



Effects of Science Learning Activity Management based on 4MAT System of the Sixth Grade Students with Different Learning Styles

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Abstract

The purpose of this study was to investigate the effects of science learning activity management based on 4MAT System to the sixth grade students with difference in learning styles. The design of this study was pretest-posttest control -group design. The participants were two classes of the sixth grade students which were selected through cluster sampling. One class was designed as the control group (30 students) which was taught through the traditional methods whereas the other was designed as the experimental group (33 students) which was taught through science learning activities based on 4MAT System. The achievement test, science process assessment and attitudes toward science measures were instruments used to investigate students' learning outcomes which were achievement, science process skills and attitudes toward science, respectively. The Multivariate Analysis of Variance (MANOVA) was statistically used to analyze the data. The results indicated that 1) there was no interaction between science learning activities and learning styles. 2) The achievement and attitudes towards science among students who were taught through science learning activities based on 4MAT System was higher than those taught through the traditional method of teaching. However, there were not the differences among science process skills. 3) Students who had different learning styles and learned through science learning activities based on 4MAT System had the same achievement, science process skills and attitudes toward science.

Keywords: science learning activities, 4MAT System, learning styles

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Introduction

National Education Act of B.E.2542 (1999) and amendments Second National Education Act of B.E. 2545 (A.D. 2002) stated in section 24 that:

"In the organization and classroom management of educational institutions shall: 1) provide substance and arrange activities in line with the learners' interests and aptitudes, bearing in mind individual differences; 2) provide training in thinking process, management, how to face various situations and application of knowledge for obviating and solving problems; 3) organize activities for learners to draw from authentic experience; drill in practical work for complete mastery; enable learners to think critically and acquire the reading habit and continuous thirst for knowledge; 4) achieve, in all subjects, a balanced integration of subject matter, integrity, values, and desirable attributes; 5) enable instructors to create the ambiance, environment, instructional media, and facilities for learners to learn and be all-round persons, able to benefit for research as a part of the learning process. In so doing, both learners and teachers may learn together from different types of teaching-learning media and other sources of knowledge; 6) enable individuals to learn at all times and in all places. Co-operation with parents, guardians, and all parties concerned in the community shall be sought to jointly develop the learners in according to their potentiality." (Office of the National Education Commission, 2008: 19-22)

Therefore the teaching and learning process must allow all learners to develop at their own pace and their highest potential and encourage children's natural curiosity in order to promote an attitude of discovery (Caine, Caine, and Mcclintic, 2002: 70-73).

The 4MAT System is an instructional model that provides a systematic approach to organizing

and delivering instruction that address the learning styles and hemispheric preferences of students. This model consists of eight steps namely: 1) Connect, 2) Examine, 3) Image, 4) Inform, 5) Practice, 6) Extend, 7) Refine and 8) Perform (McCarthy, 1980). Consequently, science learning activities based on 4MAT system can promote learning capability of students who are different in learning styles. Furthermore, science learning activities based on 4MAT System offer many opportunities for students to employ their intelligences. Besides, one of the major advantages of the 4MAT System is to engage higher order thinking throughout the lessons. These were supported by several studies that suggested students participating in activities according to the 4MAT System achieve a higher degree of conceptual understanding, attitudes toward science, science process skills and higher order thinking when compared with other teaching methods (Sangwiriya, 2001; Kusolpoon, 2002; Merngchaisong, 2004; Bowers, 1987; Sangster & Shulman, 1988; and Appell, 1991).

For these reasons, science learning activities were developed based on the 4MAT System that addressed students' different learning styles to develop students' potentiality.

Research Purposes

The purposes of this research were:

1. To investigate the interaction among science learning activities and students' learning styles on students' achievement, science process skills and attitudes toward science.

2. To investigate effects of science learning activities based on 4MAT System on students' achievement, science process skills and attitudes toward science by all aspects and by learning styles.



Significance of the Research

This research provided science learning activities that address learning styles of students. This is an alternative way for teachers to improve science teaching and learning more effectively.

Methodology

Research Design

Control group pretest-posttest design was the research design used in this study. The experimental group was taught through science learning activities based on 4MAT System whilst the controlled group was taught through traditional method.

Participants

The participants consisted of two sixth grade classes in the first semester of the 2010 academic year. The cluster sampling technique was used to select the participants which were Wat Salud School in the Samut Prakan province. The control group included 30 students whereas 33 students were in the experimental one. The student participants in both groups were surveyed of their learning styles through the learning styles questionnaire before they participated in science learning activities.

Variables

1. Independent variables consisted of :

1) Science learning activities were categorized as the two teaching methods used namely: science learning activities based on 4MAT System and science learning activities by the traditional teaching method.

2) Learning styles were categorized into four learning styles: convergent, divergent, assimilative and accommodative.

2. Dependent variables consisted of students' achievement, science process skills and attitudes toward science.

Research Instruments

1. Ten Lesson Plans with the content on "substance in daily life" were developed through 4MAT System by the researcher.

2. The Learning Styles Questionnaire was adapted from the questionnaire developed by Tearnrungroj (2005). The instrument consisted of 12 questions of four learning styles each namely: convergent, divergent, assimilative and accommodative. The internal consistency reliability of each learning style was 0.68, 0.86, 0.59 and 0.79, respectively.

3. The Achievement Test was developed by the researcher. The test consisted of two sections: 22 multiple choices test items that each item had four choices with one correct answer and four open-ended questions. The difficulty (p) and item discrimination (r) of the test items were between 0.20-0.80 and the internal consistency reliability of multiple choices and open-ended question was 0.62 and 0.71, respectively.

4. Science Process Assessment was adapted from Science Process Assessment for Elementary Students (Smith, 2003). It consisted of 40 multiple choices test items and the internal consistency reliability of test was 0.73.

5. Attitudes toward Science Measures were adapted from Attitudes toward Science Measures (Kind, Jones, & Barmby, 2007). The test consisted of five-response Likert Scale and the internal consistency reliability of test was 0.86.

Data Collection and Analysis

Firstly, the teacher participant was trained on Science Learning Activities Based on 4MAT System.



Then, she delivered the 27 periods of science lessons through Science Learning Activities Based on 4 MAT System to experimental group which was the six grade students and the control group through the traditional method. The data collection was done through the pretest and posttest of students' achievement, science process skills and attitudes towards science.

The quantitative data was analyzed through basic statistics: mean and standard deviation and Multivariate Analysis of Variance (MANOVA). was the statistics used for examining the research hypotheses

Results And Discussions

1. Interaction between the science learning activities and students' learning styles

The interaction between the science learning activities and learning styles of student on students' achievements, science process skills and attitudes toward science was not significant at the 0.05 level and the effect size of the science learning activities model and learning style on four dependent variables (Eta Square) was 0.086 which was very low as shown in Table 1. It was shown that there was no interaction between science learning activities and learning styles. This indicated that both of science learning activities and four learning styles did not affect on students' achievement, science process skills and attitudes toward science. Similarly, Pothongsangaroon (1993) studied an interaction of discovery and expository approaches in computer-assisted instruction lesson and learning styles upon mathematics learning achievement of the vocational education certificate students that there was no statistically significant interaction between the use of computer-assisted instruction lesson approach and types of learning

styles upon mathematics learning achievement at the 0.05 level. Furthermore, Day (1998: 73) studied the effects of world wide web instruction and traditional instruction and learning styles on achievement and changes in student attitudes in a technical writing in an agricommunication course and found that interaction effects did not occur between learning styles and types of instruction (Web-dependent or traditional) on students achievement and attitudes.

2. Effects of science learning activities based on 4MAT System

1) Effects of science learning activities based on 4MAT System by overall

The means score of achievement and attitudes toward science between experimental and control groups were significantly different at the level of 0.05 and 0.01, respectively as shown Table 2. This indicated that mean scores of achievement and attitudes toward science (12.33, 141.70) among the students who learned through science learning activities based on 4MAT System was higher than those who were taught through the traditional method of teaching (8.87, 134.17). The results supported the finding of Szewzyk (1987), Winkerson and White (1988), Meehirun (2003) and Sinsomros (2005) which found that learners who learned through learning activities based on 4MAT System had higher scores of achievement and attitude toward science than learners who learn through learning activities based on other teaching methods such as textbook approach, enrichment based on Bloom's Taxonomy, conventional methods, and traditional teaching method.

However, they were found that means score of science process skills between experimental and control groups were not significantly different at the level of 0.05. This indicated that students who learned through science learning

activities based on 4MAT System were not much different mean scores (21.36) than the students who learned by the traditional method of teaching (18.23) because they did not have enough time to practice any science process skills that need to be more of practices. This statement was supported by S. Thomson's interview with Dechsri (Jansawang. 2005: 86; citing Dechsri. 1994: 96). Thompson believed that each skill needed to be practiced many times. In regard to complex skills, he also believed that the fluency in each skill would improve through hundreds of attempts.

2) Effects of science learning activities based on 4MAT System by learning styles

The comparison of the scores among students who had divergent learning style, assimilative learning style, convergent learning style, and accommodative learning style showed that the mean scores of achievement, science process skills, attitudes toward science and multiple intelligences were not significantly different at the 0.05 level as shown in Table 3. This indicated that students with different learning styles who learned through science learning activities based on 4MAT System were not different in scores of achievement, science process skills and attitudes towards science. The result may have been caused by science learning activities based on 4MAT System which emphasized the different learners of four learning styles as following Kolb's experiential learning style and developed both right- and left- mode processing skills. All learners have an equal chance to learn and construct their knowledge. This statement was supported by McCarthy (1990: 31) that learning activities based on 4MAT System offers a way to accommodate, as well as challenge, all four types of learners, by appealing to their accustomed learning styles. Similarly, Suebtrakul (2003) studied effects of concept mapping in

hypermedia lessons based on the 4MAT System on learning achievement in life experience were on "Electricity" of the sixth students with different learning styles and found that the accommodative, assimilation, convergent and divergent learning style students who learn through hypermedia lessons based on the 4MAT System had significantly increase on learning achievement at 0.05 level. However, the accommodative, assimilation, convergent and divergent learning style students who learn through hypermedia lessons based on the 4MAT System did not have significantly difference on learning achievement at 0.05 level.

Conclusions

According to this research, effects of science learning activity management based on 4MAT System of the sixth grade students with different learning styles were investigated through pretest-posttest control-group design. The participants consisted of two classes of sixth grade students that were selected through cluster sampling technique. One group was designed as an experimental group which received the treatment (science learning activities base on 4MAT System) whereas the other was designed as a control group which was treated through traditional method. The students' achievement, science process skills and attitudes toward sciences were examined through the achievement test, science process assessment and attitudes toward science measures, respectively. The results showed that both of science learning activities (based on 4MAT System and traditional methods) and four learning styles (divergent, assimilative, convergent, and accommodative) did not affect on students' achievement, science process skills and attitudes toward science. However, students who learned through science learning activities based on 4MAT System had



higher mean scores of achievement and attitudes toward science than those who learned through the traditional method of teaching. Moreover, students who were different in learning styles and learned through science learning activities based on 4MAT System had the same score of achievement, science process skills and attitudes toward science. The results may have been caused by the activities themselves in that the activities based on 4MAT System emphasized the difference of learners and the well balance of both the right- and the left-mode of brain. All learners have an equal chance to learn, practice and construct their knowledge by themselves.

Recommendations

1. Recommendations for teachers

1) In order to motivate students' learning, teachers should explain the criteria of evaluation to students when starting the lessons. This also affects the science learning activities based on 4MAT System to be more effectively.

2) For the development of science process skills and help make lessons more understandable, teacher should explain and demonstrate scientific equipments, as well as the procedures of experiment for students before starting to use science learning activities. Furthermore, teacher should provide variety of activities and opportunities for students to use their skills continuously. These also help promote the effect of the science learning activities based on 4MAT System more effectively.

2. Recommendations for further studies

- 1) There should be more further studies that aim at investigating the achievement, science process skills and attitudes toward science among students in groups of four learning styles.
- 2) There should be more further studies that investigate the effects of science learning activities based on 4MAT System with other variables such as retention, creative problem solving skill.
- 3) There should be more further studies on the comparison of the effects between science learning activities based on 4MAT System and that of based on other theories such as Constructivism.

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