CHAPTER III

RESEARCH METHODOLOGY

A. Location, Subject and population of Research

The research was conducted in in Salman Al-Farisi School Bandung which applied national curriculum in learning process. The data collection was done in September 2013. Population of this research is all students' ability in creative thinking skill in secondary two. The sample is all students' in creative thinking skill on newton's law chapter and consists of 25 students. The sampling technique of this research is purposive sampling.

B. Research Design

Design used in this study was one group pretest-posttest design (Fraenkel and Wallen, 2008). Designs can be described as follows:

Table 3.1 The one group pretest-posttest

	Pre-Test	Treatment	Post-Test
Subject	A ₁	Х	A ₂

Description:

- A₁ : Pre-test
- A₂ : Post-test
- X : Robotic Project in Project based learning

There are three steps taken in this design are:

1. Provide pre-test to measure creative thinking of students early before given treatment.

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2. Provide treatment of robotic project as implementation of project based learning

3. Provide post-test to measure creative thinking of students after treatment. The difference in the value of the difference between the initial test and final test is assumed to be the effect of robotic project as implementation of project based learning in newton's law concept to develop student creative thinking.

C. Research Method

Research method that will be conducted is a study weak experiment on robotic project as implementation of project-based learning in concept of newton's law to develop student creative thinking. The method is used because this method is the most suitable to the condition which the research subjects were examined only in one class and does not use using control class for comparison (Arikunto, 2006).

Data is taken from 8th grade of junior high school in Salman Al-Farisi School that learns about newton's law. This research is conducted that show in the flowchart:

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RPU



Figure 3.1 Diagram of Research Plot

Procedure of research is arranged based on the syntax of project-based learning implemented and robot as final product. There are three stages of procedure consists of preparation stage, implementation stage, and analysis and conclusion stage. The procedure could be explained as follows:

1. Preparation Stage

In this stage, the researcher conduct several steps that support the research, there are:

- a. Formulating problem that will be investigated, in this step there are problem that must be solve, so this research would solve problem in learning about concept in newton's law.
- b. Determining the focus of variable research
- c. Conducting literature review of newton's law concept, project-based learning, robotic project, creative thinking skill, and curriculum.
- d. Arranging the research proposal which is presented in proposal seminar
- e. Revised of research proposal after having suggestions and critics from lecturers.
- f. Arranging the research instrument and being judged by expert or lecturer. Instrument that used are essay test that measured creative thinking, rubric form to measured final product in form of robot, questionnaire to measured student respond in implementing robotic project, and note observation to observe student activity in implementation of robotic project.
- g. Arranging instructional tool which are including lesson plan, robotic project module, worksheet of robotic project, and robotic part that will be used in robotic project.
- h. Revised of research instrument after having suggestions.
- i. Testing of research instrument, researchers implement this step to 9th grade of junior high school of salman alfarisi.
- j. Revised of research instrument based on instrument try out analysis result

2. Implementation stage

During implementation stage, it will be observed the robotic project as implementation of project based learning. Implementation conducted several stages that include:

- Determining the class that used for experimental class, in this stage researcher used 8th grade students consist of 25 students.
- b. Giving pretest that conducted to measure student creative thinking before implementation of robotic project.
- c. Collecting pretest data and processing pretest result.

Conduct research activity by implementing The arrangements of implementation refer to activity syntax of project based learning proposed by Adair and Lei (2012) which is consisted of five syntaxes that should be conducted in robotic project there are: Assign collaborate working groups, present real-world problems that students can connect, set the parameters for completing the project, teacher consultation input/feedback, final project shared with larger group. project-based learning model with robot as final product in the flowchart below:

- Assign collaborate working groups
 - Determine theme of robotic project related to newton's law concept and robotic technology
 - · Learn about newton's law concept and robotic technology
- Design robot
- assemble mechanical robot
- assemble cable of robot
- Programming robot that is helped by teacher
- Testing robot
- Demonstration and presentation of final product in form of robot

Figure 3.2 Diagram of Robotic Project

The implementation of robotic project could be explained as follows:

- First Meeting, teacher inform that in the end of the chapter students should make a robotic project in a group related to newton's law concept and robotic technology. In this meeting teacher give explanation about newton's law concept, robotic technology, application of newton's law concept in robotic technology and gives some video that apply newton's law concept in robot.
- 2) Second meeting, teacher give explanation about newton's law concept and component of robotic technology. In this meeting student should understand about newton's law concept and robotic technology before making robotic project that apply robotic technology and newton's law concept. Teacher give explanation about robotic component that should have by robot and show robot in the class and give explanation about robotic technology and newton's law concept that used in the robot.
- 3) Third meeting, teacher describes the robotic project that will be conducted, in this meeting teacher choose group member consist of high-low ability achievement (8-9 students), teacher distributes individual worksheet as guidance and give one sample of product that used newton's law concept and robotic technology, teacher ask student to determine robot that will be made by student, students find literature in concept of newton's law that can be used as a literature in completing the robotic project and design the robotic project. After that student design the robot that used concept of newton's law and robotic technology, student design based on the available materials, in this project there are 3 groups with different theme of robotic project. Robotic guidance is made by teacher to make student easier in making robot, after student determine the theme of robot, student must prepare for material and tool that used for the robotic project and robotic guidance as instruction for student in making robot. Robotic guidance consist of procedure in making robot based on theme that chosen by each group. Students consult about the project to teacher and make

project work plan such as material, procedure and the concept that related to the robotic project.

- 4) Fourth Meeting, Students working on the project. Students do their robotic project and teacher guide student in making robotic project. Teacher give worksheet to fill it based on robotic project. Student followed the robotic guidance and consult about the project. In making robot, students only assemble the mechanical of robot and cable of robot, but programming of the robot is programmed by teacher. After student has finished doing their robot, each group shows their robotic project and presentation of robotic project. And teacher gives suggestion of the robotic project. Teacher gives assessment for robotic project in form of robotic project rubric.
- d. Give posttest that conducted to measure student creative thinking after implementation of robotic project.
- e. Give questionnaire to know the student's response towards implementation of project-based learning in the whole learning.
- 3. Final stage

1) Data Analysis

All Data is collected and then data is analyzed and make some discussion in Implementation of robotic project in concept of newton's law to develop student creative thinking.

2) Conclusion

After analyze the data, it make conclusion about robotic project as implementation of project based learning in concept of newton's law to develop student creative thinking.

D. Operational Definition

Explanation of the term is intended to describe the meaning of the various concepts used in this study, so hopefully will not cause different interpretations.

1. Robotic Project is a project that starts by design and create a robot, demonstration and presentation of robot as final product, in this regard the

used robot is a robot that uses the concept of newton's law and robotic technology.

- 2. Project Based Learning is a learning method that uses problems as a first step in collecting and integrating new knowledge based on their experiences in real activity. Through the act of investigation or research which indirectly students understand the concepts and principles of a discipline and produce a product to be presented
- 3. Student develop creative thinking is the development of students' ability to generate new ideas and products, see a pattern or a new relationship between one thing and another thing that originally did not seem that finding new ways to express one thing, combining existing ideas to generate new ideas and better. Creative thinking abilities reflected in four aspects there are fluency, flexibility, originality and elaboration.

E. Instructional Tool

Instructional tool that is used in the implementation of this research are enlisted as follows:

1. Lesson Plan

Lesson plan is design of instructional arrangement that will be used in the implementation of robotic project. These arrangements of lesson plan refer to syntax of project based learning proposed by Adair and Lei (2012). There are mainly five syntaxes that should be conducted in robotic project there are : Assign collaborate working groups, present real-world problems that pupils can connect, set the parameters for completing the project, teacher consultation input/feedback, final project shared with larger group. Lesson plan arranged according to learning objective stated in national curriculum for concept of newton's law. Accordingly arrangement of lesson plan can be seen in appendix A.1

2. Robotic Project Module

Robotic project module is additional tool that used to helps implementation of robotic project. Robotic project is used to be students' guidance during project. There are three robotic modules that used in project there are:

- a. Excavator robot module
- b. Quadruped Walking Robot module
- c. Probing Robot module

The module consists of material, tool and procedure that is used in making robot. Draft of robotic project module can be seen in appendix A.2.

F. Research Instrument

The instrument used to obtain the data in this study consists of:

1. Creative thinking test

Creative thinking test in form of essay is used to measure students' creative thinking skill. Teacher will mark the rubrics based on students' answer and calculate it as final result. The rubrics will determine the aspect of creative thinking skill that students have based on each essay question given. Draft of Creative thinking test can be seen in appendix B.3.

2. Rubrics form

Rubrics form for assessing the final product in of the project-based learning. The final product is in a form of robot, the robot will be analyzed based on rubrics criteria. Draft of Rubrics form can be seen in appendix B.4.

3. Questionnaire

Questionnaire in this study is designed to determine students' responses to robotic project that has been applied as well to know the advantages and disadvantages of robotic project as implementation of project based learning. Draft of Questionnaire can be seen in appendix C.2.2.

4. Note observations

Note observations used to observe implementation phases of robotic project as implementation of project-based learning and development of creative thinking of students during the project work. Draft of Note observations can be seen in appendix C.1.

G. Process of Instrument Development

This research was conducted using a test instrument in writing in the form of essay, questionnaire, and observation notes. Before the first test item made lattice prepared to determine the suitability of indicators about the mastery of concepts and contents lattice with the test item. The instrument needs to be consulted (judgment) by the concerned lecturer and some experts in related fields. After being judged, the instrument which is not appropriate enough should be revised. After the instrument revised, it should be tried out on another class which has the same level of research sample. Based on the test results, the instrument questions will be analyzed with the following requirements:

1. Instrument Test Requerments

a. Questions Validity Test

In this research needs to test the validity of the questions so that appropriate assessment tools to the concept being assessed. According Sudjana (2011), validity with respect to the accuracy of the assessment tool is assessed so that the concept really assesses what should be assessed. After the first validity test by expert lecturers, the questions the students tested outside the study subjects who had been getting the concept to be taught. According Arikunto (2009) a data or information can be said to be valid in accordance with our actual results. The test is called valid if the test can measure what it intends to measure. Validity is sought is the validity item. Technique that used to measure the validity of the test is the product moment correlation technique proposed by Pearson. Here is the Pearson product moment correlation formula:

$$rxy = \frac{n\sum x y - (\sum x)(\sum y)}{[n\sum x^{2} - (\sum x)_{2}] \{ n\sum y_{2} - (\sum y)_{2}]}$$
(Sudjana, 2005)

Description:

 r_{xy} = correlation coefficient between variables x and y variables

- n = number of participants test
- X = score of students at each items
- Y = total score

Interpretation about r_{xy} will be divided into different categories based on Guilford (Arikunto,2010).

Value r_{xy}	Interpretation
$0,90 \le r_{xy} \le 1,00$	Very high validity
$0,70 \leq r_{xy} < 0,90$	High validity
$0,40 \le r_{xy} < 0,70$	Medium validity
$0,20 \le r_{xy} < 0,40$	Low validity
$0,00 \le r_{xy} < 0,20$	Very low validity
<i>r_{xy}</i> < 0,00	Invalid
	(Arikunto 2

able 3.2 Classification validity coefficient	Table 3.2 Classification validity coefficie	nt
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b. Test of Difficulty Level

In test of difficulty level, researcher separated two subgroups of test; an upper group consisting of the top (27%) of the total group who received the highest scores, and a lower group including an equal number of tests (27%) who received the lowest scores. The researcher also counted the number of times each response to each item is chosen correctly on the test of the upper group and does the same separately for the papers of the lower group. So, it intended to calculate the difficulty level of each item. It means as Gronlund (1976:211) remarks "the percentage of students who got the item right"; so, in order to find out the level of difficulty for each item in the test, the following formula has been used:

$$DL = \frac{HC + LC}{\text{Total Number of the Sample}}$$

Description:

DL = Difficulty level

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(Madsen, 1983)

Classification of difficulty level in each test item that used is based on Arikunto,2010:

Value DL	Interpretation
$\mathbf{DL}=0,00$	Very difficult
$0,00 < DL \le 0,30$	Difficult
0,30< DL ≤ 0,7 0	Medium
0,70< DL <1,00	Easy
DL = 1,00	Very easy

Table 3.3 Coefficient classification of difficulty level

c. Discriminating Power

Calculating the item discrimination power which can be defined as the degree to which an item test discriminates between students with high and low achiever. Discriminating power of test item is the ability of test item to distinguish between a high achiever and low achiever student (Arikunto, 2006). So, to obtain the discrimination power of the items, the following formula has been used:

$$DP = \frac{RU - RL}{\frac{1}{2}T}$$

(Arikunto, 2006).

Description:

DP = Discriminatory power.

RU = The number of tests in the upper group who got the item right.

RL = The number of tests in the lower group who got the item right.

T = The total of tests included in item analysis.

Classification of discriminating power interpretation used is:

Value DP	Interpretation
$DP \leq 0,00$	Very poor
$0,00 < DP \le 0,20$	Poor
$0,20 < DP \le 0,40$	Fair
$0,40 < DP \le 0,70$	Good
$0,70 < DP \le 1,00$	Very good

Table 3.4 Discriminating Power Classification

(Arikunto, 2006)

d. Reliability Test

Reliability according to the Word (2000) is a measure of the extent to which a measuring instrument gives a completely reliable about ability of a person. If the measuring instrument has a high reliability of the measurements were performed repeatedly with the measuring instrument to the same subject in the same condition in the same conditions will produce the same information or the same approach. One of the ways to calculate the reliability of a test without splitting the two tests is by using the Kuder-Richardson 20 formula, with the formula:

$$r = \frac{k}{k-1} \left[1 - \frac{\sum pq}{S^2} \right]$$

(Arikunto, 2006)

Description:

k = number of question

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- p = proportion of correct responses to a question
- q = proportion of incorrect responses to a question
- $s^2 = variance of test scores$

Value r_{11}	Interpretation	
0,90 ≤ <i>r</i> ₁₁ ≤ 1,00	Very high reliability degree	
0,70 ≤ <i>r</i> ₁₁ < 0,90	High reliability degree	
$0,40 \leq r_{11} < 0,70$	Medium reliability degree	
$0,20 \le r_{11} < 0,40$	low reliability degree	
r ₁₁ < 0,20	Very low reliability degree	0

Table 3.5 Classification of Reliability Coefficient

(Arikunto, 2006)

e. Instrument analysis result

1) Recapitulation of students' Creative thinking skill Instrument

The instrument for measuring students' creative thinking skill is by giving an essay test in a form of four questions. The instrument should be tested in terms of validity, reliability, discriminating power and difficulty level, as explained before. The test was given to 30 students which have learned about the chapter that will be learned for the research. The recapitulation of test item analysis is shown in the following table.

Reliability: 0.65 (Medium reliability degree)

Table 3.6 Recapitulation of test item for students' creative thinking skill

Question Number	Discriminating Power	Difficulty Level	Validity	Status
1	Good	Difficult	High	Used

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2	Good	Difficult	High	Used
3	Fair	Difficult	Medium	Revised
4	Fair	Difficult	Medium	Revised

Question number 3 and 4 are revised because discrimination power is fair and validity is medium and difficulty level for this question is difficult so it should be revised, question number 1 and 2 are used because discrimination power is good and validity is high and difficulty level for this question is difficult.

2) Instrument non-test requirements

a. Rubrics

The rubrics will be used to observe the final result of students' project in newton's law chapter. The final result of students' project is in form of robot. The robot will be assessed into some criteria which is available in the rubrics. It will be used in the last meeting of the chapter as additional mark. The rubrics made by the observer after being judged with certain scale to measure the result, the rubrics will be fulfilled by the researcher as well as the observer.

b. Questionnaire

Questionnaire is used to know the response of the students towards robotic project as implementation of Project-Based Learning model in newton's law chapter during the lesson. This data obtained from students' answer from 27 questions given in the end of the lesson.

H. Data Collection Technique

In this research, there are three different data which is collected, those data has different instrument to measure. The data collection techniques are explained as follow:

1. Data of creative thinking skill

Creative thinking skill result will be gained from four essay questions. The answer of students in the test will be analyzed in specific rubrics. The rubrics will show whether the students have already mastering the skill or not. The rubrics display the leveling of each student who answering the essay test.

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	No	Indicator of Creative	Measured aspects
		thinking Skill	
	1	Fluency	- Launches in submit answers
			- Able to provide accurate and quick on
			the observed object
			- Provides many ways or suggestions to
1			do many things
[2	Flexibility	- Ability to provide interpretation of the
١.			problem
			- Looking for a lot of alternative or
1			different way
1			- Generate ideas, answers, or questions
1			varied
l	3	Originality	- Have something new and unique
N			- Thinking about unusual ways to express
1			themselves
			- Being able to make combinations of
			unusual parts
	4	Elaboration	- Able to enrich and develop an idea or
			product
			- Adding or specifies the details of an
			object, idea, or situation so that it
			becomes more attractive and clearly
-			Adapted from Siswono (2004)

Table 3.7	Essay	Test	Item	Specifica	ation ((Blue	Print)
	1		1.1	10.	1		

The data that has been gained from research instrument, further it is analyzed by giving certain score for creative thinking skill. The score given is already determined in specific rubrics. The rubric for analyzing students' answer is shown in table:

	SENDIDIES.	
No.	Creative thinking Skill Aspect	Score
1.	 Fluency Answer is correct and give some ideas to solve problems using newton's 1st law, express ideas fluently, quickly able to see an 	3
	 Answer is correct and give one ideas to solve problems using newton's 1st law, express ideas fluently 	2
	- Answer is correct and gives one an idea to solve problems using newton's 1 st law	1
	- There is no correct answer	0
2.	Elaboration	
	- Answer is correct and solve problems with detailed step, developing the ideas of others, provide a solution to the problem from simple concept of newton's 2 nd law	3
	- Answer is correct and solve problems with measures that are not detailed, giving little development from ideas of others using newton's 2 nd law	2
	- Answer is correct and solve problems with measures that are not detailed, do not develop the ideas of others, does not provide a solution to the problem from simple concept of newton's 2 nd law	1
	- There is no correct answer	0
3.	Flexibility	
	- Answer is correct and give consideration from the situation in the problem, giving out some solutions in different ways using newton's 3 rd law,	3
	- Answer is correct and give little consideration from the situation in the problem, give some solutions in different ways using newton's 3 rd law,	2
	- Answer is correct and do not give consideration from the situation in the problem, do not give a solution in a different way using newton's 3 rd law.	1
	- There is no correct answer	0
4.	Originality - Answer is correct and gives design for problem solving, provides	3
	 a new solution using 3rd newton's law, give combination from robotic concepts and newton's 3rd law concept. Answer is correct and gives design for problem-solving, do not 	2

Table 3.8 Scoring Guidance of Creative Thinking Skill

	provide a new solution using newton's 3 rd law, a little give combination robotic concepts and newton's 3 rd law concept.	1
-	Answer is correct and do not give design for problem-solving, do not provide a new solution using newton's 3 rd law, a little give	
	combination from robotic concepts and newton's 3 rd law concept.	0
-	There is no correct answer	

Adapted from Siswono (2004)

2. Data of Final Product

Final product of this project based learning implementation is robot. The assessment for the robot will be measured by a rubric with specific criteria. The scoring guidance for robot assessment is shown below:

1111		7
Categories	No	Criteria
Project	1	Relevance to Theme Related To Newton's Law Concept
	2	Creativity & Quality of Solution
		How original and creative is robotic project? Does the solution
		solve the problem well that using newton's law concept?
Programming	1	Automation
		Routines are fully automated with the use of sensors as opposed
		to timing.
	2	Good Logic
		Routines and demonstrations are easily repeatable without hassle
Engineering	1	Technical Understanding
Design		Team members are able to produce clear, precise, and
		convincing explanations about each step of the robot building
		that related to newton's law concept.
	2	Mechanical Efficiency
		Parts are used efficiently. Robot uses the simplest way to
		achieve its goals using newton's law concept and does not look
		unnecessarily bulky
	3	Structural Stability
		Robot is strong, sturdy, and built in line with good newton's law

Table 3.9 Robotic Project in Newton's Law Assessment Criteria

		-
		concept
	4	Aesthetics
		Robot has aesthetic appeal.
Presentation	1	Successful Demonstration
		Robot demonstration is successful. Evidence of pre-emptive
		measures taken to ensure successful demonstration. Clear that a
		lot of preparation and practice have taken place.
	2	Communication & Reasoning Skills
		Ideas, concepts, and contents conveyed effectively, neatly, and
		convincingly. Presentation laid out in a logical and interesting
		fashion.
	3	Quick Thinking
		Ability of participants to think on their feet and answer the
		judges' questions convincingly.
Teamwork	1	Unified Learning Outcome
		Every team member is able to display internalized knowledge
		about newton's law in their robotic project
	2	Inclusiveness
		Appropriate distribution of responsibilities with each member
		clearly knowledgeable about his or her individual role.
	3	Team spirit
		Team members display positive energy, good cohesiveness, and
		value one another
6		Adapted from World Robotic Olympiad Rubric (2013)

3. Data of Students' Response

Data of students' response was used to determine the response of the students towards students' learning in newton's law chapter using robotic project in implementing project based learning. The data obtained from the questionnaire is a secondary instrument, and it is processed by a percentage calculation. The blue print of students' response questionnaire is shown in table as follows:

NO	Indicator	Question	Number
NU	Indicator	Positive Response	Negative Response
1	Students' respond toward	1,2,5,7	3,4,6
	team work ability as a group		
2	Students' respond toward	8,10,13,15	9,11,12,14,16
	project based learning		

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	implementation in newton's law chapter		
3	Students' respond in creative thinking skill on newton's law chapter	17,18,20,22,23	19,21
4	Students' respond toward making a Robotic as project result	24,26	25,27

PENDIDIKAN

I. Data Analysis Technique

As stated by Michael Quinn Patton (2002) in Hasan (2010) data analysis is "the process set the order of the data, organizing it into a pattern, category and description of the basic unit." Stages of data analysis include:

1. Quantitative Data Processing

The quantitative data processing is done using Microsoft Excel for pretest score data and post-test. The value of quantitative data will be gained by the result of normalized gain. In this research, the data of test scores is used to measure the development of creative thinking skill. The data processing, carried out in the following way:

a. Score of Essay test

Essay score has a range of 1-3 depending on the answers that given by students. The criteria of scoring will be determined by specific rubrics as shown in table 3.8.

b. Calculation of Gain Score and Normalized Gain

Calculating of gain score student that occur before implement robotic project and after implement robotic project. The difference in pretest scores and the post-test is assumed as the effect of implementation of robotic project. Normalized gain calculations are intended to determine the categories of students' improvement. According to Hake (1999) gain is calculated by using this following formula:

$$G = S_f - S_i$$

(Hake, 1999)

Description :

$$G = Gain$$

 S_f = Post-test score

 S_i = Pretest score

The effectiveness of robotic project in implementation of Project-Based Learning model in increasing students' creative thinking of newton's law chapter will be seen from the result of the normalized gain that achieved by students during the learning process. For the calculation of the normalized gain value and its classification will use equations (Hake, 1999) as follows:

Normalized gain of each student <g> defined as following formula:

$$\frac{\%G}{\%G \max} = \frac{(\%Sf - \%Si)}{(100 - \%Si)}$$

(Hake, 1999

100 - % Si

KAP

Description:

= Normalized gain $\langle g \rangle$ G = Actual gain G_{max} = Maximum gain possible = Post-test score S_f = Pretest score S_i

 $\langle g \rangle =$

Average of normalized gain (<g>) which is formulated as:

$$\langle g \rangle = \frac{\% \langle G \rangle}{\% \langle G \rangle maks} = \frac{(\% \langle S_f \rangle - \% \langle S_i \rangle)}{(100 - \% \langle S_i \rangle)}$$

(Hake, 1999)

Description:

= Normalized gain <g> $\langle G \rangle$ = Actual gain

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<g>max</g>	= Maximum gain possible
$<\!\!S_f\!\!>$	= Average of post-test score
$<\!\!S_i\!>$	= Average of pretest score

The value of normalized gain $\langle g \rangle$ which is already gained is interpreted with the classification of Table 3.11.

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Value (g)	Classification
$\langle g \rangle \ge 0,7$	High
$0,7 > \langle g \rangle \ge 0,3$	Medium
⟨g⟩< 0,3	Low

a. Observation Note

Analyze note observation to get description about robotic project as implementation of project-based learning in newton's law concept. The design of the project, interim reports, final product, exhibits and presentations will illustrate implemented from learning and creative thinking skills of students in the group. From these data will also conclude the advantages and disadvantages of robotic project as implementation of project based learning.

b. Robotic rubric

The rubrics will be created into several raw score criteria; the rubrics will be assessing the robot as the final product. The analysis of rubrics is conducted by converting the raw score into percentage form. Percentage can be classified into several categories. The technique of converting score into percentage is used formula as follows:

$$Score = \frac{Raw Score}{Maximum Score} \ge 100\%$$

(Firman, 2000):

The interpretation of score percentage is categorized into certain criteria according to Kunjaraningrat (Suherman, 2001:6) as follows.

	e i
Percentage (%)	Criteria
0%	None
0 %- 25%	A few of criteria
26%-40%	Almost half of
41%-50%	Half of
51% - 75%	Mostly
76% - 99%	Generally
100%	All of them

c. Processing of Questionnaire

Data of questionnaire results of student responses were analyzed descriptively quantitative to presents the results of students 'response to the project robot as Implementation of project based learning. Questionnaire sheet of student responses is arranged based on criteria of assessment Likert scale (Riduwan, 2008). Analyses were conducted by using the response percentage formula:

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

(Riduwan, 2008)

Description

Robby Maududy, 2013 Robotic Project As Implementation Of Project Based Learning In Concept Of Newton's Law To Improve Students' Creative Thinking Universitas Pendidikan Indonesia | repository.upi.edu | perpustakaan.upi.edu P: Percentages of respondent answer

C

- F: Total of respondent answer
- N : Total respondent

From the results of the response percentage, and then inserted into the data interpretation student response in Table are:

Percentage of Responses (%)	Re <mark>sponse</mark> s categorize
0-20	very weak
21-40	weak
41-60	enough
61-80	strong
81-100	very strong
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	(Riduwan,
	(Riduwan,
	(Riduwan,
	(Riduwan,

Table 3.13 Interpretation student response