“HOW THE STUDENTS’ METACOGNITIVE STRATEGIES COULD BE DEVELOPED IN A SCIENCE CLASS AT LOWER SECONDARY SCHOOL LEVEL”

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Key words: metacognitive strategies

1. Background of the Study

The school where the study was undertaken is located in the province of Sakol Nakhon in the Northeast of Thailand. It is a public extended school under the patronage of the Crown Princess Mahajakri Sirindhon. Most of the children came from underprivileged living condition in the rural and remote areas. There is a diversity of dialects used in the school. As a whole, the children were not at the satisfactory level of their science learning achievement and thinking abilities. Although the school teachers have attended in-service training courses and programs including further studies for higher degrees in their profession, there are still some lacks in applying appropriate methods and strategies for the development of students’ learning achievement and their thinking abilities. Their analytical thinking is at the low level. These happenings might have been attributed to the ineffectiveness of science teaching and learning. Not only the teacher is to be blamed but also the academic management of the school itself.

There were about 800 students registered in the 2005 academic year at this school. About 97 percent of the student body was from “Thai So”, the minority group who had their own dialect which was close to Khmer language. They also had their own culture and traditional believe in invisible spirits of their ancestors. Almost all of them earn their living on rice farming, have an average income of about Bht.5,000 per year. The younger generation migrated to work in the bigger cities after completed compulsory education and left their children with their parents and the elders. Only about 3 percent of the student population were Thai-Laos and Kalerng. The students came from the vicinity areas of many villages nearby. The school also received some funding from Charoen Pokapan Company besides the support from the Crown Princess as mentioned earlier.

The students were attending the school with less and no interest to further their education. Most of them had mainly finished the level of compulsory education. Only a few portions of the students showed their interest in continuing their education. However, the school was the only basic education institution where extension was granted to provide teaching and learning until senior high school level in this area.

The results obtained from the National Education Quality and Assessment Evaluation in 2004 indicated that the students’ science scholastic achievement and thinking abilities were at low level. It was crucial to provide and facilitate both the teachers and students at this school with more academic support for the development
of teachers’ professional growth and especially the students’ learning and thinking abilities so that they could improve quality in their thinking and learning.

It is mandated that all of the schools in Thailand have to provide their students with proper learning experience to develop them to the fullest potentialities. According to Chapter 4 of the National Education Act of Thailand, there are guidelines for the arrangement of teaching and learning stated in Section 24 as follows:

“In organizing the learning process, educational institutions and agencies concerned shall---
(2) provide training in thinking process, management, how to face various situations and application of knowledge for deviating and solving problems;
(3) organize activities for learners to draw from authentic experience; ___
(4) achieve, in all subjects, a balanced integration of subject-matters, integrity, values and desirable attributes ___
(5) enable instructors to create the ambiance, environment, instructional media, and facilities for learners to learn and be all rounded persons. ___”


It is also emphasized that the learners’ thinking shall be developed so as to enhance and promote their thinking skills while learning in any subject especially in science whereby its scientific process of inquiry is in the nature of scientific knowledge acquisition. Therefore it is very necessary to incorporate the strategies for thinking development in the teaching and learning process. How to make this happen? This question was responded based on the guidelines from the knowledge about metacognitive strategies and the model of thinking learning and constructing knowledge namely Trip RIP in the next section.

2. Basic Understanding on Metacognition and Trip RIP model

2.1 Metacognition

Metacognition consists metacognitive knowledge and metacognitive experiences. The knowledge consists primarily of knowledge or belief about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises. These factors are ‘person’, ‘task’ and ‘strategy’. (Flavell,1979)

Metacognitive experience deals with self, task, goals, and strategies helping you to have conscious experiences which can occur at any time; before; after; or during a cognitive enterprise. These experiences may make you feel that you are liable to fail some upcoming enterprise or that you did very well indeed in some previous one. Many of these experiences have to do with where you are on enterprise and what sort of progress you are making or are likely to make. Metacognitive experiences are especially likely to occur in situations that stimulate a lot of careful, highly conscious thinking: in a job or school task that expressly demands that kind of thinking; in a novel roles or situations, where every major step you take requires planning beforehand and evaluation afterwards; where decisions and actions are at once simply improving your knowledge.
In sum, metacognition is concerned with in-depth thinking of oneself in a situation where task, goals, and strategies are interdependently interactive among each other aiming to assessing your knowledge and thereby generating metacognitive experiences on which you can control your own thinking and acting upon things you are currently dealing with.

2.2 II. Trip RIP: The Processes of Thinking, Learning, and Constructing Knowledge

Trip RIP is based on both cognitive and metacognitive psychological principles which are helpful for the learners to take active control of themselves on the process of learning and being aware of their own strategies in getting to know the knowledge as well as reflecting upon how and what they have learned and what should be improved for the betterment of their learning. It might not be fast and easy to use Trip RIP for learning. Instead, it takes more time and somewhat stressful or difficult to move on for learning as the learners have to be cautious about what, how, and how much they have learned not only by themselves but also with their teachers and their peers to make the most agreeable construction of the knowledge they learned.

Trip RIP includes thinking strategies one can use with his/her own consciousness in his/her learning and constructing knowledge. It can help you to determine your goal where you can design your task to reach the goal with the strategies in the process of R, I, and P.

Trip has 2 meanings: one is planning for a trip and the other is triple which is conveyed to the three R’s, I’s and P’s.

These will be used for three times consecutively, one after another. However, each of the components of R, I, and P, may be reutilized if necessary in order to reach the abilities of regulating, investigating, and producing. The meanings of these steps are as follows:

The RIP is started by firstly Recalling (R₁), secondly Relating (R₂), and thirdly Refining (R₃). By using the three Rs, in the first phase of thinking the learners will be able to gradually regulate their thinking until they can adjust themselves to the condition they have encountered.

The second phase of this learning development is to use the three Is which will gradually be completed on the process of Investigation. The learners will conduct their investigation by using Inquiring dealing with questioning by ;Interpreting exchanging and sharing with their peers and teachers; and finally Interpreting which they will perceive and demonstrate what they have learned through many means.

In the last phase of RIP the learners use the three Ps as they aim to produce their meaningful understanding and knowledge they have learned and present to their peers. So, they work on the processes of Participating, Processing, and Presenting.

While using 3Rs, 3Is and 3Ps, the learners will reflect their knowledge and thought what they have learned and how they did on their thinking and learning processes at the end of each phase. Through these means, they can control their own learning. These processes can be demonstrated by the following flow chart below and the concept map on the next page.

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<thead>
<tr>
<th>Regulating</th>
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<td>Recalling</td>
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<td>Refining</td>
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Reflection

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<th>Investigating</th>
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Reflection

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<th>Producing</th>
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<td>Participating</td>
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Figure 1 shows how Trip RIP is processed for thinking, learning, and understanding or constructing knowledge.

3. Related Principles and Research

Piaget’s major goals were to investigate the ontogenetic emergence of new forms of thinking and the construction of knowledge based on logical necessity. His findings have contributed a great deal of every concept, principle, and assumptions to the world of education, especially in human learning and development. Consider the potential impact of Dewey’s thought and principles on education, the notable one is problem-solving to which is always referred and used by enormous number of studies including teaching and learning approaches. Vygotsky was another educational psychologist whose works have contributed to the world of education. His prominent idea in schooling was Zone of Proximal Development (ZPD) which has popularly been used as guidelines for teaching and learning especially in the field of language development.

With regard to the application of aspects from constructivist learning principles claimed by the famous persons as mentioned, Piaget, Dewey, and Vygotsky, it is necessary to include both cognitive and metacognitive views on learning and development into the strategies for teaching and learning. The Trip RIP model is constructed by Sintoovongse as strategies for thinking, learning, and constructing knowledge whereby learners can use these strategies as pathways for their learning. As a result, human learning can be gradually evolved and developed meaningfully, reflectively, and productively.

Sintoovongse (2005 and 2006) has presented the model showing how thinking, learning, and constructing knowledge is evolved and developed. This model is based on Piaget’s, Dewey’s, and Vygotsky’s constructivist learning principles. It involves logical and systematic thinking, problem solving, as well as socio-cultural and historical aspects of an individual while acquisition of knowledge occurs.

The research findings (Sintoovongse, 2006) and the data collected from the undergraduate classes in thinking and learning in science where Trip RIP had been utilized showed that the students were actively engaged in the learning processes and gradually constructed their own knowledge presented among their peers in various
forms. These products of learning indicate that the students’ abilities to think, learn, and construct are emphasized and developed on their own abilities with their awareness and happiness.

4. Research Questions
From the problems stated on the earlier page, research questions could be identified as follows.
(1) How could Trip RIP strategies be incorporated in the teaching and learning process of science at the secondary school level?
(2) How much would students’ experience through Trip RIP processes have an effect on their thinking, learning and constructing knowledge?

5. Objectives
This study aims to develop the secondary school students’ thinking abilities, learning strategies, and to have them engaged in the process of knowledge construction through the use of Trip RIP model in the science class.

6. Scope of the Study
This study was a part of the research project at masters’ degree level in science education as a requirement for the fulfillment of this degree program. Therefore, only qualitative study and its findings are reported.

7. Methodology
The research target population consisted 35 in Grade 8 students, the two research assistants who were science teachers at the same school, the teacher researcher herself, and the research committee participated in the research as facilitators as well as validators.

The research tools were (1) the lesson plans; (2) the students’ self assessment record; (3) the teacher’s observation record; (4) the Trip RIP rubric scoring assessment; (5) the student’s interview form. These were constructed by the researcher except the Trip RIP rubric scoring assessment. Face validity was also used to confirm the validity of these tools.

8. Undertaking the Research
This study was carried out by the teacher researcher with her 2 research assistants under close supervision of her research committee. It was undertaken for about 6 weeks during the second semester of the 2006 academic year.

In order to incorporate thinking strategies into classroom culture, the teacher began working on her teaching and learning plans by using the Trip RIP model. She had revised her lesson plans several times until it was demonstrated that the plans had the following components in a clearly stated and applicable manner.
• Goals and objectives were clearly identified.
• Concepts and/or principles and other contents were clearly stated in an organized fashion.
• Learners’ prerequisite knowledge and abilities were demonstrated and related to the concepts to be learned.
• The Trip RIP strategies are utilized in each steps of the teaching and learning processes accordingly.
• Questions and description of the activities were clearly shown in the direction that the questions could engage the students in the RIP processes.
• Media and learning resources were identified and described suitably.
• Assessment and evaluation were embedded in the teaching and learning processes where appropriate tools and approaches were identified clearly in accordance with the objectives of the lessons.
• The learning outcomes were accessible through the provided activities of the plan.
• Reflection by both teacher and students were included.

These plans were firstly on trail for 2 plans and the rest of 6 plans were implemented for about 6 weeks. The data were collected by using the research tools in the above mentioned. The content analysis was made and the findings were as follows:

9. The Results

In addition to the information on the teaching and learning plans prepared by the teacher researcher as described in the above, the findings from teacher research assistants, the students, and the teacher researcher herself are in the following:

1. At the Regulating Stage, R

• Teacher assistants’ view:
The information obtained from classroom observation recorded by the teacher assistants indicated that the activities provided the first stage of the Trip RIP helped the students who had less or no prerequisite knowledge adjust themselves closely to what their friends had comprehended; The assistants said that the questions used should be refined and adjusted to the specific points related. The students were interested in giving their answers what they had known as they teachers told them not to worry about correction. They found that the students themselves had learned more and ready to work on their investigation.

• Students’ view:
The students were pleased with the condition that they could respond to the questions with regard to what they understood and paying less attention to competition with their friends and the correction. They found that they had learned more and changed their misconceptions.

• Teacher researcher’s view:
The researcher found that with the use of appropriate questioning technique, she learned about her students’ prior knowledge although there were some who could not follow with others. Some could recall, related, and refine accordingly as some were less able to do so. Only a few could regulate their knowledge immediately. She had to change her questions to be adaptable and applicable to all of the students so that the students could come to the same level of understanding before taking the next step.

2. At the Investigating Stage, I

• Teacher assistants’ view:
The assistants found that the students were very much satisfied with the activities that they had chance to do the experiment and explore through the internet. They could work cooperatively in group although they had different
abilities. They could exchange and share with each other. Only one comment was that they needed more suggestion on the process of interpretation.

- **Students’ view:**
The students were very much satisfied with experimentation on their own investigation and internet search for knowledge. They would like that the teacher could find better approach to call the other students’ attention as they were showing less interest in the process of investigation. They needed more direction and suggestion on the process of interpretation.

- **Teacher researcher’s view:**
The teacher reported that the students had a few choices of exploration because they were mostly depended on experimentation. They were unlikely to participate in group with cooperative skills. Not until their teacher had given orientation and suggestion on how to work in group, they could work together. They had shown their interest in investigation through experimentation and internet as well as reading. The teacher had added more information as needed besides what they had learned from their own investigation. They were mostly lacking in the interpretation skills.

3. At the Producing Stage, P

- **Teacher assistants’ view:**
It was shown that the students’ oral presentation was generally better than their written one. They were proud of their work especially at the early beginning. Their interest was dropped as they spent more time on the activities provided. The teacher should have provide them with more of a variety of learning experiences.

- **Students’ view:**
The students expressed their thought that this stage was the most difficult one as they had to think and organize the knowledge. They had learned by using longer period of time so that they could produce a good work which wouldn’t be repetition of others. They showed their worries but they were felt released when they could make their peers understand their presentation.

- **Teacher researcher’s view:**
The teacher researcher found the time used was not adequate as the students needed more time to organize and construct what they had learned so that the presentation could be made. Their cooperation was improved although they were worried about their assignments. Their oral presentation was better than the written one although there were some groups who could not perform well. However, the teacher had given them some assistance when needed and it was helpful.

The overall result showed that the students were able to perform their tasks while learning along with those activities provided in the three stages of Trip RIP. The rubric scoring assessment results showed that most of them were at the satisfactory level on their performance at all stages of the Trip RIP processes. (scoring at the Level 3 in relation to the rubric scale).

10. Discussion and Conclusion
The students were able to work along with the steps of the Trip RIP and complete their tasks but were able to participate only limited account of the required thinking strategies involved in the teaching learning process. These were reported by
the teacher research assistants’ and researcher as well as the students as described in
the above section.

Soon after finishing up with all of the in the activities in the plans, the
students’ performance was improved as there was evidence of students’ metacognitive
thinking strategies utilized while working on those learning tasks. Their performance
was also evolved and developed on the Trip RIP as the evidences found on the results
analyzed from all of the assessments by the research tools. As a result, it could be
indicated that their metacognitive thinking abilities were improved through the new
approach, the Trip RIP, incorporated the learning activities provided.

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