An Effect of STEAM Activity Programs on Science Learning Interest

Young Tae Kong[1], Sun-Chen Huo[2]

[1] Department of Science Education, 380 Shinandong, Jinju, GN, Korea
[2] Kumseong Elementary School, Jinju, GN, Korea
ytkong@cue.ac.kr

Abstract. The purpose of this study is to find out the effects of using paper crafts in STEAM-based learning on elementary school students' self efficacy, interest, and attitude toward science. For this purpose, the curriculum based on the paper crafts was designed for STEAM-based learning and applied to the class. Experimental classes were designed for 4th graders and applied for 10 hours throughout five weeks. We studied two classes in the 4th grade of G elementary school located in Jinju. Prior to the experiment, a pre-test was conducted on the two groups. Then, the STEAM based programs were conducted over five weeks and applied to the experimental group only.

Keywords: Theme based STEAM activity, Elementary School, Science learning motivation, scientific attitude, Self-efficacy, Paper Art

1 Introduction

The new paradigm of the 21st Century science education explores a wide range of possibilities that can foster students' interest toward science and creative convergence thinking. Therefore, STEAM (science, technology, engineering, art and mathematics) education has been implemented to enhance scientific literacy to use the integrated knowledge in the newly revised Korean science education curriculum.

The STEM education in USA aims for the improvement of students' achievement of mathematics and science, improvement of teacher's specialty, and the advanced of enlightment of female and minority student toward science and technology field (Sanders, 2006). However, there is the purpose that the STEAM education of Korea stimulates a domain of the heart and conscience for the science of students and draws motive induction for the science (Baek *et al.*, 2011 & 2012).

Many teachers agreed that STEAM education has an affirmative influence on the school education, but, on the other hand, their manner that was going to participate was really negative. The main reason is that they has not been experienced the STEAM education during their in-service and pre-service teacher education period. And there have been few empirical researches of the implementation and its educations effects.

Therefore, this research develops STEAM activity programs and applies in elementary classes to examine the effects of STEAM activity on students' science learning interest, scientific attitude, and self-efficacy

2   Methodology

2. 1. Research object

This study has randomly selected three classes of four-grader in an elementary school in Jinju city, South Korea. Among these classes, students who have participated in both pre- and post-test are taken into the consideration. Classes are divided into two groups of the experiment and control. There are 25 students in the experiment group, 13 males and 12 females, and the other group of control has 25 students in total, 13 males and 12 females. The teacher is female and has 15 year educational carrier.

2. 2. Research Design

This research conforms to the quasi-experimental design meanwhile the controlled groups are examined prior to the STEAM class, once more after the STEAM class.

Table 1. Research design

G1	O1	X1	O2
G2	O1	X2	O2

G1: Experimental group, G2: Control group
O1: Pre-test (science learning interest, scientific attitude, and self-effective)
O2: Post-test (science learning interest, scientific attitude, and self-effective)
X1: STEAM class
X2: Normal class

2. 3. Research procedure

The experimental group is taught the unit of 'Star with me' with STEAM activity while the other control group learned the different unit by different teacher. The study has examined all groups before the STEAM class in order to establish homogeneity in terms of forming such the science learning interest, scientific attitude, and self-efficacy. The post-test has also tested among on science learning interest, scientific attitude, and self-efficacy.

2. 4. Development of STEAM activity

We developed the scientific activity program of the quantity of 10 hours based on the theme of paper art. This program was based on 4C-STEAM framework. MEST (2012) and Baek *et al*., (2011, 2012) reported the major STEAM components and the framework of STEAM education. STEAM education has been designed with the framework that is very adaptable to all levels, types and styles of teaching. The framework is composed of 'Creative Design' and 'Emotional Learning' as a crucial element. In addition, the framework focuses the affective aspect of science, technology, mathematics education on 4C-STEAM stands for 'Caring', 'Creativity', 'Communication', and 'Convergence' (Baek *et al*., 2011 & 2012). The framework is intended to develop deeper understanding of content, process, and characteristics of science through 'Creative Design' and 'Emotional Learning'.

2. 5. Measurements

To measure the science learning interest, this study has applied CIS questionnaire (Kim et al., 2002). The value of Cronbach's alpha on the questionnaire is 0.93. It has 34 questions in total with a five step of Likert scale relevant to quantization on statistical analysis. Questionnaire of the science learning interest is composed of 3 sub-categories. And for the measurement scientific attitudes, we adopted scientific attitudes instruments developed by Yoen (1996). The value of Cronbach's alpha on the questionnaire is 0.90. It has 40 questions in total with a five step of Likert scale relevant to quantization on statistical analysis. Questionnaire of scientific attitude is composed of 4 sub-categories.

4   Results and Discussion

4. 1. The effect of STEAM education on self-efficacy

A value (99.50) of experimental group on pre-test is higher than that (96.04) of the control group. To confirm the statistically validity, t-test is conducted. But, there was no valuable variation in t-test result, which explains the homogeneity between two groups on science learning motivation.

However, the average of post-test of experimental is greater at 103.25 than 92.40 of the control group where the result of t-test of post-test has shown valuable variation. Therefore, STEAM activity has positive effects on students' science learning interest**.**

4. 2. The effect of STEAM education on scientific attitude

A value (143.70) of experimental group on pre-test is higher than that (143.50) of the control group. To confirm the statistically validity, t-test is conducted. But, there was no valuable variation in t-test result, which explains the homogeneity between two groups on scientific attitude.

However, the average of post-test of experimental is greater at 149.58 than 141.22 of the control group where the result of t-test of post-test has not shown valuable variation. Therefore, STEAM activity has not positive effects on students' scientific attitude. However, it showed positive influence in subordinate elements such as meaning of social science, attitude of scientific education, and scientific attitude itself.

4. 3. The effect of STEAM education on science learning interest

A value (127.41) of experimental group on pre-test is almost even that (125.45) of the control group. To confirm the statistically validity, t-test is conducted. But, there was no valuable variation in t-test result, which explains the homogeneity between two groups on self effective.

However, the average of post-test of experimental is greater at 131.08 than that (122.27) of the control group where the result of t-test of post-test has not shown valuable variation. Therefore, STEAM activity has not positive effects on students' self-efficacy.

5   Conclusion

The approach of the research is to study how development and application of theme based STEAM education affect students' self efficacy, scientific attitude and science learning interest.

Results of the research are as following.

First, theme based STEAM education showed positive significance to elementary students' self efficacy improvement..

Second, although theme based STEAM education did not show significance through statistics, still showed improvement in student's positive attitude towards science relations.

Third, theme based STEAM education did not show significance to students' science learning interest. STEAM education's basic level which applies paper craft requires diverse activities reformed by original text.

References

1. Baek, Y., Park. H., Kim, Y., Noh, S., Park, J., Lee, J., Jeong, J., Choi, Y., & Han, H. (2011). Steam education in Korea. Journal of Learner-Centered Curriculum and Instruction. 11(4), 149-171. (in Korean).

2. Baek, Y., Kim, Y., Noh, S., Park, H., Lee, J., Jeong, J., Choi, Y., Hand, H., & Choi, J. (2012). Basic research for establishing the direction of STEAM education in Korea. Korea Foundation for the Advancement of Science and Creativity.

3. Kang, H. J. (2001). The effect of self-controlled learning strategy on achievement and self-efficacy of slower learner, Master thesis, Pusan National University of Education.

4. Kim, H. G. (1997). The role of learning motivation on the change of concept. Master thesis, Seoul National University.

5. Ministry of Education, Science and Technology[MEST] (2012). 2012 National Plan for STEAM Education. Seoul: MEST.

6. Sanders, M. (2006). A rationale for new approaches to STEM education and STEM education graduate programs. Paper presented at the 93rd Mississippi Valley Technology Teacher Education Conference, Nashville, TN.