

Chapter 5

Conclusions, Discussions and Suggestions

The development of science curriculum emphasizing on science technology society and environment learning approach to promote students' problem-solving thinking skill and sense of responsibility toward the environment and the society, Detail conclusion, discussion and suggestion were as follows.

5.1 Conclusion of research results

5.1.1 The development of science curriculum.

Science curriculum was a supplementary chemistry course in a branch of science, subject code; 33266 grade level; 12 learning credit; 1.50 and learning hour; 30 hours, Pongpattanawittayakhom School, Pong District, Phayao Province. It was designed to conform to Basic Education Core Curriculum 2008, B.E and the school target. It contained three learning matters; learning matters two-Life and Environment, learning matter three-Substance and its property and learning matter eight Natures of science and technology. The objectives of the curriculum were to develop the students' knowledge, understanding and skill in science and technology, to promote students' problem-solving thinking skill, to educate students' sense of responsibility toward the environment and the society and to possess moral, ethic and social value in the use of science and technology.

5.1.2 The results of the implementation.

1) The assessment of students' problem-solving thinking skill, it was found that the students had problem-solving thinking skill higher after learning than before learning at the statistically significant level of .01.

2) The assessment on students' sense of responsibility toward the environment and the society before learning level of .01 assessment of thinking reflection writing before learning the science curriculum was at high level and after learning was at highest level at the significant level of .01. In the terms of the interview on students' sense of responsibility toward the environment and the society, it was

discovered that behavior, sense of responsibility and attitude had changed after learning with their clear sense and awareness of problem-solving on the environment.

5.2 Discussion

From the results of science curriculum development, these were some points taken into discussion as follows.

5.2.1 The science curriculum had the quality according to its objectives because the curriculum process development was designed as the features of integrated course consisted of 4 steps and followed the curriculum elements and processes of curriculum development of Taba (1962: 12), Sa-ngard Utthranun (1989: 36-43), Kanut Thatthong (2003: 76-79) and Fred (2011: 6). Besides, this curriculum was consistent to the study of Somjit Sawathanaphaiboon (2007: 5) stating that the development of the integrated science curriculum and the investigation of the curriculum implementation were done systematically and based on the students' learning from the real situations with their own practice. As a result, they could solve and be aware of the sense of responsibility to the environment and the society. Moreover, it was in congruence with Aikenhead (1988: 8) and Pedretti and Forbes (2000: 39-41) about the science curriculum development emphasized on the connection coming theory, principle and contents of science and technology led to its application in a real life.

5.2.2 The results of the science curriculum implementation were discussed below.

1) Students problem-solving thinking skill in accordance with science, technology, society and environment.

The searcher had analyzed the successful factors of the science curriculum implementation as follows.

1.1) The learning approach with STSE Problem-Solving Model had good step and sequence which activated the students' problem-solving thinking skill from low to high level consistent to Polya (1957: 221) and Jonassen (1997: 65-66). Also the STSE Problem-Solving Model was congruent with the learning principles of Basic Education Core Curriculum 2008, B.E. about the learning approach which activated the students' problem-solving thinking through real situations, meaningful to may of life as the study of Carin (1977: 241-250) and science's aim to develop humans to possess

knowledge, problem-solving thinking skill, knowing how to use technology, sense of responsibility toward the environment and happy living in society (Ministry of Education, 2008: 5).

1.2) Pattern, learning management and development steps were suggested by the experts led to the curriculum implement as aimed which was in the line with Aikenhead (1988: 2-31) and Nuttawit Potjanatunti (2005: 15-17) claimed that this notion was the development of high thinking skill focusing on problems occurring in life, creating the meaningful learning led to the development of thinking skill through learning by doing, sequence of learning activity, the use of easy language, a wide variety of activities, considering the individual difference, time consumption, visual aids. All these resulted in the success of the curriculum.

1.3) The result from the assessment during the curriculum implementation through different learning activities, it was found that the level of curriculum quality was high-highest level. There were many reasons to support this result as follows.

1.3.1) The Analysis and the understanding the concept, advice from the experts, all learning activities suitable for the real problem situation and completion of all learning activities consistent to the curriculum elements as claimed by San Thammabumrung (1991: 10) Thanaporn Loonla (2009: 6), Bingle and Gaskell (1994: 89), Solomon and Aikenhead (1988: 156) that learning approach must have full elements, suitable process and the conceptual application to the development of science, technology, culture, environment and social settings.

1.3.2) Several learning techniques were included in the curriculum such as discussion rethinking, reflection, team word-webbing, experimenting, criticizing and e3mail letter. Aikenhead (1988: 2-31) pointed out that the STSE Approach had to contain 11 learning techniques such as the use of multi-media and learning from the real world.

1.3.3) Learning through the real problems, this made the students be aware of the problem-solving cooperation in consistency to Pranee Heepkeow (1999: 53) by using local-based problem solving which inspired the students' curiosity and tried to search for more information led to the experiment. In addition, Nuttawit Potjanatunti (2001: 42) and Rosario (2009: 269-272) revealed that the result of learning

approach using STSE Approach enable the students to have the scientific through which was clearly seen from their knowledge summary obtaining from practice. They possessed knowledge of science, technology and society as well as saw their relationship and daily application.

2) Sense of responsibility toward the environment and the society from the results, some factors should be promoted as follows.

2.1) The students had higher sense of responsibility toward the environment and the society after the implementation of science curriculum and their reflecting writing was at highest level due to the clear activity design which considered the objective, the quality of the instruments and a wide variety of techniques according to Theatchana Khaemane and Sirichai Karnjanawasri (2001: 169-179) and Wassana Prawarnphuek (1995: 48) said that the assessment design had to be congruent with the behavior and instrument and the assessment method had to be suitable and measurable.

2.2) Learning through practice and real situations enabled the students to see the importance and the sense of problem-solving responsibility as Phetcharat Srisawat (2011: 26) found that students' behaviors toward their local environment which meant that they had higher voluntary mind after learning. Besides, Solomon (1993: 76) stated that learning approach contained discussion technique and critique in order to know the problem and the science learning.

2.3) Thinking Reflection on students' sense of responsibility toward the environment and the society through writing by following KWL-search technique. This helped students' have the target and the direction of thinking via writing. The assessment after learning should be done continuously. Also, the time consumption should be flexible and answered freely in accordance with the studies of Dewey (1933: 98) Barth (2001: 43), Somsak Phuwiphadawan (2008: 39), Wanlapa Khunsongkiet (2005: 67) and Pollard (2008: 185) indicated that the value of thinking reflection together with KWL could increase students' skill, knowledge and ability in expressing the inner feelings creatively.

2.4) The promotion of students' sense of responsibility toward the environment and the society, it was clearly seen from the interview was consistent to the study of Rattana Tosaklon (2006: 39) who had studied Piere Brudior, found that the cultivation of the student sense of responsibility toward the environment and the society

through the command or the force did not function properly. Thus, she suggested that the signal power should be done through culture in school system by focusing on the positive relation and motivation with them and their community. Giving them time to express their ideas freely and time to discuss all problems occurring in school and community. These were the factors increasing students' sense of responsibility toward the environment and the society.

5.3 Suggestions

5.3.1 Suggestions for research result applications.

1) To promote students' problem-solving thinking skill and sense of responsibility toward the environment and the society, it was important to choose the real problem occurring in their daily life. If possible, the problem had to be integrated with the main contents used in the classroom. This would inspire the students' interest and awareness of responsibility.

2) To assess students' problem-solving thinking skill, different kinds of instruments should be applied such as a questionnaire on problem on problem-solving thinking skill, interview, authentic assessment and other forms of assessment.

3) To assess students' sense of responsibility based on duration of time, continuity and a variety of instruments such as interview, thinking reflection writing etc. Moreover, the domination of the clearly behavioral feature, the criteria of the assessment or the analysis of the interview were essential for the assessment.

5.3.2 Suggestions for future studies.

1) There should be a study on the development of science curriculum emphasizing on science, technology, society and environment to promote students' problem-solving skill by the use of STSE Problem-Solving Mode in other subjects or levels of study or schools

2) There should be a study on the promotion of students' sense of responsibility by the use of different models such as a participatory research or a problem-based research in other subjects and levels of study.