

CHAPTER III

RESEARCH METHOD

A. Operational Definitions

An effort to avoid errors in interpreting the term is used as a variable of this study, carried out an explanation of the terms used for more effective and operational. The terms are:

1. The cognitive burden diasses includes three components: intrinsic cognitive load (ICL), extraneous cognitive load (ECL) and germane cognitive load (GCL). ICL is meant is the score of the ability to analyze the information that is assessed by the student worksheets, ECL scores meant mental effort was assessed by questionnaire, while GCL is an interdisciplinary thinking skills scores were assessed using the posttest questions according to the indicators of the ability to think The second and third are interdisciplinary advancement through integration and critical awareness.
2. Connected Learning in this study is the excretory system linking material with material circulatory, digestive and hormonal systems and the regulation specifically relate to the material on fluid physics and materials chemistry (solution of electronic and non-electronic, and buffer solution K_{sp}).
3. Excretion system in question is the material that covers the organs of excretion, the excretion and excretion products as well as diseases that can occur in the excretory system and excretory system in animals that were taught in class XI High School.
4. Instructional framework based on learning dimensions in this study is the procedure that follows the teaching of the four dimensions of learning that attitudes and perceptions, acquiring and integrating knowledge, extend and refine the knowledge and use of meaningful knowledge.

B. Location and Subjects Research

This research was conducted at SMAN 24 Bandung. Subjects were high school students in grade XI academic year 2013/2014 that have not received the learning material excretory system. Classes are used as research amount to two classes XI Science 1 as an experimental class and class XI Science 2 as the control class. Selection of grade level, they are chosen as the level of class-related research that investigated the learning material excretory system is the material presented in class XI.

C. Population and Sample

The population is the entire object to be studied. The population in this study were all students of class XI Science SMAN 24 Bandung. The sample is part of a population that can be considered representative of the population. The sampling technique used was non-probability sampling that is purposive sampling, ie sampling with a specific purpose. In this study sample is taken classes with students who are considered to have the ability interdisciplinary higher than the other classes. Selection of sampling class of research is also a teacher recommendation based on daily average values.

D. Research Methods

The experiment was conducted with an experimental method is weak (weak experimental). Learning to connect learning approach using the dimensions of learning-based instructional framework was applied to the experimental class while learning to connect learning approach but using methods EEC (exploration, elaboration and confirmation).

E. Research Design

The research design used in this study is a nonrandomized pretest and posttest control group design. Nonequivalent and patterns found in Figure 3.1. There are two levels of treatment: learning to connect using the dimensions of learning-based instructional framework that is implemented in the experimental class and learning connected with conventional instructional framework is implemented in the control class. Both classes are given the same instrument as a pretest or posttest questions were the same, student worksheets with the same questions and the questionnaire with the same questions as well. Pretest-posttest both are used to measure the ability of interdisciplinary thinking that is an indicator of the GCL. During the learning, both classroom study students are given a worksheet that is used as a measure of the ability to analyze information that is an indicator of the ICL as well as a questionnaire at the end of the lesson which is used to measure the mental effort which is an indicator of ECL.

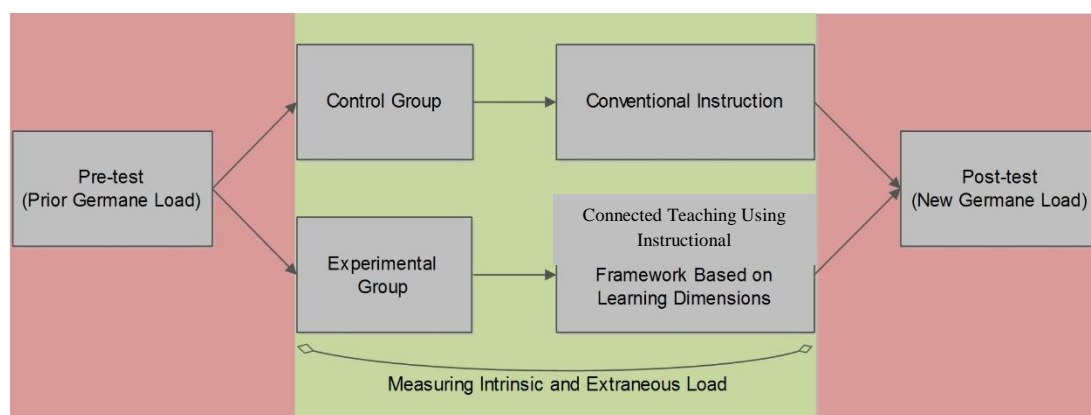


Figure 3.1. *The study design*

F. Learning Strategies

In this study learning activities conducted four meetings, with each meeting time allocation of 2 x 45 minutes. There are four stages of the application of learning in the connected classroom experiments conducted using the dimensions

of learning-based instructional framework that can decrease cognitive load. Following stages include:

1. Presentation of information stage
2. Stimulation prior knowledge stage
3. Analysis and transformation of knowledge stage
4. Internalization of knowledge stage

Stages used above is adopted from Hindriana stage (2013) which examines the cognitive load on students. The following are descriptions of the stages of the application of learning connected conducted in this study.

1. Presentation of information stage

At this stage in the experimental class that uses a frame-based instructional learning dimensions starting with 1 dimensions, namely attitudes and perceptions or dimensions which formed the class ambience with a pleasant attitude and positive perception towards learning of students. This had been the basis of class differentiation experiments with the control class. According Hindriana (2014) states that the development of positive attitudes and perceptions of learning can improve student's curiosity in learning and it is the main capital to develop its attention so that students can further explore and move into meaningful knowledge, and eventually the student can maintain concentration the dimensions or later stages of learning. Hindriana (2014) also explained that the students' positive attitudes and perceptions can lead students can focus on learning delivered in the classroom. This is a class that can not be obtained by conventional methods of control.

2. Stimulation prior knowledge stage

The second stage is the beginning of knowledge stimulation used in the experimental class as an implementation of dimension 2, namely acquiring and integrating knowledge. At this stage students are guided to explore the knowledge they have about the material prior to excretion. This initial knowledge is essential

to stimulate working memory that can be used by students to integrate new information or knowledge to be gained with the knowledge to be able to establish high interconnection which can then be stored in the cognitive scheme with meaningful knowledge.

Maximizing initial knowledge becomes important to establish meaningful knowledge to the fullest as well. The more prior knowledge extracted by the student, the more easily as well students perform processing intrinsic to knowledge or new information obtained and then stored in long term memory or make it meaningful knowledge. With prior knowledge to the fullest tergalinya also able to form a perception to students that learning is delivered is not a new teaching, especially when learning is delivered packaged in a contextual presentation. Students will form a perception that learning is learning that is being studied close to daily life so consider it important to make it pay high attention on the material presented in an effort to form meaningful knowledge.

3. Analysis and transformation of knowledge stage

This stage is the implementation of a 3-dimensional learning that expand and refine knowledge in the experimental class. Stages of the third dimension has a very close relationship with the dimensions of acquiring and integrating previous knowledge. In analyzing the stages of knowledge or information, the student must first have a prior knowledge provision with the newly acquired knowledge in order to analyze the relationship that can occur in it. The high initial knowledge is integrated with new knowledge in dimension 2 will also cause high ability group should analyze the relationship in both. The high ability to analyze information that can degrade intrinsic its processing experimentation in class because there is enough knowledge to be processed so its ICL can be arranged in a reasonable level. It is raised by the different control classes with low information analysis capability resulting in high processing giving rise to the high their ICL anyway. Knowledge or information obtained on the analysis of students during the learning will take place later transformed in a meaningful new knowledge in cognitive system.

4. Internalization of knowledge stage

Both of classes of research experience this stage by using the practical method in this case is an experimental class of dimension 4 implementation using meaningful knowledge. Both were given a practical method that can be traced to the use of knowledge that has been shaped from the earlier stages of learning.

G. Research Instrument and Development

The research instrument used with the following details:

1. Test

The instrument of this type of cover including the pretest and posttest and student worksheets. Problem pretest and posttest GCL indicators used to measure the ability of students to think interdisciplinary. Both are about the same that was developed based on indicators of the ability to think both interdisciplinary integration and advancement through critical awareness and the third is based on learning indicators Marzano in 2 and 3 dimensions which include analyzing perspectives, analyzing errors, system analysis, decision making, predicting, abstracting and constructing support. Problem sections advancement through integration with a number of multiple choice questions along with five of six choices as well as critical awareness about the description or essay form the number two about each question consists of three subsoal.

Worksheets non-practicum students who are the other types of tests used to measure indicators of ICL is the ability to analyze information. This research instrument in the implementation is given twice, the second and third meetings, but are used as a research instrument is only the third meeting LKS just because it is suspected that when students are working on the first worksheet in the second meeting, yet distinguishable difference in treatment between the two so that when the first hypothesis is tested on two-class worksheets show the same results.

The material in question on the worksheet is the material presented by the teacher is connected (the integration of structure and function of the human kidney, urine formation processes are integrated with buffer and hydrostatic pressure, abnormalities in kidney structure and function, and integration tool excretion in animals) through questions on LKS students are expected to hone their ability to analyze information submitted by the teacher connected so that problems can be asked by the question.

2. Non-test

The research instruments included in this type of a questionnaire or questionnaires and worksheets at the time after practice implemented. Questionnaires were made based on the type of differentiation systematic questionnaire that includes five options. This questionnaire is used as a measuring tool to measure indicators of ECL is a mental burden. This option includes a questionnaire. When students have the students do not experience a mental burden, if students choose other options to b and e indicate the student has the mental burden of learning in certain subjects asked each point of the questionnaire. Practice worksheets are given a kind of non-test given second. Contains six numbers in question were carried out in accordance with the practice that is about urine. Ability excavated on this worksheet is the ability to answer the fourth dimension is to use knowledge meaningfully, for the given problem is a result of the development of the indicator 4 of them are: system analysis, invention, analyzing errors, Investigating, experimental inquiry and task analysis perspective.

An instrument that is used as a measuring device can be said to be good and fit for use if it meets the requirements of the test is to have adequate validity and reliability. However, in this study will test the feasibility of the instrument only on written questions, both multiple choice and essay questions. Here are today the results of the analysis of items was based on results of testing instruments include validity, reliability, level of difficulty and discrimination power.

1. Validity

Scarvia B. Anderson and colleagues (Arikunto, 2009: 64) reveals "A test is valid if it measure what it purpose to measure" which means that a test be valid if the test is measuring what it intends to measure. Moreover, if a test result is said to be valid in accordance with the criteria, meaning that it has parallels between the results of the test criteria. The technique used to determine the alignment is the product moment correlation technique proposed by Pearson (Arikunto, 2009: 69-75). Product moment correlation formula is:

Product moment correlation formula

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Description:

r_{xy} = coefficient of correlation between variables X and Y

X = score test answers

Y = total score

N = number of

Table 3.1. Category of Correlation Coefficient

Correlation Coefficient Value	Note
0,800-1,000	Very hgh
0,600-0,800	High
0,400-0,600	Enough
0,200-0,400	Low
0,000-0,200	Very low

Based on calculations using the formula product moment correlation coefficient is then obtained by the interpretation of the numbers in Table 3.1.

Researchers using version 4.0.9 ANATES program for analyzing and validating multiple choice questions ANATES version 4.0.5 for the essay questions for pretest and posttest. The results of both are listed in Tables 3.2 and 3.3.

Table 3.2. Validity Test Results Item Multiple Choice Questions

Validity criteria	Number of Question	Total	Note
High	2	1	Used
Enough	1,6	2	Used
Very low (1)	3,7,11	3	Corrected
Very low (2)	4,5,8,9,10,12	6	Not used

Table 3.3. Validity Test Results Item-Essay

Validity criteria	Number of Question	Total	Note
Medium	1a,1b,1c and 2a,2b,2c	6	Used

2. Reliability

A test is said to have high reliability if the test results can provide fixed and unchanging although tested many times (Arikunto, 2009:86). A test may be reliable but not valid, otherwise a valid test is usually reliable. To test the reliability of using the formula Alpha (Arikunto, 2009) as follows:

$$r_{11} = \frac{n}{n-1} \left(1 - \frac{\sum \sigma^2(b)}{\sigma^2(t)} \right)$$

Description:

r_{11} = Instrumen reability

n = total of question

$\sum \sigma^2_{(b)}$ = varians value of one question

$\sigma^2_{(t)}$ = varians total

Table 3.4. Categories Reliability

Reliability Coefficient	Interpretation
0,80-1,00	Very high
0,60-0,80	High
0,40-0,60	Enough
0,20-0,40	Low
0,00-0,20	Very low

Measurement reliability can be a matter of using indicators or interpretation listed in Table 3.4. Reliability of items was measured using version 4.0.9 ANATES program for multiple choice questions and ANATES version 4.0.5 for the essay. The results obtained for the calculation of the reliability of multiple choice questions and the essay is 0.78 by 0.89. Multiple choice questions with a reliability value of 0.78 in the high category while the essay with a reliability value of 0.89 is in a category is very high.

3. Level of difficulty

Analysis conducted to further test the instrument to analyze the level of difficulty. Problem is good is a matter that is not too easy or too difficult (Arikunto, 2009: 207). Difficulty level can be calculated using the following formula (Sudjana, 1995):

$$TK = \frac{SA + SB}{IA + IB} \times 100$$

Description:

TK = Level of difficulty

SA = Sum of scores on items above groups were analyzed

SB = Total score of the group under the analyzed grain soai

IA = Total score on items above groups were analyzed

IB = Total score group looking down on items that were analyzed

Table 3.5. Category Level of difficulty

Level of Difficulty	Interpretation
86-100	Very easy
71-85	Easy
31-70	Medium
16-30	Difficult
0-15	Very difficult

The criteria of the value of the level of difficulty can be categorized based on Table 3.5, while the results of analytical calculation of the items was the difficulty level can be reviewed in Table 3.6 for the multiple choice and essay questions for all fall into the category of being.

Table 3.6. The difficulty level of the test results Multiple Choice Questions

Interpretation	Number of Question	Amount	Description
Very easy (1)	1,3,6,11	4	Corrected
Very easy (2)	4	1	Not used
Easy (1)	2	1	Used
Easy (2)	7,10	2	Corrected
Medium	5	1	Not used
Difficult	12	1	Not used
Very difficult	8,9	2	Not used

4. Distinguishing power

Analysis distinguishing features is a way to check if the questions are given the ability to distinguish between students who fit into the category of students with high achievement and low achievement. To analyze the distinguishing grain problem can use the following formula (Sudjana, 1995):

$$DP = \frac{SA + SB}{IA} \times 100$$

Description:

DP = index distinguishing

SA = Sum of scores on items above groups were analyzed

SB = Sum of scores on items under the group analyzed

IA = the number of ideal score items were analyzed

The distinguishing categorization can be seen by Table 3.7. Distinguishing measured using ANATES program version 4.0.9 for multiple choice questions and ANATES version 4.0.5 for the essay. Based on the calculation results of the

analysis of the grain problem, distinguishing features of multiple choice questions and the essay can be seen in Table 3.8 and Table 3.9, while the results of tests conducted fundamental analysis listed in Table 3.10 for the MCQ and Table 3.11 for the essay.

Table 3.7. Distinguishing Power Category

Coefficient of Distinguishing Power	Interpretation
0,70-1,00	Very good
0,40-0,70	Good
0,20-0,40	Enough
0,00-0,20	Less

Table 3.8. Power Test Results of Multiple Choice Questions differentiator

Criteria of Distinguishing Power	Number of Question	Amount
Very good	2	1
Good	1	1
Enough	6,7	2
Less	3,4,8,10,11,12	6
Negative	5,9	2

Table 3.9. Test Results Differential Power Problem Essay

Criteria of Distinguishing Power	Number of Question	Amount
Sangat baik	2c	1
Baik	1a,1b,1c,2a,2b	5

H. Data Collection Techniques

Pretest and posttest both use the same questions to measure students' ability to think interdisciplinary indicator used is advancement through integration and critical awareness. Interdisciplinary thinking skills is one of the indicators to calculate the GCL students. Pretest is a measuring instrument for measuring the initial or prior germane load germane load while the posttest is a measuring tool used to measure the new GCL or GCL end. This test is converted using a scale of 100 that indicates the higher value of the pretest or posttest, the higher the ability of interdisciplinary thinking that automatically marks the GCL also high and vice versa. Pretest and posttest conducted at the beginning of the meeting and the final meeting of the excretory system in both classes of research (experimental and control).

Student worksheet that is used as an indicator to determine the ability of the analysis of information is one way to find out the ICL students are given at any time after the learning takes place. Learning in the classroom-based experiments with the five dimensions of learning dimension, measured at interverensi done in class is only 2.3 and 4 dimensions, namely acquiring and integrating knowledge (2), expand and refine knowledge (3), and using knowledge meaningfully (4) while the control class worksheets given at 2,3, and 4. worksheets converted to a scale of 100. worksheets the higher the value the higher the ability to show the analysis of student information, otherwise if the value is low then lower the BLM analysis capabilities.

Questionnaire or questionnaires administered in both classes both experimental and control studies. Questionnaire was used to measure mental load during the learning progress of students in the experimental class is based on the dimensions of learning and conventional classroom-based control. Mental burden is one of the indicators that can track the whereabouts of ECL in students. Questionnaires were prepared using a systematic differentiation type questionnaire with a scale of 100. Higher value of the questionnaire indicates that

the higher the students' mental load and conversely the lower the questionnaire then the lower the mental load.

I. Data analysis

1. Prerequisites Test

Prerequisite test is a test that is used to test the normality of research data. The results of this test determines that the data were then analyzed using parametric tests or non-parametric. Both of these tests has its own criteria for normality result of the data being tested. Normality test has a function to determine whether a sample of the population has a normal distribution or not. In this study normality test performed using SPSS 20 with the type of application Kolmororov-Smirnov test with a significance level (α) was 0.05. Criteria when the data has significant value is > 0.05 so H_0 will be accepted funds H_0 will be rejected when the significance value < 0.05 . The hypothesis is:

H_0 : The samples comes from a population that is normally distributed

H_1 : The samples come from populations that are not normally distributed

2. Hypothesis Test

The hypothesis was tested using the Mann Whitney U test two tailed (two-tail). Mann Whitney U test is one type of non-parametric tests were used to test the significance of the two samples come from two different populations. This test is used by several criteria one of which is if the sample distribution is not abnormal. Samples previously tested using the prerequisite test or normality test has showed that all the samples are not normally distributed so Mann Whitney U test performed using SPSS 20 statistical applications. Criteria used to test the significance of this is if the value resulting from the test is < 0.05 then H_0 is rejected and vice versa if the significance value > 0.05 then H_0 is accepted. This test has tested the significance of cognitive load between the experimental class

and the control class. Here's a hypothesis to test the average difference of each type of cognitive load on students' experimental class and control class:

H0-1: There were no significant differences in the intrinsic load of the control class and experimental class.

H1-1: There are significant differences in the intrinsic load of the control class and experimental class.

H0-2: There were no significant differences in extraneous load of the control class and experimental class.

H1-2: There are significant differences in extraneous load of the control class and experimental class.

H0-1: There were no significant differences in germane load from the control class and experimental class.

H1-1: There are significant differences in germane load from the control class and experimental class.

3. Correlation Test

Correlation tests performed after normality test and test hypotheses. The type of test used is the Spearman's rho test which is a non-parametric correlation test. This test tested the correlation or relationship between indicators of cognitive load that interdisciplinary thinking skills, mental load and the ability to analyze information. First, the ability to think interdisciplinary mental burden correlated with both the ability to think interdisciplinary then correlated with the ability to analyze information and third information correlated with the ability to analyze the mental load. SPSS 20 was used to test the correlation of all these indicators.

J. Research procedures

The procedure in this research study includes three phases: planning, implementation stage and the last stage or final stage.

1. Planning stage

There are three activities carried out at this stage. Such activities are:

a. Preparation of research

Activities are important for this stage is the identification of the problem to be investigated. The issue is happening recently is the cognitive load on students' learning chiefly connected with the use of frame-based instructional learning dimensions which then determines the purpose of the research is conducted and after the problems that have been discovered and formulated formulated hypothesis anyway.

b. Study literature

Literature review conducted to look for theories related to the study variables such as: cognitive load, connected teaching, excretory system and instructional framework based learning dimensions, and then coupled with other supporting studies eg the types of cognitive load as intrinsic load, extraneous load and germane load as well as the description of the dimensions of learning are like the attitude and perception, acquire and integrate, extend and refine and use knowledge meaningfully.

c. Research Instrument Design

Research instrument is used as a tool for research. There are two types of tools are used that test and non-test. The tests used include pretest and posttest student worksheets while the non-test used was a questionnaire or a questionnaire. Pretest posttest was used to measure the indicators of germane load that interdisciplinary thinking skills while BLM is used to measure the intrinsic load indicator of the ability to analyze information. Questionnaire or the questionnaire

used to measure indicators of extraneous load is the mental burden. All the instruments used have to face the judgment made by the experts prior to the analysis of the test subject.

Pretest posttest that had been developed then test them prior to the class that has been tested on experience learning about the pretest and posttest. The test is generally referred pikok analysis test consisting of validity, reliability, discrimination, and level of difficulty of the questions. The test is done by using ANATES assessment application version 4.0.9. results that have been obtained through tests are then fixed to deserve to be tested on peneletian. Score a matter which has been obtained from a sample population of the study data is then processed to obtain the mean value and classification using Ms. Excel is then tested by statistical tests using SPSS 20. Student worksheets and questionnaires only processed using MS Excel and classification to obtain the mean value after it is processed statistically by SPSS 20.

2. Implementation Stage

Activity at this stage is done when testing this research instruments to study samples that experimental classes and control classes such as pretest posttest, student worksheets and questionnaires. In this stage of the experimental class to get connected intervensi using teaching learning-based dimension. Classes are used as the experimental class is a class XI Science 1. Classroom teaching intervensi control get connected, but not with base dimensions of learning but using only conventional methods of exploration, elaboration and confirmation (Table 3.12). Time employed during the conduct of this research carried out during four meetings with each meeting lasts 2x45 minutes.

3. Final Stage

At this stage is the final stage of the dilakukanb penelitian which include data processing, data analysis and making conclusions and make a final report. Data analysis including normality test, hypothesis testing and correlation testing.

K. Alur Penelitian

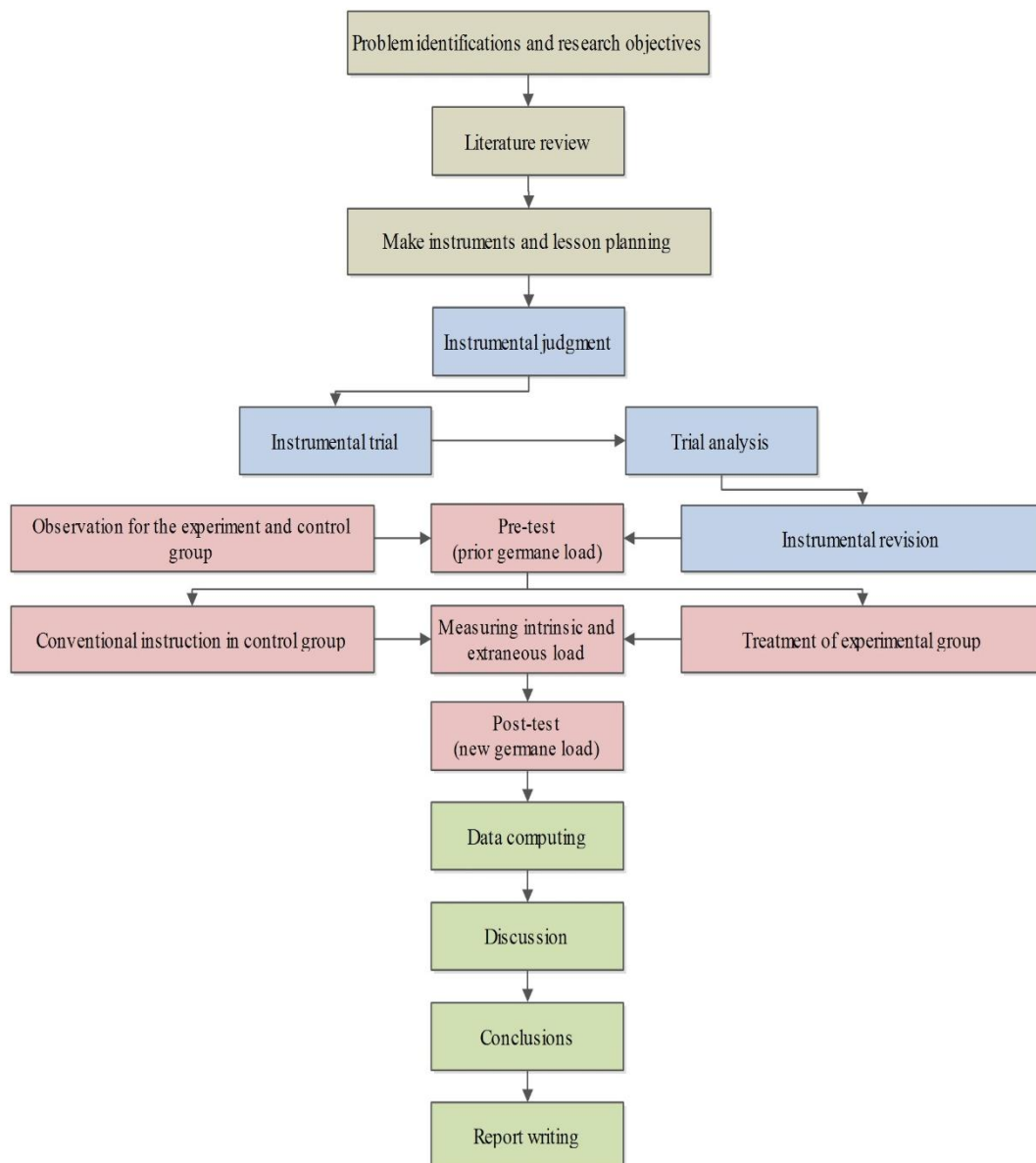


Figure 3.2 *Flow study*