Effects of 7-E, KWL and Conventional Instruction on Analytical Thinking, Learning Achievement and Attitudes toward Chemistry Learning

Rungrawee Siribunnam and Sombat Tayraukham
Faculty of Education, Mahasarakham University, Mahasarakham 44000 Thailand

Abstract: Problem statement: The purposes of this research were to compare in analytical thinking, science learning achievement and attitudes toward chemistry learning of Matthayomsuksa 5 students who learned using the 7-E learning cycle, KWL learning method and conventional approach. **Approach:** The sample consisted of 154 Matthayomsuksa 5 students attending in the first semester of the academic year 2008, Phayakkhaphumwitthayakhan School, Phayakkhaphumphisai District, Mahasarakham Province, cluster random sampling technique was employed. The were divided into two experimental groups who learned using the 7-E learning cycle and KWL learning activities and one control group who learned using the conventional approach. **Results:** The research instruments were: (1) 12 lesson plans for organization of 7-E learning cycle, 12 lesson plans for organization of KWL learning method and 12 lesson plans for organization of the conventional approach; (2) A 30-item analytical thinking test; (3) A 40-item achievement test of science learning achievement and (4) A 20-item of attitudes toward chemistry learning. The statistics used for analyzing the collected data were mean, standard deviation, F-test (one-way MANOVA), Hotelling's T^2 and Univariate t-test. The results of the study revealed that the students who learned using the 7-E learning cycle, KWL learning method and the conventional approach were differently showed analytical thinking, science learning achievement and attitudes toward chemistry learning at the 0.05 level of significance. The students who learned using the 7-E learning cycle showed more science learning achievement than did the students who learned using KWL learning method. Also the result and indicated than analytical thinking, science learning achievement and attitudes toward chemistry learning higher than did the students who learned using the conventional approach. In addition, the students who learned using KWL learning method showed higher analytical thinking than did the students who learned using the conventional approach at the 0.05 level of significance. **Conclusion:** In conclusion, students who learned using the 7-E learning cycle showed analytical thinking, science learning achievement and attitudes toward chemistry learning higher than did the students who learned by KWL learning and the conventional approach. Therefore, teachers should be supported to implement the 7-E learning cycle in science teaching in the future.

Key words: 7-E learning cycle, KWL, analytical thinking, learning achievement, attitudes toward chemistry learning, science instruction, learning activities

INTRODUCTION

If the thinking skills are developed, the students will be ready and they can also adapt themselves to face any problem; furthermore, the students will have virtue, morality and their life long learning. Many people had revealed teaching thinking processes in various ways, such as teaching thinking processes by an instant program[1]. Another way, is to teach by following the objectives of the curriculum. Teachers can apply teaching methods emphasizing on thinking development to improve their students' ability. It is not only in content but the thinking skills as well. There are many methods that can develop students' thinking skills such as inquiry and critical reading methods.

Learning by inquiry method is to study continuously; hence, it is called learning cycle which is originally developed by intellectual development. Students are about to think in order to find the knowledge by themselves. At the beginning, learning cycle was divided into 5 phases[2]. Eisenkraft[3] added 2 more phases-Elicitation phase and extension phase. There are many teaching methods for the 7 phases as follows, (1) elicitation phase, during this phase, teachers are to ask students so as to motivate them to express their own knowledge. After that the teachers

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Corresponding Author: Sombat Tayraukham, Faculty of Education, Mahasarakham University, Mahasarakham 44000 Thailand

will plan how to teach according to the students' knowledge. (2) Engagement phase is the motivation. Teachers must motivate students to be curious to learn such as using interesting story to tell students before studying. (3) Exploration phrase is to identify ways of exploring and checking, setting hypothesis, identifying the possible choices, practicing to collect some data to be a base for the next phase. (4) Explanation phase, after students have got enough information, then bring it to analyze, summarize and present in various formats. (5) Expansion phase or Elaboration phase is to bring the knowledge that students built up to cooperate with their own knowledge, or it is to bring the model or even conclusion to explain another case. (6) Evaluation phase is for teachers to evaluate students by any technique to find out what students know after learning. (7) Extension phase, teachers are about to prepare students knowledge after learning for applying using in their daily life. Teachers should also motivate students to use their knowledge so as to make a new one.

KWL Learning method is focused on analytical reading for encouraging learners to have thinking skills such as what or how to think. The students will be trained to think, plan, set a goal, check their thinking abilities and manage the data system for further study by themselves. There are 4 phases of KWL[4] including, (1) K phase (What you know) is for preparing before reading. Teacher may recall students' own knowledge and let students brainstorm what they know. The students then record their opinions, mind map or web diagram which include a main idea or a minor one after brainstorming (2) W phase (What you want to know) is to set goals of reading after the teacher's motivation during K phase. The teacher will lead students to set their own goals by asking questions to stimulate them. For instance, what else would you like to know? Do you have any suggestion for your friends and other people? (3) L phase (What you have learned), students are supposed to answer the questions by writing in an empty paper after reading. They can add any information they got from their reading as well. (4) Conclusion and Presentation phase, students have to adjust their diagram in the K phase. They can add more information or delete some invaluable thing out to make the diagram complete. The teacher can also add an important activity such as a debate on the effects of the topic that students have learnt.

According to KWL learning method, the researcher is interested in studying the comparisons of analytical thinking abilities, science learning achievement on acid-base and attitudes toward chemistry learning of matthayomsuksa 5 students learned by the 7-E learning cycle, KWL learning method and the conventional approach in order to get an information base of managing teaching and studying and to gain students' analytical thinking skills and attitude toward learning. This study aims to compare the students' analytical thinking abilities, Science learning achievement entitled Acid-Base and attitude toward chemistry learning of matthayomsuksa 5 students learned by the 7-E learning cycle, KWL learning method and the conventional approach.

The research hypothesis: The analytical thinking, the science study achievement and the attitude toward learning Chemistry of Matthayomsuksa 5 students learned by the 7-E learning cycle, KWL learning method and conventional approach will be different from each other.

MATERIALS AND METHODS

Sample: The populations of the research were 362 students from 7 classrooms attending in the first semester of the academic year 2008, Phayakkhaphumwitthayakhan School, Phayakkhaphumphisai District, Mahasarakham Province. The sample consisted of 154 Matthayomsuksa 5 students attending in the first semester of the academic year 2008, Phayakkhaphumwitthayakhan School, Phayakkhaphumphisai District, Mahasarakham Province, cluster random sampling technique was employed. They were divided into two experimental groups. The first group was studying in class 5/3 learned by the 7-E learning cycle, 5/5 class was the second group and learned by KWL learning method and one controlled group, 5/7 who learned with conventional approach.

Research tools: There are 4 types of research tools as follows:

- Lesson plans of 7-E learning cycle, KWL learning method and conventional approach. Each type of learning styles had 12 plans. The researchers used 18 h, 6 weeks to complete their teaching
- Thirty items of four-choice analytical thinking test. The test's difficulty index ranged from 0.38-0.95, the discrimination value was 0.76 and its reliability was 0.77
- Forty items of five-choice test on Acid-Base. Its type was a criterion dependence test. The discrimination of the test ranged from 0.20-0.82 and the test reliability was 0.93

- Rating scale on students' attitude toward Chemistry learning, including 5 levels, 20 items, the discrimination ranged from 0.517-0.799, the reliability was 0.94

Procedure: Teach students by Acid-Base lesson plans. The first experimental group, 5/3 learned by 7-E learning cycle plans while the KWL plans were laid on for the second group, 5/5 and the controlled group students, 5/7 learned with the normal plans. Each group was to spend 18 h to learn with the researcher. Test the three groups of students after studying by the analytical thinking test, science study achievement test on Acid-Base and rating scale on students' attitude toward chemistry learning. Bring the students' scores from two types of the test and also their attitude toward chemistry learning to analyze.

Data analysis:

- Find the mean, standard deviation from the students' scores earned in taking the three tests including analytical thinking, science study achievement tests and rating scale on the attitude toward chemistry learning
- Find the multi-correlation coefficient value of an accordance variable including, analytical thinking abilities, Acid-Base study achievement and attitude toward the learning. These were employed by Pearson's technique
- Compare the students' analytical thinking scores, science learning achievement based on Acid-Base and attitude toward chemistry learning by using one-way MANOVA
- Compare the mean of the students' analytical thinking abilities, study achievement on Acid-Base learning and attitude of the learning by Hotelling's T^2 and Univariate t-test

RESULTS

Since the researchers had studied and compared the Mattayomsuksa 5 students' analytical thinking abilities, study achievements on science entitled Acid-Base and attitudes toward chemistry learning who learned with 7-E learning cycle, KWL learning method and regular learning, they got the conclusions as follows,

The students learnt by using the 7-E learning cycle model, KWL learning method and the conventional approach differently indicated analytical thinking, science learning achievement on Acid-Base and attitudes toward chemistry learning at the 0.05 level of significance. The students who learned on using the 7-E learning cycle model showed more science learning achievement on Acid-Base than did the students who learned with KWL learning method and indicated more analytical thinking, science learning achievement on Acid-Base and attitudes toward chemistry learning than did the students learnt by the conventional approach. In addition, the students learned by KWL learning method showed more analytical thinking than did the students learned by using the conventional approach at the 0.05 level of significance.

DISCUSSION

It followed the hypothesis that the students learnt by using 7-E learning cycle, KWL learning method and conventional approach had different analytical thinking abilities, study achievements and attitudes toward chemistry learning at 0.05 level of significance. The teachers' teaching methods affected the students' learning achievement[5]. Wang Heartel and Walberg[4] had studied instructional models by collecting data from the analytical deducing research and experts. It revealed that there were three variables that influenced on students' learning including, psychological, instructional and home environmental variables.

It was especially true that the different learning methods would be an important variable for the students to have differences of an analytical thinking ability, learning achievement and attitude towards learning. The varieties of teaching strategy that lead science classroom to meet what students need, what students have to learn and what students evaluate learning outcomes[6]. Any instructional theory that ignores the limits of working memory when dealing with novel information or ignores the disappearance of those limits when dealing with familiar information is unlikely to be effective. The inquiry-based instruction, 7E learning explain how such a procedure of science learning can deal with novel information.

Student who learned with 7-E learning cycle model got higher chemistry learning achievement on Acid-Base than those learnt by KWL and conventional approach. The reason why the learning achievement of students who learned from 7-E cycle learning model was higher than those who learned from KWL learning method and conventional learning was because the learning model included the phases to check the students' own knowledge so that the students would use it for their further study, then they would learn accurately[3]. The approaches challenges to instructional strategies based on reality of science teaching, it need to able helped students learn natural things that surround them. Teachers have to use instructional methods based

on recitation and direct instruction[7]. Inquiry-based learning requires students to collaborate with peers, think deeply about complex concepts, relate new science content to their lives and self-regulate their behavior[8,9].

Learning by 7-E cycle learning model caused students to have higher analytical thinking abilities and attitudes toward chemistry learning than studying with conventional class because the learning model provided students to build up the knowledge by themselves particularly during an exploration and an elaboration phases. The students themselves were to find the technique to arrange the knowledge to learn. Every learning phase encouraged students to develop their thinking abilities, thus their learning achievements were improved also[3]. Traditional science classrooms are teacher centered with demonstrations and lectures, while inquiry-based classrooms are supported by the learners' real world experiences[10].

The reasons why students learned by 7-E learning cycle model had higher attitude on chemistry learning than those learnt by conventional learning method was because the method was new, then the students would be enthusiastic to learn. Moreover, according to the 7-E cycle model, the students were about to learn or practice by themselves. They had to evaluate themselves not only a negative way but the positive one as well. Students will be engaged and express their feeling how learning environment will be incorporated. They are continuously building and rebuilding understanding, need to reflect on their knowledge and experiences as well. They should be provided with opportunities to appreciate and understand various forms of scientific inquiry.

CONCLUSION

The students who learned with KWL had higher ability in analytical thinking than students who studied by using a conventional method. The reasons were that the KWL method emphasized on students' reading skills, practicing thinking skills by acknowledging what they were thinking, how to think, checking their thinking and also adjust the thinking to be suitable. Thus, their thinking skills were higher than those before. The result was that the students' analytical thinking average scores after learning by KWL Plus were higher than before studying. The level of their analytical thinking skills was defined as a good one.

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