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THE DEVELOPMENT OF *INQUIRY BY LEARNING CYCLE* (*RYLEAC*) MODEL ON ELECTRICITY AND MAGNETIC CONCEPT TO INCREASE SCIENCE PROCESS SKILL AND THE ACADEMIC ACHIEVEMENT OF STUDENTS

Tirtawaty Abdjul[i],
Mursalin,
Elya Nusantari,
W. Dj. Sarson Pomalato
Department of Mathematics and Natural Sciences,
Universitas Negeri Gorontalo,
Indonesia

Abstract:
This study aims at developing an inquiry by learning cycle (RYLEAC) model in electricity and magnetic concept to increase science process skill and the learning achievement of students at physics department of Universitas Negeri Gorontalo and to describe factors supporting and inhibiting the RYLEAC learning model in basic physics subject, especially in electricity and magnetic concept. This study was a development study with 4D model. This study revealed: (1) the 4D development of RYLEAC learning model with the following steps of 4D: (a) define, (b) design, (c) develop, and (d) disseminate; (2) factors supporting the implementation of RYLEAC model implementation were (a) sufficient laboratory condition and facilities; (b) interaction among students, between students and lecturer, environment, and learning resources, lecturer allocated time to interact students and provide them with opportunities to ask questions. Meanwhile, the inhibiting factors were: (a) tools and media to carry out experiments were insufficient; (b) lack of reading the relevant books, making notes on what was gained from reading, discussion with friends, and lack of concentration during teaching and learning process.

Keywords: electricity, magnetic concept, RYLEAC learning model, science process skill

1. Introduction

Science is "*knowledge gained through learning and proofing*" or "*knowledge that encompasses general truth of the natural law*". Science, in this sense refers to a system to obtain

[i] Correspondence: email abdjultirta@gmail.com

knowledge through observation and experiment activities to portray and to describe the natural phenomena. Science or natural resource (hereinafter will be referred to as IPA) is an ideal way to obtain competencies such as skills, maintain attitude and develop concepts related to daily experiences (Suastra as cited by Ali, Suastra, Sudiatmika; 2013, 2).

One of the essences of IPA is as a process. The process to learn IPA or science is directed to make students willing to work on something not only understanding something, but also to make them actively participate in learning (Sujana, 2012: 27). Students should be allowed to have direct contact with objects that are currently or would be learnt. They are guided to carry out learning activities, such as carrying out problem identification, finding out various explanations on the discovered phenomena, develop minds-on (cognitive and affective) and develop hands-on skills (motoric) through experimental activities to solve problems.

Hands-on skills (motoric) in IPA learning are called science process skills. The science process skill is an activity that facilitates science learning, thus, enables students to actively participate in problem solving process and develop responsibility by using scientific methods (Rahmawati & Dasna, 2016: 1063). In physics science process skill, students are enabled to experience the essence of physics to make them skilled in carrying out activities related to physics. Wiratana (2013; 3) argued that science process skill of the students have large impact on their learning achievement.

Avianti & Yonata, 2015: 225), on one hand, mentioned that the advantages of the process skills are it is able to make students more creative, active, skilled in thinking, and skilled in obtaining knowledge. In order for those advantages to happen, a learning model specifically designed to make students active in a learning process is needed.

On the other hand, the situation is yet as expected. The data show that obstacles in physics learning, especially on process skill in physics learning are many. Based on the interview with one of the basic physics 2 lecturer, students' skills in physics learning were far from the expectation, they were lacking in observation skill, observation data trends interpretation skill, determining the variables, drawing conclusion and the skill to process and analyze observation data.

In addition to process skill, on the topic of electricity and magnet, students' learning output was relatively low. There were 40% of the students who enrolled in this subject got the C and D grades. This was due to their conceptual understanding on that topic was still lacking. The learning outcome is changes of learners' behavior due to teaching and learning process, such as changes in cognitive, affective, and psychomotor aspects.

To solve the problem above, a model specifically designed to develop students' thinking skill, like inquiry model, to be active in learning process is needed. Piaget (as cited in Setyowati; 2014: 9), mentioned that inquiry learning model is a learning model that prepare students for situations where they have to carry out experiment themselves, to see what was happening, willingness to do something, pose questions, and inquire for the answer themselves, as well as correlating one finding with another, and compare what has been previously discovered with other students.

Inquiry learning model made students actively involved in exploration activities, thus, effective to teach science concepts. This strengthened Neka, Marhaena and Suastra (2015:9) who argued that inquiry learning model can provide opportunities for students to actively participate in teaching and learning process.

Sanjaya (Astuti; 2015: 10), argued that several benefits of inquiry learning models were: 1) emphasizes on development of cognitive, affective, and psychomotor aspects proportionally, thus, learning through inquiry is considered as more meaningful.

In addition to implementation of inquiry learning model, one of the learning model to make students participate actively in learning is learning cycle model.

Learning cycles stages of activities organized to make students master the competencies that should be mastered in learning through active participation. 5E learning cycle model guides students to develop their own knowledge through 5E stages, which comprised of *engagement, exploration, explanation, elaboration, and evaluation* (Chiappetta & Koballa, 2010:129). The advantage of learning cycle model according to Warsono and Heriyanto (2014:35) were that: provide opportunities for students to think, inquire, discover, and describe the example of concepts that they learnt.

Based on the definition of inquiry model and learning cycle model, it can be concluded that RYLEAC learning model is a learning model who prepare students through experimental activities. Therefore, there is a need for the development of inquiry and learning cycle or abbreviated into RYLEAC model. This RYLEAC model is expected to increase the science process skill as well as students' learning outcome, especially in electricity and magnetic concepts.

Based on the problems identified above, the problem statements of this study were: How was the development of RYLEAC learning model and What were the supporting factors and inhibiting factors of RYLEAC learning model in basic physics 2 learning on electricity and magnetic concepts to increase science process skill and learning outcome of the students at the department of physics, Universitas Negeri Gorontalo?

Therefore, this study aims at developing a RYLEAC learning model and describing the supporting factors and inhibiting factors of the implementation on electricity and magnetic concept to increase science process skill and learning outcome of the students at the physics department of Universitas Negeri Gorontalo.

2. Methods

This study was carried out in the Department of Physics Department of Mathematics and Natural Science Faculty of Universitas Negeri Gorontalo. The limited trial subjects in this study was 1 classroom who enrolled in Basic Physics 2 subject at the Department of Chemistry Education, whereas the mass trial of this RYLEAC learning model was implemented in Class A, B, and C of the Physics Department who enrolled in the Basic

Physics 2 subject in the academic year of 2017/2018. This was a research and development study with 4D (*define, design, develop* and *disseminate*) originally developed by Thiagarajan, et al., (1974; 6) through descriptive quantitative approach.

This study produced several products such as learning model text book and RYLEAC learning media which consisted of :(1) lesson plan, (2) syllabus, (3) student worksheet, (4) teaching materials Ajar, (5) learning outcome test and process skill test.

This research was designed with *one group pretest post-test design.* The data obtained from this study were qualitative data (from the observation sheet to see factors that support and inhibit the implementation of the developed model and its learning media) and quantitative data (from the validity, practicality, and effectiveness test and the responses of the students toward the developed model and its learning media).

The quality of the developed RYLEAC learning model was determined based on:

A. Validity

Validity of the learning media in this study was obtained from the validity result from the experts using the validation sheet.

Validity sheet of the developed RYLEAC learning model consisted of 4 categories: very good, good, moderate, and not very good with the following indicators: (a) the syntax of RYLEAC learning model, (b) social system, (c) reaction principle, (d) support system, and (e) the direct and indirect impact. In the implementation of the developed model, learning media which comprised of lesson plan, syllabus, student worksheet, learning materials, process skill test and learning outcome test, and questionnaire (response questionnaire and questionnaire to find out the supporting and inhibiting factors of the RYLEAC learning model implementation), which need validation from the validators.

B. Practicality

The practicality of the model and the developed RYLEAC learning media inn the classroom and students' responses toward the implementation of RYLEAC learning model and its instruments are as follow:

a) Observation sheet on the implementation of learning process consists of the syntax of the RYLEAC model. The observers will provide a checked (√) sign on the Yes option for each syntax implemented by lecturer and checked (√) on the No option for each syntax that was not implemented by the lecturer.
b) Questionnaire was implemented to see the students' responses on the implementation of RYLEAC learning model. This was an 18 items statement. The scoring used Likert scale.

Table 2: Likert Scale Scoring

Category	Statement Score	
	Positive	Negative
Strongly Agree	5	1
Agree	4	2
Undecided	3	3
Disagree	2	4
Highly Disagree	1	5

C. Effectiveness

Effectiveness of the developed learning model using the observation sheets (students' activity and process skill) and test instrument (cognitive learning outcome). For observation sheet, each observer gave the score (4,3,2,1) in each aspect of activity and observed process skill, as well as cognitive learning outcome using the essay test type with the determined indicator.

D. Validity Analysis of the Model and Learning Media

Validity of the developed learning model is validated by the validator. The average score is described as follow:

Table 3: Validation Category of RYLEAC Learning Model

Average	Assessment Criteria
$4,0 \leq SV \leq 5,0$	Highly Valid
$3,0 \leq SV \leq 4,0$	Valid
$2,0 \leq SV \leq 3,0$	Moderately Valid
$1,0 \leq SV \leq 2,0$	Less valid
$0,0 \leq SV \leq 1,0$	invalid

(Arikunto, 2010:44)

E. Students' response and obstacle questionnaire

The result of students' responses and students' obstacle on learning implementation were analyzed using percentage of students' responses with the formula:

$\frac{F}{N}$P = x 100%

The model is said practical when 80% of the students responds positively and the percentage of the RYLEAC model implementation is in excellent and good category.

F. Effectiveness Analysis of the RYLEAC Learning Model Students' Activity and Process Skill

Data on the students' activity and students' process skill obtained during the learning process were analyzed using the following:

% of students' activity = $\frac{total\ obtained\ score}{maximum\ score} x\ 100\ \%$

The analysis of the average score of students' activity and process skill used the following category:

Table 5: The Criteria of Students' Activity and Process Skill

Percentage Range	Category
81% - 100%	Excellent
61% - 80%	Good
41% - 60%	Moderate
21% - 40%	Low
0% - 20%	Very Low

(Arikunto, 2010: 44)

G. Cognitive Learning Outcome Test

Data on the cognitive learning outcome in pretest and posttest were analyzed using N Gain analysis as presented below:

$$\langle g \rangle = \frac{\langle G \rangle}{\langle G \rangle_{maks}} = \frac{\bar{X}_{post} - \bar{X}_{pre}}{X_{maks} - \bar{X}_{pre}}$$

The analysis used the following criteria:

Table 6: Classification of the average N gain test

Value	Criteria
$(\langle g \rangle) \le 0,3$	Low
$0,3 < (\langle g \rangle) < 0,7$	Moderate
$(\langle g \rangle) \ge 0,7$	High

Source: Hake (1999).

3. Results

3.1 The Developed Model

The developed RYLEAC model refers to the characteristics of the model proposed by Bruce and Weil (1992: 135-136) which consisted of the syntax for RYLEAC learning model, social system and activity principle/reaction, support system, and instructional impact and indirect impact.

3.2 Syntax

Table 7: The Syntax of RYLEAC Learning

Syntax	Learning Direction
Engagement	➢ Demonstrate or present video about daily lives' phenomena ➢ Information and experience exchange by posing questions
Orienting	➢ Deliver the topic and describe learning objectives. ➢ Divide students into several groups, then distribute teaching material and students' worksheet to each group
Formulate problem	➢ Present problem to be addressed through learning activities
Formulate hypothesis	➢ Formulate hypothesis based on the determined problem
Collect data through	Provide opportunity for students to collect data through exploration activities

exploration	
Test hypothesis	Determine the acceptable answer based on the data or information obtained from data collection activities.
Explain	Describe a concept using their own sentences based on their exploration
Elaboration	Apply the concept that they obtained from exploration activity to answer advance questions
Formulate conclusion	Formulate conclusion based on the result of hypothesis testing
Evaluate	Carry out assessment on the knowledge and science process skill of the students

3.3 Social System and Reaction Principle
Lecturer and students participate in all relevant ideas. The reaction from this RYLEAC learning model is found within the engagement, exploration, and explanation stages. In engagement phase, lecturer present demonstration of things related to daily activities. Based on those demonstrations, students are expected to be able to construct initial knowledge to answer questions based on the presented demonstration.

3.4 Support System
Optimum support systems needed in RYLEAC learning model are: 1) lesson plan, 2) Syllabus, 3) teaching material for students reference in correlating the information based on the given tasks, 4) students' worksheet, 4) assessment tools, and 5) sufficient laboratory to support students in their experiments.

3.5 Instructional Impact and Indirect Impact
The indirect impacts of these learning models are: ability to honest in presenting their observation result, ability to respect others' opinion, ability to see the problem from various perspective, creative thinking, self-confident, and motivation.

3.6 4D Development Model
The developed RYLEAC with 4D (define, design, develop, and disseminate) model developed by Thiagarajan & Semmel (1974) described as follow:

Stage 1: Define
This stage consists of five main steps namely: preliminary-final analysis, students' analysis, task analysis, concept analysis, and formulate learning objectives.
a. Final-Preliminary Analysis
Interview with one of the lecturer who teach basic physics 2 subject, revealed that students process skill are still low in aspects such as, observation skill, formulating hypothesis, formulating problem statement, and skill to present the exploration result in front of the class. Students' cognitive were also relatively low. This was evident on their learning outcome, where 40% of the students got the Cs and Ds. Many of the students had never gained experience related to the concept being taught. In utilization of learning resources, lecturer mostly used text book and internet.

b. Students' Analysis

Based on the interview result, it was obtained that the students' background on electricity concept and magnetic concept were from different cognitive level. There were several students who can quickly understand the concept being described, and there were many students who slowly understand the described concept. Their economic background was also varied, some were from low economic background, and some were from middle class family. Their origin were also different, 25% of the students were from the South, 20% from the South East and 55% were originally from Gorontalo. Most of the students live in the dormitory or rent rooms, and there were students who still live with their parents. Based on their age and gender, the average age was 18-23 years old and from both sexes.

c. Task Analysis

The task analysis was aimed at identifying the main tasks that would be carried out during the learning process. The given tasks were done in groups based on the achievement analysis related to the concept being learn at the present, and it consisted of observing, formulating the problem statement, formulating the hypothesis, collecting the data, drawing conclusion, prove hypothesis with engagement, and elaboration.

d. Concept Analysis

This analysis was aimed at determining the content of the concept that would be developed.

e. Specifying Instructional Objectives/Learning Objectives Analysis

The formulation of learning objectives were based on the basic competencies and indicators mentioned within the curriculum. Based on the indicators on electricity and magnetic concept, the learning objectives that would be achieved are as follow:

- Basic process skill. Through experiment, students are expected to a) observe cases through presented pictures, b) classify experiment data, c) interpret observation result through presented pictures, d) formulate hypothesis based on the presented case, e) communicate experiment data using their own sentences, and f) formulate conclusion.
- Cognitive learning outcome comprised of several expected objectives, namely: a) describe the differences between open circuit and closed circuit, b) describe which circuit picture can conduct electric current, c) determine the amount of the flowing electricity and the amount of electron that goes through a point within the circuit using a presented case, d) determine the direction of the electricity current and the direction of the electron movement using the presented picture, e) determine the degree of the isolation and the current through presented case, f) calculate the electricity power within an electric circuit, g) show the position of the switch in a closed circuit through presented case, h) determine the polar produced in a magnetic production through induction process, i) classify the characteristics of materials based on its magnetic characteristics, j) describe the concept of magnetic power of an electric conductor within the magnetic field, k) determine the magnetic induction at the center and the tip of celenoid, l)

determine where the C wire should be placed in order for the force resultant in C to be zero through the presented picture, m) determine the direction of Lorentz power experienced by the wire, and n) compare the maximum GGL in Generator A and Generator B through the presented picture.

Stage 2: Design Phase
The activities in this stage were: (a) formulation of test (criterion-test construction); Construction of test instrument based on the learning objectives as the benchmark for students' ability such as product, process, and psychomotor; (b) media selection. The learning media that would be used are LCD, internet, and white board. Media selection was carried out to identify relevant learning media with the characteristic of the concept and their relevancies to students' needs. This was in order to help students to achieve the expected standard of competencies and basic competencies; (c) format selection. Format selection in the development of model and learning media was intended to design the content of the learning, strategy selection, approaches, learning methods, and learning sources. Strategies, approaches, methods, and learning sources especially on electricity and magnetic concepts were described within the Lesson Plan and the developed lesson plan; (d) initial design. The initial design is the design of all model and learning media that should be carried out before the trial was implemented.

Stage 3: Develop
The define and design stages produced an initial learning model called the first draft, which later validated by experts and following this validation would be tried on limited classroom trial. Validation was the first step of the develop program, which focused on format, content, and language of the developed learning model. Three experts validated the developed RYLEAC learning model. The results of validation such as the validation score, correction and recommendation were used to revise the developed learning model. The result of this revision was a valid model called draft 2.

Stage 4: Disseminate
The dissemination stage was the last stage of the development model in 4D development model. Dissemination of research result was carried out through a publication in internationally reputable journal called, *Global of Educational Studies* with ISSN 2377-3936 in 2018.

4. The Quality of RYLEAC Learning Model

4.1 Validity of RYLEAC Learning Model
Validation was carried out by three validators to see the validity of the learning, content and language, which comprised the model and all developed RYLEAC learning media in Basic Physics 2 subject. The validation result is presented in Table 1 below.

Table 1: Validation Result of RYLEAC Learning Model

Validation Aspects	**V1**	**V2**	**V3**	**Average**	**Notes**
Learning Syntax	5.00	5.00	4.92	4.97	Highly Valid
Social System and Reaction Principle	4.80	4.80	4.60	4.73	Highly Valid
Support System	5.00	5.00	5.00	5.00	Highly Valid
Instructional and Indirect Impact	4.75	4.75	4.75	4.75	Highly Valid
General conclusion of the validation	5.00	4.50	4.50	4.67	Highly Valid
Average	4,91	4,81	4,754	4,824	

Based on Table 1, it is seen that the developed learning model was highly valid, which means that the developed learning model is appropriate for learning. The implementation of RYLEAC learning model needs valid learning media. Below is the validation result of RYLEAC learning media.

Table 2: Validation Result of RYLEAC Learning Media

Learning media	Average	Category
Lesson plan	4,42	Highly Valid
Syllabus	4,43	Highly Valid
Students' worksheet	4,42	Highly Valid
Learning materials	4,54	Highly Valid
Test	RK	RK

Based on Table 2 above, it is evident that the developed RYLEAC learning media were appropriate to be implemented in learning Basic Physics 2, especially on the electricity and magnetic concepts.

4.2 Practicality

Practicality of the developed model was assessed form the implementation of the learning and students' responses toward the implementation of this developed RYLEAC learning model:

4.2.1 Implemented Learning

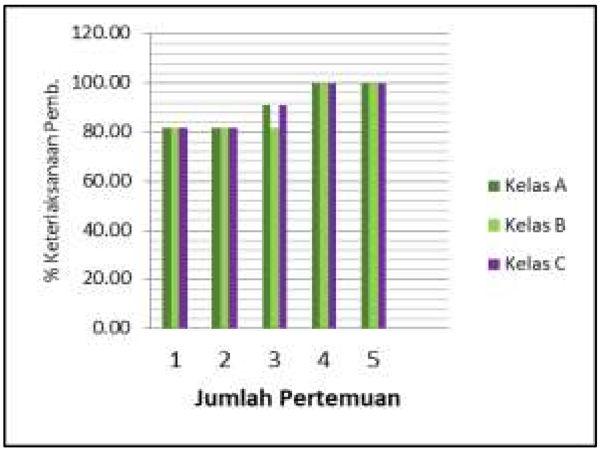

Figure 1: RYLEAC Learning Model Implementation on Large Scale Trial

Figure 1 above describes that the average implementation of RYLEAC learning model in limited classroom was 89.08 (excellent category) and on large scale trial was 90.03, with excellent category. The factors that support the well implementation of this RYLEAC learning model based on observation was that lecturer's performance was excellent in planning and implementing the learning process, group experiments, lecturer provides opportunities for students to voiced their opinion and ask question, students were actively and directly involved in learning process, and lecturer's role as facilitator in learning. This is similar with Arends (2012; 46), who stated that teacher's role is not only to deliver knowledge and truth, but also as facilitator and guide. Based on these descriptions, it can be concluded that developed RYLEAC learning model is appropriate to be implemented in Basic Physics 2 learning.

4.2.2 Students' Responses

Students' responses on the implementation of RYLEAC learning model is presented in the following Figure 2:

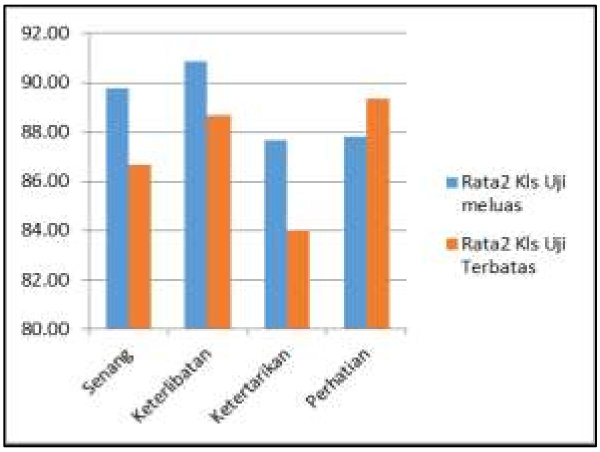

Figure 2: Students' Responses on Limited Trial Class

Based on Figure 2, students, both on limited trial class and large scale trial showed that large proportion of students highly agree with the implementation of RYLEAC learning model.

Based on these data, it can be concluded that the developed learning model was practical to be implemented in basic physics 2, especially on electricity and magnetic topic

4.2.3 Effectiveness

Learning Activity

Below is the students' learning activity in limited and large-scale trial:

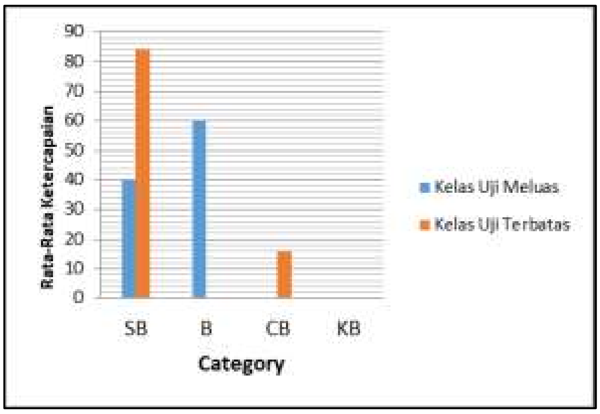

Figure 3: Students' Learning Activity on the Implementation of RYLEAC Learning Model

Based on Figure 3 above, it can be concluded that RYLEAC learning model encouraged students to actively participate in basic physics 2 learning. The learning process emphasized and encouraged that students be actively participated in learning (*student centered learning*) (King, Goodson & Rohani, 2011; 125). Students who actively participated in learning would construct their understanding with the knowledge; hence, it is expected to maximize their learning outcome. Maftuhah and Rahman (2015; 64) insisted that student-centered learning provide opportunities for students to apply the materials, develop knowledge and work in group; thus, can develop their scientific attitude, which in turn, increase their concept mastery. Ideally, students actively participate in learning activity, thus, learning would be meaningful and useful.

4.2.4 Learning Outcome

Students' Process Skill

The result of students' science process skill in the first, second, third, and fifth meetings for class trials are presented in the following figure:

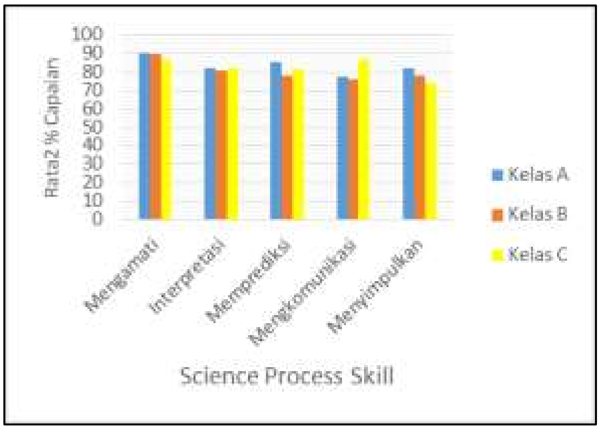

Figure 4: Students' Process Skill

The data on the students' process (Class, A, B, and C) through RYLEAC learning model could increase students' process skill. Inquiry learning used in increasing the science process skill contributed toward the science process skill and science concept

(Rizal, 2014; 76). In addition to inquiry model, 5E learning cycle could also increase students' science process skill, especially on exploration phase, as students carry out exploration and investigation activities. Thus, students could train their observing, communicating, classifying, measuring, inferring, predicting, hypothesizing, and defining variables (Tania & Murni ; 2017; 72)

4.2.5 Cognitive Learning Outcome

The cognitive learning outcome was presented in the following figure:

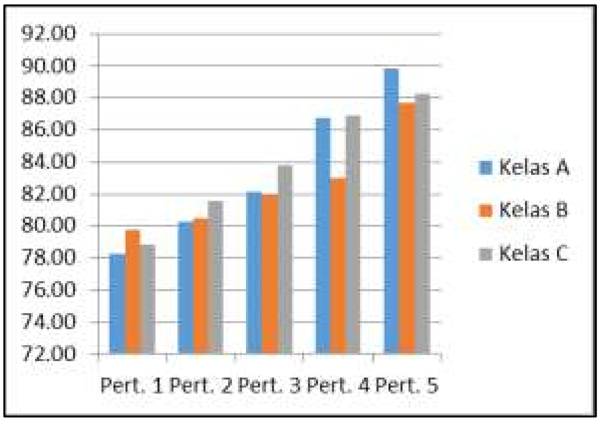

Figure 5: Cognitive Learning Outcome

Classically, students who accomplished this basic physics 2 subject, especially on electricity and magnetic topic in limited trial class was 87% and students who could not accomplish this subject was 13%. Based on the N gain test analysis, it was obtained that the students' learning outcome was on moderate category with the average achievement of 0.69.

Based on the N gain test, the average cognitive learning result test of class A was 0.78 or high category, Class B was 0.69 or moderate category, and Class C was 0.69 or moderate category. Learning result is essentially a change of students' behavior (Setiasih, 2016; 132). The success of a learning can be seen from the increase of learning ability of the students themselves (Arends, 2001 as cited in Eronika, Santoso & Maryami; 2013).

The description above showed that the developed RYLEAC learning model was valid, practical and effective; hence, could be used in teaching Basic Physics 2 subject on the topic of Electricity and Magnetic Concepts.

4.3 Supporting and Inhibiting Factors of Implementation of RYLEAC Learning Model and Media

The supporting factors in implementation of RYLEAC learning model based on the questionnaire distributed to students were 1). The facilities and infrastructure to implement RYLEAC learning model were sufficient to support learning activities, such as well-stuffed and well-maintained laboratory. Thus, students and lecturer felt comfortable to learn using RYLEAC learning model and motivated to participate in learning activities; 2) the learning model was well implemented as there were interactions among students, lecturer, environment, and learning resources; lecturer provided time for consultation to help students solve their learning problems, and provided opportunities for students to ask questions.

In addition to supporting factor, there were also several inhibiting factors in implementation RYLEAC model, such as 1) the lab facilities for practicum were yet sufficient. This was due to lack of experiment materials to be used. Therefore, in learning, students had to be distributed into three groups in learning. This was due to many laboratory facilities that were broken and could not be used; 2) some students' habit that were not used to read relevant books and made notes on what they have read and obtained during discussion in class, and lack of concentration in learning. These influenced the learning outcome; thus, there were students who could not accomplish the learning.

4.4 The Advantages and Disadvantages of RYLEAC Learning Model

In implementation of this learning model, several advantages and disadvantages were also found. Some advantages found in this study were: (1) students have active and hands-on learning experience. This was evident in their involvement in observation/experiment solving problems together through group discussion and present the result of their observation; (2) students understand the electricity and magnetic concepts. Their concept mastery was the evident from the increase of their learning outcome from the 1st, 2nd, 3rd, 4th, and 5th meeting; (3) students were able to solve problems presented through story or phenomena; (4) students' learning motivation increased as they were actively involved in learning process; (5) Due to their active participation in learning and exchange of information among students and lecturer, learning became more meaningful; (6) RYLEAC learning modelwas based on constructivism learning; (7) This model reduced the cognitive conflict on students during learning.

The advantages found in this study are similar to those of learning cycle according to Warsono and Heriyanto (2014:35) who argued that the advantages of learning cycle were: 1) increase students' learning motivation as students are actively involved in learning process, 2) assist in developing students' scientific attitude, and 3) more meaningful learning.

Aside from those advantages, there were also several disadvantages of RYLEAC learning model implementation, such as: 1) it needed shifting of students' way of learning from only receiving information without direct involvement in learning to active participation, 2) it needs more time in planning and implementing this learning model. This was evident from the amount of time spent in learning is longer than the conventional model time. This was due to students that were still not used to implement stages in RYLEAC learning model. This was in agreement with Sanjaya (as cited in Astuti; 2015: 11) where he stated that some disadvantages of inquiry learning model is that it takes more time in implementation. Ngalimun (2014; 35) also agreed that learning cycle has disadvantage such as it needs more time and resources in developing and implementing the learning.

5. Conclusion, Implication and Recommendation

5.1 Conclusion

The developed RYLEAC learning model based on 4D development model are:

a. Define Stage

In this stage, several analysis such as, preliminary-final analysis, students' analysis, task analysis, concept analysis, and formulate learning objectives were carried out.

b. Design Stage

The developed RYLEAC learning model design based on the result from the define stage and would be validated before the trials were carried out. The tests consisted of process skill test to find out the level of process skill and students' learning outcome test to find out the students' cognitive level.

c. Develop Stage

Define and design stages produced draft model of the learning called the first draft. This first draft would be validated by experts and would go through field trials. The steps in RYLEAC learning model were: (a) engagement, (b) orienting, (c) formulating the problem statement; (d) formulating the hypothesis; (e) collecting the data through exploration activity; (f) test the hypothesis; (g) explain; (h) elaborate; (i) formulate conclusion; and (j) evaluation.

d. Dissemination Stage

Dissemination stage was the final stage of the 4D development model. The dissemination of this study was through publication in international journal of Global of Educational Studies with the ISSN 2377-3936. Factors that support the implementation of this RYLEAC development model based on the questionnaire distributed to students were:

1) The facilities and infrastructure to implement RYLEAC learning model were sufficient to support learning activities, such as well-stuffed and well-maintained laboratory. Thus, students and lecturer felt comfortable to learn using RYLEAC learning model and motivated to participate in learning activities
2) The learning model was well implemented as there were interactions among students, lecturer, environment, and learning resources; lecturer provided time for consultation to help students solve their learning problems, and provided opportunities for students to ask questions.

The lab facilities for practicum were yet sufficient. This was due to lack of experiment materials to be used. Therefore, in learning, students had to be distributed into three groups in learning. This was due to many laboratory facilities that were broken and could not be used; 2) lecturer distributed students into groups based on the sitting arrangement, and often they decided themselves; and 3) time limitation.

RYLEAC learning model has several benefits namely: (1) students have active and hands-on learning experience; (2) students understand the electricity and magnetic concepts; (3) students were able to solve problems presented through story or phenomena; (4) students' learning motivation increased as they were actively involved in learning process; (5) learning became more meaningful; (6) RYLEAC learning model was based on constructivism learning; (7) this model reduced the cognitive conflict on students during learning.

Apart from those advantages, this learning model also has some disadvantages such as, 1) it needs shifting of the students' way of learning from only receiving information without direct involvement in learning to active participation, 2) it needs more time in planning and implementing this learning model.

5.2 Implication

The reasoning behind the implementation of RYLEAC learning model in basic physics 2 learning, especially in electricity and magnetic concept was that students' were actively involved in carrying out investigation, trained students to interact, and focused on understanding physics concepts, thus it could increase students' science process skill and students' learning outcome. Therefore, it is expected that students would get better understanding on basic physics 2 learning, especially in electricity and magnetic concept.

The result from this study was used as input for lecturers and students as candidates of physics teacher to equip themselves to develop learning media, which can increase students' science process skill and learning outcome in basic physics 2 at Universitas Negeri Gorontalo.

5.3 Recommendation

Based on the result of this study, the following things were recommended:

1) RYLEAC learning model could be treated as an alternative model in increasing students' learning outcome, especially students' science process skill, as students were actively and directly involved in learning process from engagement, formulating problem statement, formulating hypothesis, carry out exploration, explain, elaborate, and formulate conclusion; hence, students' science process skill and cognitive learning outcome could be increased.
2) In this study, implementation of RYLEAC learning model needed more time, thus, in implementation of learning needs more time for better planning to obtain better result.

RYLEAC learning model has only been implemented in electricity and magnetic concept to increase science process skill and learning outcome. Therefore, the design of this learning model needed to be implemented as reference in other materials within the basic physics 2 subject to increase the level of students' science process skill and students' cognitive.

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