

Chapter 3

Research Methodology

This experimental research involves the following topics.

3.1 Population and sample

3.1.1 The target population used in this study was the twelfth grade students studying in second semester, academic year 2012 in the total number of 120 students from three classes at Pongpattanawittayakhom School, Pong District, Phayao Province.

3.1.2 The sample group in this study was chosen by a cluster random sampling from one class in grade 12 with the total number of 38 students at Pongpattanawittayakhom School, Pong District, Phayao Province.

3.2 Research instrument

3.2.1 Science curriculum emphasizing on science, technology, society and environment learning approach to promote the student's problem-solving thinking skill and sense of responsibility toward the environment and the society.

3.2.2 A rating scale questionnaire on student's problem-solving thinking skill.

3.2.3 A rating scale questionnaire on student's sense of responsibility toward the environment and the society.

3.2.4 A reflexive thinking writing on student's responsibility toward the environment and the society with the use of KWL-Search Technique.

3.2.5 A semi-structured interview on the responsibility for the environment and the society.

3.3 The development of research instrument

3.3.1 The development of science curriculum consists of 4 steps;

1) The first step, The study of basic information for the curriculum development.

1.1) The study of all related literature and researches such as the indicators of science matters, scientific concept, technology social and environment, teaching method, assessment, learner's data, learning philosophy and psychology, the environment (show in Appendix B page 43).

1.2) The analysis of problems for the curriculum development

2) The second step – The development of science curriculum. The science curriculum development involves the following processes.

2.1) The determination of the science curriculum elements.

2.2) The testing of the curriculum elements and the appropriateness of the curriculum by the expert's index of consistency (IOC) which was set at 0.91.

2.3) The curriculum try-out was done with 30 twelfth-grade students at Khunkuanwittayakhom School, Pong District, Phayao Province in the first semester, academic year 2012 before curriculum implementation.

3.3.2 The development of a rating scale questionnaire on student's problem-solving thinking skill

1) The preparation step-review the related literature and research, and study the STSE-Problem solving Model, criteria and assessment technique.

2) The development step-develop the rating scale questionnaire on the problem-solving thinking skill assessment in accordance with the model and the criteria and testing its reliability by the experts to look for its index of consistency which was accepted at the level of 0.50 or higher.

3) The quality measurement of the problem-solving thinking skill questionnaire. The statistics used for data analysis is as follows;

3.1) Determining the level of Cronbachs' alpha coefficient with the level of reliability higher than 0.70 (Thanun Anumarachathon, 2001:140)

3.2) Determining the level of the index of consistency from the expert for the validity

3.3.3 The development of a rating scale questionnaire on student's sense of responsibility toward the environment and the society

1) The preparation step-review literature, research, definition conceptual framework learning assessment according to the core curriculum of Basic Education, 2008 B.E. and the Institute of Science and Technology Teaching Promotion

2) The development of a rating scale questionnaire on student's sense of responsibility toward the environment and the society

2.1) Design the rating scale questionnaire as with positive and negative questions in the form of 5 rating scale answers. (Thiwat Maneechot, 2006: 10-14; Yut Kraiwan, 2009: 4-47) as shown in Table 3.1

Table 3.1 Five levels of a rating-scale questionnaire

Level of opinion	Scoring number	
	Positive	Negative
strongly agree	5	1
agree	4	2
not sure	3	3
not agree	2	4
not strongly agree	1	5

Source: Thiwat Maneechot (2006, 10-14) and Yut Kraiwan (2009: 46-47)

The meaning of the interval score as set by Boonchom Srisa-ard (2003; 103) as follows:

- 5 means highest, the interval score 4.51 – 5.00
- 4 means high , the interval score 3.51 – 4.50
- 3 means moderate, the interval score 2.51 – 3.50
- 2 means low, the interval score 1.51 – 2.50
- 1 means lowest, the interval score 1.00 – 1.50

2.2) Submit the questionnaire to the thesis advisor to judge its completeness, then measured by the experts for its validity the index of consistency equals or high than 0.50 which is acceptable.

3.3.4 The development of reflexive thinking writing or journal on student's sense of responsibility toward the environment and the society according to KWL-Search

1) Preparation step-Review literature and research, the reflexive thinking writing assessment of Dewey's model (2001:1) and Barth (2001: 65-74), the reflexive

thinking writing, the reflection writing. The criteria on reflexive thinking writing according to KWL technique. (Somsak Phuwiphadawan, 2002: 75-77) and science assessment manual of the Institution of Science and Technology teaching promotion. (Institution of Science and Technology teaching promotion, 2003: 115-116)

2) The second step-Develop the reflexive thinking writing as follows.

2.1) To determine the research question as defined and the indicating behaviors containing in the KWL–Search and then assess the reflexive thinking writing according to levels of quality (Oeyporn Ruengtrakul, 2003: 25) The criteria for the result interpretation are as follows:

4 means	verygood	the interval score	3.60 – 4.00
3 means	good	the interval score	2.60 – 3.59
2 means	fair	the interval score	1.60 – 2.59
1 means	be improved	the interval score	1.00 – 1.59

2.2) To submit the questionnaire to the thesis advisor and followed by the measurement of its index of consistency by the experts which is set and acceptable at 0.5 or higher.

All research instruments must be measured for their validity by a try-out with a non-sample coefficient with the validity level higher than 0.70 (Thanun Anumaonrachathon, 2001: 140; Yut Kraiwan, 2009: 83-89). The result of their validity measurement was 0.80.

3.3.5 The development a semi-structured interview on the student's sense of responsibility toward the environment and the society has the following processes.

1) Preparation step – To study the principle, the research related to the interview development, questioning technique, the qualitative data collection and the guideline of research quality.

2) Development step – To design semi – structured interview questions by interview the sample group.

3) Measurement step – To measure the interview question's quality. There are many steps involved as follows.

3.1) Submit the interview to the research advisor and the experts.

3.2) Try out the interview with the sample group.

3.3) The questions are used to collect data from the sample group and then present the data in the form of description (Suphang Chantarawanit, 2008: 69–121; Ongard Naiyapat, 2008: 224-253)

3) The third step – The curriculum implementation.

The researcher had done many steps in the curriculum implementation as follows.

1) To carry out the implementation by following one – group pretest – posttest design (Fraenkel and Wallen, 2006: 271 – 272; Creswell, 2007: 160)

2) To implement the curriculum as planned.

2.1) Apply the learning approach to the sample group

2.2) Evaluate the student's problem-solving thinking skill and sense of responsibility toward the environment and the society along the implementation duration; before, during and after.

4) The fourth step – The evaluation of the curriculum implementation.

This step involved two steps; during and after the curriculum implementation.

3.4 Data collection involved the following processes;

3.4.1 Asking for a letter of cooperation from Graduate School, Chiangmai University.

3.4.2 Contacting the school for the permission of the curriculum implementation.

3.4.3 Collecting data as follows;

1) Before implementation

1.1) Randomize the sample group by cluster random sampling with the number of 38 students.

1.2) Conducting a pretest with the assessment forms on problem-solving thinking skill, sense of responsibility, reflexive writing and interview.

2) During the implementation

Implement through learning approach according to the STSE Problem-Solving Model to the class.

3) After the implementation

3.1) Conducting a posttest with the assessment forms on problem-solving thinking skill, sense of responsibility, reflexive writing and interview.

3.2) Analyzing and assessing the data as planned.

3.5 Data analysis and presentation

3.5.1 Data analysis by the use of descriptive statistics; percentage, mean and standard deviation (Boonchom Srisa-ard, 2002: 105; Boontham Kitpreedaborisut, 2006: 45-46)

3.5.2 The comparison between before and after the curriculum implementation by the use of t-test (dependent sample) (Boontham Kitpreedaborisut, 2006: 45-46)

3.5.3 The result presentation of the interview on student's sense of responsibility toward the environment and the society by content analysis, data description and summary.