Chapter 4

Results of Data Analyses

This chapter aimed to reveal the results divided into two parts as follows.

4.1 Part 1 The development of science curriculum emphasizing on science technology society and environment learning approach to promote student's problem-solving thinking skill and sense of responsibility toward environment and society

The development of science curriculum emphasizing on science, technology, society and environment to promote student's problem-solving thinking skill and sense of responsibility toward environment and society was a supplement Chemistry, Science curriculum, Pongpattanawittayakhom School, Pong District, Phayao Province for grade 12 which was congruent with Basic Education Core Curriculum details were as follows.

4.1.1 Problem and importance of the curriculum

The objectives the science curriculum development were to enhance the student's science learning which emphasizing on the content's integration and related to real life, flexible, and responsive to student's aptitude and to promote the development of thinking process, attitude, moral, ethic and value appropriate to science, technology, society and environment. (Institute of Science and Technology Teaching Promotion, 2003: 1-3)

Thus, science learning could help develop the thinking skill knowledge-seeking skill and the ability to solve the environmental problem systematically and suitably (Institute of Science and Technology Teaching Promotion 2010: 1) in particular grade 12 emphasizing on thinking skill, knowledge search, the use of technology as a source of knowledge and responsibility for their own studying and working. (Office of Basic Education Commission, 2010: 2)

As mention earlier, the development of science curriculum with the integration among science, technology, society and environment through practice could

enhance the student's life and problem-solving skills, know how to apply all useful knowledge to the environment and the happy living in society.

4.1.2 The principle of curriculum

The developed science curriculum contained learning contents in line with the Basic Education Core Content, 2008, B.E, Science Learning Content 2; Life and Environment, Science Learning Content 3; Substance and Its Property, and Science Learning Content 8; Nature of Science and Technology focusing on learning approach conforming to STSE Problem-Solving Model.

4.1.3 The objectives of the curriculum

1) The students are able to know and understand the principle and the basic theory of science learning content and the learning outcome of Chemistry.

2) The students are able to develop their thinking skill, problem-solving skill and science and technology-searching skill.

3) The students are able to be aware of the relationship among science, technology, society and environment in terns of the impact on each other.

4) The students are able to apply their knowledge and ability to the development of their environment, society and living.

5) The students are able to have science awareness and sense of responsibility toward the environment and society, moral, ethic and value in the use of science and technology initially.

6) The students are able to analyze, and articulate the theory and the important principle from the petroleum having an impact on the environment in school, community in Pong, Phayao Province, solve the problem and decide to choose the petroleum products suitably.

7) The students are able to be responsible and aware of the value and the use of the environmental resource in their home town, Pong District, Phayao Province.

4.1.4 The learning standards, the expected learning outcomes and the learning core contents in Science in the Basic Education Core Curriculum 2008, B.E

In the development of science curriculum, it was found that the curriculum contents were congruent with Basic Education Core Content 2008, B.E in Learning Content 2; Life and Environment, Learning Content 3; Substance and Its Property, and Learning Contents; Nature of Science and Technology,

4.1.5 Course Description

The course description of chemistry, Subject Code 33266, Science Curriculum consisted of knit one; Chemistry and Environment, Unit two; Environment, and Living things and society, and Unit three; the relationship among Science, Technology, Society and Environment, and teaching plans shown in Appendix A page 42.

4.2 Part 2 The result of the curriculum implementation emphasizing on science, technology, society and environment was assessed before and after the implementation. Its results were as follows:

4.2.1 The result of the assessment on student's problem-solving thinking skill in accordance with science, technology, society and environment was carried out two times; before and after the implementation through three problematic situations given to students to solve as shown in table 4.1

Table 4.1 Result on the assessment of student's problem-solving thinking skill in congruence with science technology society and environment before and after the curriculum implementation (N=38)

Situations	Level of quality	Before			After			t-test	p-value	Percentage difference
		$\bar{X}$	S.D	Result interpretation	$\bar{X}$	S.D	Result interpretation			
1. The resolution of excessive garbage in Phayao	4	3.11	0.51	high	3.74	0.45	highest	7.19	.00*	20.26
2. Whose garbage in our school?	4	3.05	0.46	high	3.89	0.31	highest	11.89	.00*	27.54
3. Ngim River, the upper source, full of living creatures	4	2.84	0.37	high	3.97	0.16	highest	20.36	.00*	39.39
Mean ($\bar{X}$)	**4**	**3.00**	**0.30**	**high**	**3.97**	**0.23**	**highest**	**19.51**	**.00***	**32.33**

*at significant level of .01

The assessment of student's problem-solving thinking skill during learning activities in 5 learning from 1-5. The results were shown in table 4.2

Table 4.2 The assessment of student's problem-solving thinking skill emphasizing science technology environment learning approach during the science curriculum implementation according to the points on problem-solving thinking skill containing in the five learning plans (N=38)

Learning plan	Level of quality	Points on problem-solving thinking skill						$\bar{X}$	S.D	Percentage	Result interpretation
		searching	solving	reflecting	creating	sharing	acting				
1	4.00	3.68	3.82	3.58	3.74	3.71	3.74	3.71	0.08	92.79	highest
2	4.00	3.72	3.74	3.87	3.71	3.89	3.92	3.81	0.09	95.25	highest
3	4.00	3.76	3.79	3.84	3.74	3.71	3.84	3.78	0.05	94.50	highest
4	4.00	3.95	3.89	4.00	3.76	3.79	3.89	3.88	0.09	97.00	highest
5	4.00	4.00	3.97	4.00	3.89	4.00	4.00	3.98	0.04	99.50	highest
Conclusion	**4.00**	**3.82**	**3.84**	**3.86**	**3.77**	**3.82**	**3.88**	**3.83**	**0.04**	**95.75**	**highest**

Remarks: 1. Learning plan 1: Petroleum Shadow; The reflexive picture of life
2. Learning Plan 2: The Polymer; Beyond of thought
3. Learning Plan 3: Pollutions; what you and I should do?
4. Learning Plan 4: Stop polluting the environment; You stop doing it means stop killing you
5. Learning Plan 5: Science and Technology; Their values for life and environment

4.2.2 The results of the assessment on student's sense of responsibility toward the environment and the society.

This result was collected from the sampled students with two research instruments; a rating scale questionnaire and a reflexive writing according to KWL-Search toward the environment and the society. The results were illustrated below.

Table 4.3 Student's sense of responsibility toward the environment and the society before and after the implementation of the science curriculum in overall (N=38)

Points	Before			After			t-test	p-value	Percentage difference
	$\bar{x}$	S.D	Result interpretation	$\bar{x}$	S.D	Result interpretation			
1. The awareness of the duty's importance	3.90	0.27	high	4.27	0.10	high	8.62	.00*	9.49
2. The duty performance with volunteer	3.98	0.45	high	4.88	0.18	highest	11.11	.00*	22.61
3. The duty performance with hard working	4.08	0.31	high	4.85	0.14	highest	14.94	.00*	18.87
4. The continuous working until finishing	4.21	0.38	high	4.84	0.22	highest	9.82	.00*	15.20
5. The acceptance of your own action	3.54	0.25	high	3.78	0.14	highest	5.67	.00*	6.78
6. The devotion to help or solve the environmental problem with your great effort	3.84	0.46	high	4.96	0.11	highest	15.21	.00*	29.17
Conclusion	**3.93**	**0.35**	**high**	**4.60**	**0.15**	**highest**	**10.86**	**.00***	**17.05**

*at significant level of .01

The assessment of thinking reflection writing by setting 3 environmental situations. The result was displayed in Table 4.4

Table 4.4 The assessment of reflexive writing on student's sense of responsibility toward the environment and the society according to KWL-Search Technique before and after the implementation as shown in Table 4.4

Situations	Level of quality	Before			After			t-test	p-value	Percentage difference
		$\bar{x}$	S.D	Result interpretation	$\bar{x}$	S.D	Result interpretation			
1. Convenient shop garbage convenient throwing	4.00	2.95	0.23	good	3.97	0.16	very good	39.00	.00*	34.58
2. From trunk to log…. The breath of life	4.00	2.89	0.31	good	4.00	0.00	very good	21.91	.00*	38.41
3. The flooding situation in Pong, Phayao Province	4.00	2.97	0.16	good	3.97	0.16	very good	26.51	.00*	33.67
Conclusion	**4.00**	**2.95**	**0.15**	**good**	**3.99**	**0.05**	**very good**	**46.63**	**.00***	**35.25**

*at significant level of .01

4.2.3 The result of the semi-structured interview on student's sense of responsibility toward the environment and the society.

It could be concluded from the interview of the students and their parents that their behavior and attitude after the implementation had changed through their sense of responsibility toward the environment and the society. They had more awareness and concern in the environment problems occurring in school and community and were able to tackle them together in different activities such as science project, environmental chemical club, voluntary activity etc. which were beneficial to their family, school and community.