the society also regulate the same thing as in the Regulation of Ministry of Education and Culture Number 65 Year 2013, emphasizing on the standard of process as the main goal in improving students' competence. It can be seen from students' skills which emphasized on scientific approach. Scientific approach emphasizes on research-based learning model.

According to Chrysti (2011), research-based learning is an authentic learning which focuses on students' problem-solving skills from the perspective of problem's formulation, problem's solving, and communicating the advantage of research's objective. These things are believed to be able to improve the quality of learning. This method is included as cooperative learning, problem-solving, authentic learning, contextual (hands on & minds on), and inquiry discovery approach. It is expected that this model can develop students' critical thinking, analyzing skills, and evaluation to certain problems.

Regarding the advantage of learning with research basis, GIHE (in Widyawati *et al*; 2010) explains various advantages of research-based learning, as; (1) enrich the learning source; (2) the use of modern research discoveries; (3) enrich learning activities with contemporary research issue; (4) teaching research methodology in learning process; (5) enrich the learning process with small-scaled research activities; (6) enrich the process of learning by involving students; (7) enrich the learning process with encouraging the students to be a part of research culture; and (8) enrich the learning process with values which should be owned by a researcher.

In the execution, the facts in the field shows a crucial problem. General learning strategies of teachers are in the form of lecture, discussion, and question and answer section. It is proven from the data of the fields. From simple questionnaire to 10 students of 5 XI grade science class obtained that 9 of 10 students answered that they only got lectures, discussion, and question and answer section in their X grade. The condition makes research-based learnings, like Inquiry Learning, Problem-Based Learning (PBL), Contextual Learning, or Project-Based Learning (PjBL) only written in the lesson plan. Meanwhile, in its operational term, it is always be changed with lectures followed by discussion and question and answers to solve the load of materials. To handle the problem, Wardoyo (2013) views that it is the right time to build students' scientists character. This behavior is characterized with high curiosity and able to solve problems with systematic, objective, and strong mindset. Similar to Wardoyo (2013), Sarwiji (2013:04) emphasizes on the target system of the school by teaching students to think, including (1) the way to ask, (2) the way to arrange question and conduct research, (3) the way to embrace intellectuality, and (4) the way to change people's behavior in positive way.

Apart from the problems above, the environment of students' family also has a crucial problem, especially on the minimum awareness and family roles in supporting the students' learning outcome. This problem generally happens to parents of students in SMA Negeri 1 Lasem. Family and parents tend to unaware with students' learning activity at home. They tend to delegate all learning process to school environment. This minimum awareness of the parents to students' learning habit is strongly related to their education background and economic level. From the information of Guidance and Counseling teacher of SMA Negeri 1 Lasem, many parents of the students were only able to pursue Junior High School education, while they only have the average monthly income of below Rp. 2.000.000,-.

This problem becomes a challenge for the government, especially in the level of education. As the effort to involve family and other party to

fix this, the government has regulated the Regulation of Ministry of Education and Culture Number 23 Year 2015 regarding the Character Building. It is a collective movement involving all parties, including the government, house of representative, non governmental organization, media, school, parents, industries, and society's in general. Parent has specific roles to do, the roles are:

1) Making commitment between family members to do the Character Building Movement.
2) Conducting Character Building Movement in family environment as an effort to insert social education to strengthen the values of harmony among family members.
3) Applying the adaptation of Character Building Movement in family environment, whether with obliged activities, general habit, or periodic adaptation.
4) Play important roles in many activities at school, whether intracurricular or extracurricular.

The source of family's involvement above is expected to grow children's learning habit continuously. Therefore, the building of students' scientific learning can improve their learning outcome immediately. Based on the background, the researcher tries to do research and development through the application of learning model of research-based KOLEGA (*Kontrol Lembar Keluarga* or the Family Control Sheet). The design of this learning model is planned to effectively and efficiently handle the problem. It is hoped that this research is able to grow students' scientific learning habit to improve their learning outcome.

METHODS

This research used the simple research steps of Borg & Gall as quoted in Samsudi (2009:89). There are 10 steps of research by Borg and Gall which implementation is divided into three main steps.

Initial study by using descriptive approach

This step uses initial study, where the researcher collected the data through observation and questionnaire. The observation of data was done by taking it from Guidance and Counseling teacher of SMA Negeri 1 Lasem related to the level of education and the economic status of students' parents. The data collection focused on an experiment class of XI MIPA 4. The obtained data was then correlated to the data regarding students' learning habit through questionnaire.

The questionnaire was chosen based on sampling to 5 students class of XI MIPA (Science Class) with 2 students each.

Development of learning model with applying descriptive approach

The design of developed model is a learning process which is based on research (the technical guidance is a scientific step) by including structured and periodic control of parents. This learning design was then validated by experts of competence and skills. Then, there will be a trials to simulate the application of the learning design. For the examination, the researcher conducted experiment by comparing the effectiveness and efficiency between the learning model of before and after the application of the learning model. In this step, the researcher conducted limited trials to the students of experiment class with Pre-Experimental Design in One group pretest – posttest design. It is decided that the experiment class in the testing of the learning model was XI MIPA 4. This class was going to have a pretest and posttest before and after the application of research-based KOLEGA.

Model's validation

To prove that research-based KOLEGA will be more effective or efficient, a validation of model was conducted. Validation of model was done through further testing, where the researcher continued the testing through the application of some experiment methods of True Experimental Design in the form of Pretest–Posttest Control Group Design. In this stage, the researcher added one class as the control class, which was XI MIPA 5. Two classes (experiment and control classes) are going to do pretest and posttest before the application of the research-based KOLEGA learning design. XI MIPA 4 was treated with the learning design after getting a pretest, while the control class, XI MIPA 5, do not get the same treatment.

The population of this research was the students of 5 XI MIPA Classes with the total of 140 students (35 male students and 105 female students). As the subject/sample of the research and development of the design, the experiment class of this research was 31 students of XI MIPA 4 of SMA Negeri 1 Lasem academic year 2016/2017, with the ratio of gender of 6 male students comparing to 25 female students. In the validation of the learning design, the researcher choose another class as the control class which

was XI MIPA 5 with 31 students consisting of 6 male students and 25 female students.

The result of the questionnaire was the responses of the students regarding the level of implementation of KOLEGA model to grow the habit of scientific learning of students. The taken tests were the pretest and posttest for the step of research and development and added with the control class in the validation of learning design as the parameter of students' learning result. The documentation was photo and video during the learning process. The photos and videos were taken to the data regarding the involvement of parents/family to the process of learning at home, and the interview to parents responding the application of KOLEGA.

To measure the success of KOLEGA, the researcher did it by comparing the learning habit before and after the application of the learning design using a questionnaire. It is done to prove the significant comparison before and after the application of KOLEGA, the test was measured statistically with correlated t-test.

To measure the result of KOLEGA to improve students' learning result, the researcher used two analysis, the first analysis was the developmental stage using the model of Pre-Experimental Design in the form of One group pretest – posttest design. The second analysis was the validation of design which involved the experiment and control class using true experimental design in Pretest – Postest Control Group Design. The first analysis was testing the initial difference between before and after the application of learning design through pretest and posttest of the experiment class. The testing with statistical technique using one sample t-test. The second analysis tested the initial comparison between experiment and control class (O_1: O_3) through pretest activity before the application of the learning design. The testing used t-test through homogeneity test. The next step was measuring the hypothesis by: "Applying the learning design of KOLEGA to improve students' learning outcome". The statistical technique to test the hypothesis was two-related sample t-test. It was tested to know the difference between O_2 and O_4. If there is a significant difference, where O_2 was higher than O_4, the application of research-based KOLEGA had positively influenced students' learning outcome.

RESULTS AND DISCUSSION

First Testing

1. Growing the Habit of Scientific Learning

After the handout of the learning design was validated by experts and revised, the initial stage was the testing of handout's application. The testing was done to show if the model is more effective and efficient to grow students' learning habit through scientific approach. Therefore, the testing was done with an experiment of comparing the effectiveness and efficiency of the older learning method with the newer one through the design of research-based KOLEGA. The indicator of efficiency and effectiveness of new learning method was the syntax of scientific approach which includes the activity of observing, asking, trying, associating, and communicating.

Experiment to measure the effectiveness and efficiency of the application of KOLEGA learning design was by comparing before and after the application of the model. IN this research, the researcher took XI MIPA 4 as the experiment class. The instrument to measure the effectiveness of the learning design was a questionnaire, which contain the score the aspects of effectiveness of the use of research-based KOLEGA. The scoring is based on five syntactic indicators of scientific approach, starting from observing, asking, trying, associating, and communicating in the learning process and students learning, which are very good (4), good (3), fairly good (2), and poor (1).

Table 1. A questionnaire to measure the effectiveness of new learning design

Before the Treatment	Stages of Scientific Approach	After the Treatment
	How is the activity of **observing** in the learning process?	
	How is the activity of **asking** in the learning process?	
	How is the activity of **trying** in the learning process?	
	How is the activity of **associating** in the learning process?	
	How is the activity of **communicating** in the learning process?	
	Total Score	

To count the average score of effectiveness before and after the treatment, a criterion/ideal score was determined. The ideal score = 4 x 5 x 31 = 620 (4 = the highest score; 5 = the questions; 31 = the total of respondents). Then, the ideal score for each item = 4 x 31 = 124 (4 = the highest score; 31 = the total of respondents). The scoring of 31 students regarding the effectiveness of the conventional learning model to their scientific learning habit can be seen in Table 2 as follows.

Table 2. The performance of the system before the application of the new learning design

Total of Respondents	Score of Each Stage					Total Score
	Observing	Asking	Trying	Associating	Communicating	
30	59	38	60	32	69	258

Based on the table above, the total score was 258. Thus, the effectiveness of the learning method before the treatment = 258 : 620 = 0.42 or 42% from the criterion. The effectiveness of each item or stage was, observing = 59 : 124 = 0.475 or 47.5%, asking = 38 : 124 = 0.306 or 30.6%, trying = 60 : 124 = 0.484 or 48.4%, associating = 32 : 124 = 0.258 or 25.8%, and communicating = 69 : 124 = 0.556 or 55.6%. From five instruments, the lowest score of effectiveness was associating with 25.8%. Then, the way to count the effectiveness of KOLEGA learning design application was the same to count the effectiveness of the learning method before KOLEGA. The ideal score = 4 x 5 x 31 = 620 (4 = the highest score; 5 = the questions; 31 = the total of respondents). Then, the ideal score for each item = 4 x 31 = 124 (4 = the highest score; 31 = the total of respondents). The scoring of 31 students regarding the effectiveness of the research-based KOLEGA learning design to improve their scientific learning habit can be seen in Table 3 as follows.

Table 3. The performance of the system after the application of the new learning design

Total of Respondents	Score of Each Stage					Total Score
	Observing	Asking	Trying	Associating	Communicating	
30	116	94	112	98	108	529

Based on table 1.3, the total score was 529. Thus, the effectiveness of the learning method after the application of the new learning model = 529 : 620 = 0.85 or 85% from the criterion. The effectiveness of each item or stage of scientific approach was, observing = 116 : 124 = 0.935 or 93.5%, asking = 94 : 124 = 0.758 or 75.8%, trying = 112 : 124 = 0.903 or 90.3%, associating = 98 : 124 = 0.790 or 79.0%, and communicating = 108 : 124 = 0.870 or 87%. From five instruments, the lowest score of effectiveness was asking with 75.8%. The comparison of the learning method before and after the use of research-based KOLEGA is presented in Table 4 as follows.

Table 4. The comparison of students' scientific learning habit before and after the application of research-based KOLEGA learning model

Before the Treatment	Stages of Scientific Approach	After the Treatment
47.5%	How is the activity of **observing** in the learning process?	93.5%
30.6%	How is the activity of **asking** in the learning process?	75.8%
48.4%	How is the activity of **trying** in the learning process?	90.3%
25.8%	How is the activity of **associating** in the learning process?	79%
55.6%	How is the activity of **communicating** in the learning process?	87%
41.58%	**Average Score**	85.12%

Based on Table 4, the new method is proven more effective comparing to the conventional learning method. The average score of learning method's effectiveness before the treatment only obtained 41.58% for students' scientific learning habit, while after the application of KOLEGA, it becomes 85.12%. Significant changes also happened to all stages of scientific approach; in details, observing increased from 47.5% to 93.5%, asking increased from 30.6% to 75.8%, trying increased from 48.4% to 90.3%, associating changed from 25.8% to 79%, communicating increased from 55.6% to 87%. In conclusion, research-based KOLEGA is more effective than the previous learning method. To show the difference of students' scientific learning habit before and after the application of the learning process, the data were tested statistically with correlated t-test (related). The testing began with finding the correlation of effectiveness score before and after the application of KOLEGA to students' scientific learning habit, focusing on the mean, standard deviation, and variance which can be seen in Table 5 as follow.

Table 5. The Score of Correlated System

The Scoring Aspects	X_1	X_2
n	31	31
$\sum X$	258	529
$\bar{X}$	8.322580645	17.06451613
S	0.292473118	0.795698925
S^2	0.540807839	0.892019576
r	0.162713111	0.162713111

Ho : $\mu 1 \leq \mu 2$

Ha : $\mu 1 > \mu 2$

In this research, the hypothesis can be formulated as:

Ho : The effectiveness of research-based KOLEGA is smaller or equal to conventional learning method.

Ha : The effectiveness of research-based KOLEGA is better than conventional learning method.

The testing used correlated t-test skewed to the right. The test was used since the alternative hypothesis (Ha) is "better", and the t is measured by the formula of:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\left(\frac{s_1}{\sqrt{n_1}}\right)\left(\frac{s_2}{\sqrt{n_2}}\right)}}$$

KETERANGAN :
$\bar{x}_1$ = Rata-rata sampel 1
$\bar{x}_2$ = Rata-rata sampel 2
s_1 = Simpangan baku sampel 1
s_2 = Simpangan baku sampel 2
s_1^2 = Varians sampel 1
s_2^2 = Varians sampel 2
r = Korelasi antara dua sampel

It obtain the result of t_{count} of -291.0277136 or 291.0277136, while the t_{table} is 2.045 (dk = n – 1 = 30, and α = 0.05). The test showed that the result skewed to the right, because the t_{count} falls to teh accepted area of Ha. It means that Ho is rejected as Ha is accepted.

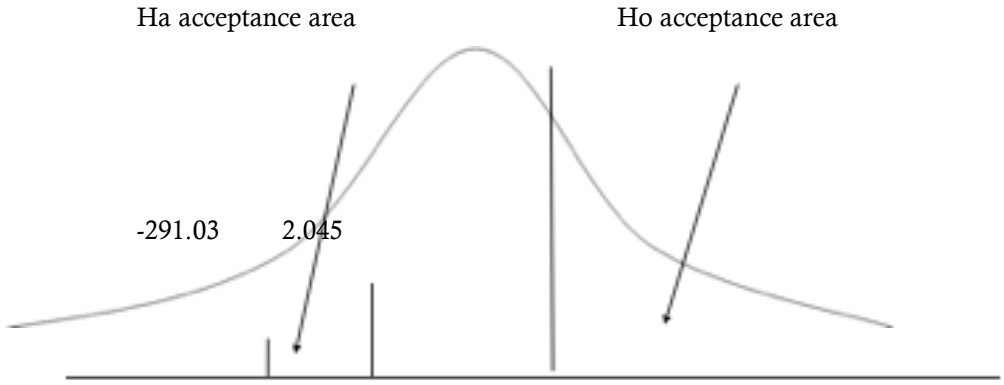

Figure 1. The Hypothesis skewed to the right. Tcount of -291.03 falls in the acceptance area of Ha, thereby, Ha is accepted.

2. Students' Learning Outcome

The data of the testing to research-based KOLEGA for 31 students in XI MIPA 4 class of SMA Negeri 1 Lasem are shown in Table 6 as follows.

Table 6. The Pretest and Posttest Score of Experiment Class

The Scoring Aspects	O_2	O_4
N	31	31
$\sum x$	1747	2299
$\bar{x}$	56.35483871	74.16129032
S	127.9698925	97.13978495
S^2	11.31237784	9.855951752
r	0.320861331	0.320861331

In this research, the hypothesis can be formulated as:

Ho : The effectiveness of research-based KOLEGA is smaller or equal to conventional learning method.

Ha : The effectiveness of research-based KOLEGA is better than conventional learning method.

Ho : $\mu 1 \leq \mu 2$

Ha : $\mu 1 > \mu 2$

This test aimed to know the difference between before and after the application of research-based KOLEGA. Based on the measurement with correlated t-test, the t_{count} is - 3.595 or |t| count = 3.595, while t_{table} is 2.045 (dk = n – 1 = 30. and α 0.05). Since $t_{count} > t_{table}$ (3.595 > 2.045), the Ho was rejected or Ha was accepted. Therefore, it can be concluded that the design of research-based KOLEGA is effective enough to improve the learning outcome of biology for the students of XI MIPA 4.

The Result of Step II Testing

1. The Pretest Score of Experiment and Control Class

To probe the effectiveness of research-based KOLEGA, step II validation test was done. The testing was done by adding control class. In this case, the researcher chose XI MIPA 5. The first step was the researcher compare the pretest result of the control class and experiment class before the treatment. The data of the pretests in both class can be seen in Table 7.

Table 7. The Pretest Score of Experiment Class and Control Class

The Scoring Aspects	Experiment Class (X)	Control Class (Y)
n	31	31
$\sum x$	1747	1789
$\bar{x}$	56.35483871	57.70967742
S	127.9698925	115.7462366
S^2	11.31237784	10.75854249

To measure the homogeneity of both data, a variance test for the pretests of experiment and control class was done under the formula of

$f = \frac{\text{biggest varianc}}{\text{smallest variance}} = \frac{127.9698925}{115.7462366} = 1.106$

From the $f_{count} = 1.106$ and $f_{table} = 1.84$ with the condition that $f_{count} < f_{table}$ (1.106 < 1.84), it can be said that the variance of both group of data was homogenous.

Then, both pretest score of experiment class and control class was employed again to prove the difference of the data using the formula of:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

From the measurement, it obtained the t_{count} = -0.483 or |t| count = 0.483, and t_{table} = 1.671 (dk = n1 + n2 - 2 . with α = 0.05). Since t_{count} is smaller than t_{table} (0.483 < 1. 6710), Ho was accepted or Ha was rejected. Thus, it can be concluded that there is no any significant difference to the score of pretests between experiment and control group.

2. The Posttest Score of Experiment Class and Control Class

The next step was testing the hypothesis. In this case, the hypothesis was "The application of research-based KOLEGA can improve students' learning outcome". The statistical technique to test the hypothesis was t-test for two related sample. The tests were posttest given to experiment class (O_2) and control class (O_4). If there is a difference of O_2 as higher than O_4 significantly, the application of KOLEGA influences the students positively. In contrast, if O_2 is smaller or equal to O_4, the application of KOLEGA is a negative influence to students. From the posttest score of experiment class and control class, it obtained the data as depicted in Table 8.

Table 8. The Posttest Score of Experiment Class and Control Class

The Scoring Aspects	O_2	O_4
n	31	31
ΣX	2299	2136
Rata-2	74.16129032	68.90322581
S^2	97.13978495	109.4236559
S	9.855951752	10.46057627
r	0.95339	0.95339

To measure the t_{count} this following formula was used.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

From the measurement, the t_{count} = 2.037, and t_{table} = 1.671 (dk = n1 + n2 - 2 , with α = 0.05). Since t_{count} > t_{table} (2.037 > 1.671), Ho was rejected or Ha was accepted. It means the conclusion of the testing in this step was there is a significant difference to the score of posttest between experiment class and control class.

3. Conceptual Framework

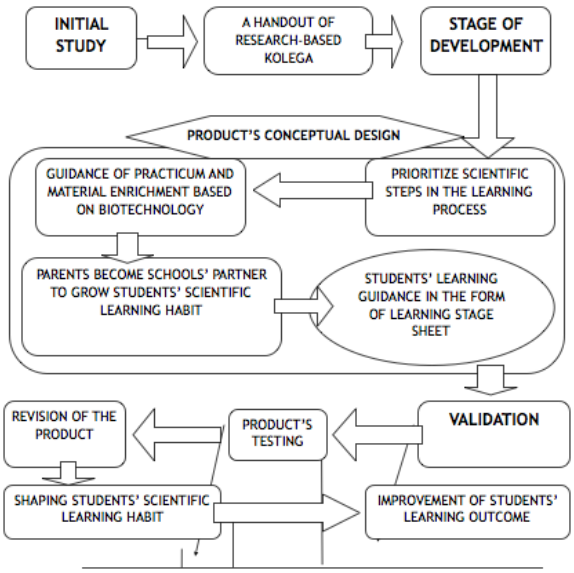

Figure 2. Conceptual Design of Research-Based KOLEGA

CONCLUSION

From the result and analysis, it can be concluded that: (1) the application of research-based KOLEGA improved students' scientific learning habit. The measurement obtained the t_{count} = 291.028, and t_{table} = 2.045. Because t_{count} > t_{table}, it means that the design is able to grow the habit of scientific learning; (2) the application of research-based KOLEGA can improve students learning outcome. The experiment obtained the data of t_{count} = 2.037 and t_{table} = 1.671. Since t_{count} > t_{table} (2.037 > 1.671), therefore, Ho is rejected or Ha is accepted.

From this research, it is suggested for teacher to apply research-based KOLEGA as the learning model to support the learning process. It is also expected that this media can inspire the creation of other learning media which can improve the quality of education in Indonesia to bear better future generation.

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