CHAPTER III

RESEARCH METHODOLOGY

A. Location and Subject

This research is implemented in one Cambridge based – private school in Bandung. The subjects of this research are 14 low achiever students in secondary 2 level in pertinent school.

The sampling method that is carried out is availability sampling method where the selection of subject with this method is not regarding to the aspect of strata, random or region, but subjects are selected based on its availability. In fact, this form of sampling is the most common type in educational research since probability samples, particularly in experimental studies, are maybe impossible (McMillan and Schumacher, 2001).

B. Research Design

Remembering that the number of classes that given treatment is only one class in the absence of comparable classes and control class, the research design used in this study is one group pre-test post-test design. In this design, observations are done before and after treatment given. Observations were conducted before the treatment is given is called the pre-test, whereas the observations made after the treatment given is called the post-test. The scheme of one group pre-test post-test design is shown by the table below:

Table 3.1 One group pre-test post-test design

Pretest	Treatment	Post Test
O1	X	O2

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With:

O1	=	Initial observation towards learning achievement and activity before treatment is given
O2	=	Final observation towards learning achievement and activity after treatment is given
X	=	Instruction with cooperative learning model type Team Games Tournament with Reading Infusion

C. Research Method

This research use pre-experimental method. This is related to the purpose of the research which is to see the impact of TGT with reading infusion toward the improvement of students' learning activities and achievement instead of effectiveness. This method is not a method of the true experiment, due to the persistence of the effect of other variables on the expected results. Thus, the experimental results are not solely influenced by its variable alone, therefore there are a number of other plausible explanations for any outcomes that occur in the absence of control. Moreover, the sample was not randomly selected.

D. Operational Definition

1. The implementation of Team Games Tournament (TGT) with reading infusion is this research regards to the syntax of TGT where before students involved in TGT, they were given homework in form of reading task to read articles related to the concept that will be taught. The reading technique used to understand the article is SQ3R (Survey, Question, Read, Recite and Review) where students are given 5 questions which are constructed according the steps of this technique. The home work aims to prepare students with adequate knowledge before following the lesson. Steps to be done in TGT are (1) class presentation, (2) study team, (3) tournament, and (4) team recognition and (5) bumping. TGT with reading infusion will be implemented in two cycles

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regarding to learning objective for waves topic. There are two meetings in each cycle, where step (1) and (2) will be implemented in the first meeting, and the rest: step (3), (4) and (5) will be implemented on the second meeting. The implementation of reading infusion will be seen from students' worksheet completion while the implementation of TGT will be seen from observation sheets.

2. The improvement of learning achievement in this research is seen from the average normalized gain value obtained from students' pretest and posttest score that will be interpreted into category of improvement according to Hake (1998).
3. Students' activities will be recorded in observation sheets, where the improvement can be seen from the changing of fulfillment percentage of activity indicator. The percentage itself is interpreted according to criteria developed by Koenjtaranigrat (in Suherman, 2003).

E. Instructional Materials

The instructional materials that will be used in this research includes lesson plan, learning scenario, instructional tools, media and sources. The lesson plan is made according to the Scheme of Work (SOW) of Secondary 2 Science used in school which is derived from the Cambridge Combined Science Syllabus 2012. The learning scenario is then constructed according to the weekly lesson plan that has been made by researcher. The learning scenario itself is made to make the planning of the lesson is more specific and detailed. The learning objective and indicators of each lesson implementation is shown by table below.

Table 3.2 Learning Objectives and indicator in each cycle of lesson implementation

Cycle	Learning Objective	Learning Indicator
1	• Explain vibration and its variable through vibration in pendulum demonstration • Describe waves and its variable through water	• Explain the concept of vibration • Describe the variable of vibration • Explain the concept of waves • Describe the variable of waves • Calculate waves' variables

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Cycle	Learning Objective	Learning Indicator
	waves demonstration • Describe the relationship between vibration and waves based on water waves demonstration	• Describe the relationship between vibration and waves
2	• Describe the characteristic of transversal and longitudinal waves through waves in slinky and rope demonstration • Identify and calculate variables of transversal and longitudinal waves • Give example of transversal and longitudinal waves • Describe the properties of waves that waves only transfer energy without transfer matter through demonstration	• Explain the characteristic of transversal waves • Calculate the waves variable of transversal waves • Mention the example of transversal waves in daily life • Explain the characteristics of longitudinal waves • Calculate the waves variable of longitudinal waves • Mention the example of longitudinal waves in daily life • Describe the properties of waves that waves only transferring energy without transferring matter.

In an instruction, tools, media and sources are essential. By the presence of those three, the instruction can be made more effective in achieving the desired objectives. The instructional tools that are used in the implementation of TGT with reading infusion are projector, laptop and board.

On the other hand the media which were utilized in the implementation of TGT with reading infusion are:

1. Reading article.

Reading article related to the concept being taught. There are two reading articles which were given to students. The first reading article is related to the concept of vibration and waves along with each variables and the relationship among them. Meanwhile the second reading article is related to the concept of kind of waves and properties of waves. These articles are made by researcher with regard to the IGCSE book and other resources. The articles are attached with the worksheet that actually guides the students to do the SQ3R reading technique

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since the indicator in the worksheet is constructed according to SQ3R stages, those are survey, question, read, recite and review.

2. Sets of demonstration.

Sets of demonstrations were used to illustrate the concept of vibration, waves, kind of waves and properties of waves. The descriptions of each set of demonstration are as follow:

a. Set of water ripple demonstration. This set of demonstration consists of a clear-jar filled with water and small stone. This media is used to show the real example of wave phenomena that is actually happening in daily life.
b. Set of vibrating ruler demonstration. This set of demonstration consists of ruler and thick book. This media is used to show the real example of vibration phenomena.
c. Set of vibrating pendulum demonstration. This set of demonstration consists of pendulum which is tied into a thread. This media is used to illustrate the concept of vibration and make the variable of vibration is visible.
d. Set of water waves demonstration. This set of demonstration consists of a clear-elongated jar filled with colored water and ruler. This media is used to illustrate the concept of relationship between vibration and wave where the wave itself is actually the traveling vibration.
e. Set of waves in rope demonstration. This set of demonstration consists of a long rope and a red ribbon. This media is used to visualize the concept of transversal waves, including its characteristic and variables. Moreover, the demonstration also explains the property of waves that waves only transferring energy without transferring matter.
f. Set of waves in slinky demonstration. This set of demonstration consist of slinky and a red ribbon. This media is used to visualize the concept of longitudinal waves, including its characteristic and variables. Moreover, the demonstration also explains the property of waves that waves only transferring energy without transferring matter.

3. Students' worksheets.

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In the implementation of TGT with reading infusion students will be given two kind of worksheet, A and B. worksheet A is filled during class presentation stage while worksheet B is filled during study team stage. Each worksheet has different indicator according to the learning objective to be addressed. Generally, the indicators for each worksheet are made according to the learning indicator which then categorized into cognitive domains which were measured in this research. The indicator for each worksheet is seen on the tables below.

Table 3.3. The indicator of worksheet A and B in cycle 1

Learning Indicator	Worksheet Indicator	Cognitive Domain
Explain the concept of vibration	Describe what is meant by vibration	C2
	Interpret vibration phenomena into picture	C2
	Exemplify vibration phenomena	C2
	Describe the path of one vibration	C2
Describe vibration's variables	Explain the displacement of vibrating pendulum	C2
	Explain the amplitude of vibrating pendulum	C2
	Explain the frequency of vibration	C2
	Explain period of vibration	C2
	Explain displacement of vibration	C2
	Explain amplitude of vibration	C1
Explain the concept of waves	Describe what is meant by waves	C2
	Interpret waves phenomena into picture	C2
Describe the waves' variables	Label the wavelength from picture	C1
	Label the wave's amplitude from picture	C1
	Explain the frequency of waves	C2
	Explain the period of waves	C2
	Explain the wavelength of waves	C2
	Explain the amplitude of waves	C2
	Explain speed of waves	C2
Calculate waves variables	Calculate speed of waves	C3
	Calculate period of waves	C3
Describe the relationship	Describe what is meant by wave in regard to vibration	C2

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Learning Indicator	Worksheet Indicator	Cognitive Domain
between vibration and waves		

According to the table 3.3 above, it can be seen that the worksheet indicator is constructed in association with the learning indicator which are derived from learning objectives in concept of vibration and waves. Differently, the indicator for worksheet A and B in the second cycle refer to the learning objectives in concept of kind of waves and properties of waves. The learning indicators, worksheet indicator and its cognitive domain is seen on the table below.

Table 3.4 The indicator of worksheet A and B in cycle 2

Learning Indicator	Worksheet Indicator	Cognitive Domain
Explain the characteristic of transversal waves	Draw waves in rope	C2
	Recognize crest and trough of waves in rope	C1
	Recognize wavelength of waves in rope	C1
	Identify direction of vibration toward waves propagation in rope	C2
Calculate the waves variable of transversal waves	Calculate the frequency of transversal waves	C3
	Calculate the period of transversal waves	C3
Mention the example of transversal waves	Exemplify transversal waves in daily life	C2
	State kind of wave happening in rope	C1
Explain the characteristic of longitudinal waves	Draw waves in slinky	C2
	Recognize rarefaction and contraction of waves in slinky	C1
	Recognize wavelength of waves in slinky	C1
	Identify direction of vibration toward the waves propagation in slinky	C2
Calculate the variable of longitudinal waves	Recall wave's period formula	C1
	Recall wave's frequency formula	C1
	Recall speed of wave formula	C1

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Learning Indicator	Worksheet Indicator	Cognitive Domain
	Calculate the frequency of longitudinal waves	C3
	Calculate the period of ;longitudinal waves	C3
Mention the example of longitudinal waves	Exemplify longitudinal waves in daily life	C2
	State kind of waves formed in slinky	C1
Describe properties of waves	Describe properties of waves	C2

4. Power point slides

This media is used to help students catch the idea of the concept easily, that is by helping them illustrating the concept through pictures or animation. Moreover, by using power point slides students can see the problems instead of only listening to teacher information. Through the slides, teacher also can give clear instruction so that students know well what should they do during the lesson.

F. Instruments

The research instruments which are designed and used in this study are in the form of tests and non-test. Associated with the data needed, the test instrument to be used consists of achievement test, while non test instrument to be used consists of observation sheet towards students' learning activities, observation sheets for TGT with reading infusion implementation and observation sheets toward learning interaction pattern.

1. Test

Test as instrument is questions which are given to students to obtain students' answer in form of oral, writing or performance (Sudjana, 2005). Commonly, test is used to evaluate and measure students' learning achievement, especially in cognitive aspect related to concept mastery. The test used to determine student learning achievement in this research is objective test in form of multiple choice. This test consists of 30 multiple choice questions with four choices. The achievement test is limited to the aspects of the cognitive abilities

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that correspond to the learning objectives in the syllabus used in schools where the research took place that is from remembering (C1) domain until applying (C3) domain.

2. Non Test

In this research, non test instrument that will be used is in form of observation sheets as follow:

a. Observation sheet towards students' learning interaction pattern

The observation sheet that will be used is adopted from Roychoudhury and Roth (1996) study about interaction pattern. The aspects that will be observed are students' interaction, type of interaction, task completion method, attention of students, orientation of task completion, and helping or problem solving. The observer is asked to fill in the observation sheet by choosing criteria which appear in teams which are being observed. The results are analyzed based on the criteria of each interaction pattern in heterogeneous team composition.

b. Observation sheet towards TGT with reading infusion implementation

This observation sheet is designed for students and teachers as its object. Observation sheet contains the learning stage which is used to view the activities of teachers during the lesson took place. Moreover in this worksheet, students' activities also observed. The students' activities which are observed and recorded are visual, oral, motor and writing activities. This observation sheets will be filled in by the observer who observed during the lesson. Observation sheet is not tested first, but fairly coordinated with the observer in order to avoid misunderstandings in the filling process. Observer will be asked to fill in the columns in observation sheet using checklist, which will then be processed by the percentage interpretation.

c. Questionnaire of students' response toward the implementation of TGT with reading infusion.

This instrument will be used to record the students' response toward the implementation of TGT with reading infusion that focus on three indicators: response toward working as a team, response toward games in science

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instruction and response toward reading infusion. Each indicator comprises of ten statements. Students are required to choose one of five scale (stongly disagree, disagree, undecided, agree and strongly agree) for each statement.

G. Instrument Development Process

1. Analysis of Test Instrument

Before being used in research, test instrument need to be judged and tried first. The result from the trial will then be analyzed based on its validity, reliability, difficulty level, and discriminating power.

a. Validity

Validity is a measure to see if the test can be used as an assessment tool to predict a particular trait or behavior. An instrument is said to be valid only if it can measure what is actually want to be measured. The technique used to determine the validity is product moment correlation technique which is developed by Pearson. The product moment correlation is calculated by using validity formula in Sudjana (2005: 144). The value of product moment correlation which is obtained is interpreted to determine the validity of test item by using its criteria.

b. Reliability

Reliability is the consistency level of test, which indicates to what extent a test can be trusted to produce consistence score although it is used in different situation. This reliability test is used to determine the reliance of instrument to be used as tools to collect the desired data.

The reliability coefficient can be obtained by using K-R 20 formula in Sugiyono (2008:132). The value is then interpreted according to its criteria.

c. Difficulty level

A good test item is an item that neither too easy nor too hard. The difficulty level of an item test is the proportion of all students that answer the item correctly. Difficulty index is a value that showing the difficulty of an item. It is between 0,00 until 1,00. The item with 0,00 difficulty index indicate that it is too difficult, meanwhile the item with 1,00 difficulty index indicate that it is too easy.

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The difficulty index can be calculated by using difficulty index formula in Sudjana (2005:137). The difficulty index that obtained is then interpreted according to item test difficulty level criteria in Arikunto (2012).

d. Discriminating power

Discriminating power of a test item is the ability of an item test to differentiate high achiever students with low achiever students. The value that shows differentiating power is called discrimination index. This index is in between 0,00 until 1,00. The item test discrimination index is calculated by using discrimination index formula in Tinambunan (1988:140). The value which is obtain is interpreted according to discriminating power criteria in Arikunto (2012: 232)

2. Observation sheet analysis

In this research, there are observation sheets toward students' learning activities, observation sheets toward learning interaction pattern and observations sheets toward the implementation of Team Games Tournament (TGT). These instruments are evaluated by supervisor first and judged by lecturer before it is used in the research.

3. Questionnaire analysis

In this research, the questionnaire will be use to measure students response toward working as a team, toward games in science and toward reading infusion. The questionnaire is evaluated by supervisor and judged by lecturer before it is used in the research.

H. Data Collection Technique

Data collection techniques are various ways which used to obtain data to support the research purposes. Data collection techniques used in this study are:

1. Test technique

According to Harahap, et.al (1982) test technique aims to measure and evaluate learning outcome including mental ability, achievement, skills and coordination between motor and aptitude. The test technique used in this study is

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the written test to measure learning achievement in cognitive aspect. Data was obtained after the implementation of the pretest and posttest.

2. Non test technique

According to Harahap, et.al (1982) non test technique is used to measure attitude and character of students which relate to learning activity, including behavior, statement, activity and experience. Non test technique instruments that will be used in this study are in form of observation and questionnaire. Observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place (Kumar, 2005).

In this study, observation was done by systematic observation, since the researcher has already known about what variable to be observed (Kumar, 2005:120). The observer do direct observation during the learning takes place by using the guidelines in observation sheet as an instrument of observation that has been made by researcher. There are three observation sheets: observation sheet towards students learning activity, observation sheet toward learning interaction pattern and observation sheet toward the implementation of Team Games Tournament (TGT). To obtain the data, it took some observers to assist researcher whose job is to observe every implementation of learning. Observer must fill out the observation sheet of students' activities, interaction pattern and learning implementation that has previously been made by researchers.

I. Data Analysis Technique

1. Learning achievement data analysis

a. Scoring

Score of each student are determined by the number of correct answer with right only scoring method. It means that each right answer is given one score meanwhile the wrong answer or unanswered questions is given zero score. The scoring is then transformed into percentage which is calculated by using the following formula:

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$$S = \frac{\sum R}{total\ question} x100$$

With:

S = students' score

R = students' right answer

b.Calculating mean

The mean of both pre test and post test score of students is calculated using average score formula in Sudjana (2005:109)

c.Calculating Score Gain

Gain is the difference between pretest and post tests score. To calculate score gain value the formula of gain in Hake (1998) is used.

d.Calculating Normalized gain

The formula of normalized gain g and normalized gain average $<g>$ is calculated by using normalized gain and normalized gain average formula in Hake (1999). Then, the value of normalized gain average <g> is determined based on improvement criteria.

2. Learning activity data analysis

The data gained from observation sheet for students' learning activities will be calculated by following formula:

$$\%\ of\ students\ average\ score\ in\ activity\ type\ x = \frac{\sum \%\ students\ score\ \ in\ activity\ type\ x}{number\ of\ students}$$

From the result, the researcher will then see the changing of students' activity percentage in the second cycle compared to the first cycle of lesson implementation. The percentage is interpreted using criteria stated by Koenjtaranigrat (in Suherman, 2003).

Table 3.5 Percentage interpretation criteria

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Percentage	Interpretation
0	None of
1-25	A few of
26-49	Almost half of
50	Half of
51-75	Most of
76-99	Generally
100	All of

3. Learning interaction pattern data analysis

The data gained from observation sheet for students' interaction will be interpreted into type of interaction pattern according to criteria developed by Roychoudhury and Roth (1996) for heterogeneous group composition as it seen on the table below.

Table 3.6 Interaction pattern criteria

No	Interaction Pattern	Criteria
1	Symmetric	1e, 2a, 3a, 4a, 5a, 6a
2	Shifting asymmetric	1f, 1g, 1h, 2b, 3b, 4a, 5b, 6b
3	Asymmetric	1i,1j,1k, 2c, 3c, 4b, 5c, 6c

4. The implementation of Team Games Tournament with reading infusion data analysis

The data gained from observation sheet for implementation of TGT with reading infusion will then calculated by following formula:

$$\%\ of\ implementation = \frac{\sum statement\ which\ is\ answered\ yes\ by\ observer}{\sum all\ statements} x100\%$$

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Steps to be done in calculating the percentage of implementation are as follow:

a. Count the number of yes answer which is filled by observer
b. Calculate the percentage of its implementation by using the formula above
c. Interpret the category of the implementation TGT according to the table below:

Table 3.7. Classification of lesson implementation

Percentage	**Category**
80% or more	Very Good
60%-79%	Good
40%-59%	Satisfactory
21%-39%	Poor
0%-20%	Very Poor

Moreover, the implementation of team games tournament with reading infusion also can be seen from students' worksheet completion. There are three types of students' worksheet, those are reading task worksheet which is given as homework, individual worksheet, and group worksheet which is given during the lesson took place. The average percentage of worksheet completion is seen from the indicators that have been fulfilled by students.

5. Students response data analysis

The data gained from questionnaire will be calculated by using the following formula:

$$\%\ of\ students\ response\ in\ statement\ x = \frac{\sum students\ who\ put\ checklist}{total\ of\ students}$$

From the result, the researcher will then see the respond of the students in which the percentage is interpreted using criteria developed by Koenjtaranigrat in (Suherman, 2003).

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J. The Result of Trial-Achievement Test Instrument

To obtain a good test instrument, it is necessary to do judgement and trial before it is used. This test instrument is judged by three lecturer who expert in content and assessment. It is also tried to second grade of secondary school students in one of public school in Bandung who have learned the same material. The test is in form of multiple choice containing 30 items.

According to the results of judgement it is found that generaly the instrument measured is associated with the learning indicator and Bloom cognitive domain. However there are some mistakes in the structure of sentences and the pictures as well as distractors in some questions are not homogen. Consequenctly, there are some question which is revised before it is tried to other students.

The result of trial is then analyzed which includes validity, difficulty level, discriminating power and reliability test. The analysis is done by utilizing AnatesV4 software. According to the recapitulation of achievement test instrument analysis, it is clearly seen that all of item test are valid, where 10% are in high category, 16.67% are in satisfactory category, 33.33% are in low category and 40% are in very low category. According to difficulty level analysis, it is found that there are 16.67% difficult items, 66.67% medium items, 13.33% easy items, and 3.33% very easy item. According to discriminating power analysis, it is found that there are 93.33% items that fulfilled the criteria to be used as research instrument, where 16.67% items are in excellent category, 20% items are in good category, 26.67% items are in satisfactory category and 30% items are in poor category. The rest of items (6.67%) are actually cannot be used as research instrument. It is also found that the reliability coefficient of this intrument is 0.60 which indicates that the instrument is reliable in satisfactory category. It means the instrument still can be used to produce the consistent and stable indication of the characteristic being investigated.

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After analyzing the trial results, there are some items which is need to be revised. Those items that were revised are those that have very low validity, have negative and poor discriminating power, and difficult and very easy item as well.

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