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The Effect of the Socio-scientific Issues (SSI) Education Program on Elementary School Students′ Understanding of the Nature of Science

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Abstract. The purpose of this study was to examine the effect of an education program focusing on socio-scientific issues (SSI) on elementary school students' understanding of the nature of science (NOS). The SSI education program used in this study was composed of 10 lessons and applied to 30 sixth graders in elementary school. The Student Understanding of Science and Scientific Inquiry (SUSSI) test was conducted as a pretest and a post-test to analyze the effect of the SSI education program on elementary school students' NOS understanding. In the results, the scores of closed questions on the SUSSI test were statistically significantly higher in the posttest than in the pretest.

Keywords: socio-scientific issues, SSI program, nature of science

1 Introduction

Due to the development of scientific technologies, people frequently face socio-scientific issues (SSI), such as the risk of accidents due to nuclear power generation and biotechnology-related ethical problems [1]. Therefore, the ability to reasonably make decisions on SSI with interest and judgement, that is, scientific literacy, is regarded as the endowment of citizens in the future society [2].

Understanding of the nature of science (NOS) cannot be excluded from scientific literacy, and it has been verified through many studies that students that understand the NOS well easily recognize experience and activities in science classrooms and easily learn the scientific method. One important thing to consider of the NOS is to understand the relationship between science and society [3]. It can be said that SSI is an effective subject in teaching students about the NOS because it includes not only science but also many social areas entwined with science [4]. However, at present, no concrete teaching–learning strategy or program for SSI has been developed because of the lack of understanding of not only SSI but also science educational studies. Therefore, this study was intended to develop an education program for SSI and analyze the effects of the SSI program on elementary school students' understanding of the NOS to check the suitability of the educational introduction to SSI subjects.

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2 Methods

2.1 Subjects

The subjects of this study were 30 students in one sixth-grade class of E elementary school located in D city, Republic of Korea. The subjects were selected through convenience sampling.

2.2 Development of the SSI program

To develop the SSI program, SSI materials included in the elementary school science subject curriculum were extracted and incorporated into syllabuses, and a demonstration formation class model was used to generate concrete teaching–learning strategies. Based on the strategies, a program for a total of 10 lessons consisting of teaching materials, students' reading materials, and student activity sheets was developed. In the process of SSI material selection, drafting syllabuses, and material composition, validity was tested by three experts in science education.

2.3 Testing tool

The Student Understanding of Science and Scientific Inquiry (SUSSI) test was used to measure students' NOS understanding [5]. This test is composed of a total of 30 closed and open-ended questions in the six following areas: observation and inference, changes in scientific theories, scientific laws and theories, social/cultural effects on science, imagination and creativity in scientific research, and methods of scientific research.

2.4 Data collection and analysis

To examine the degree of understanding of the NOS, tests were conducted before and after administering the SSI program using the SUSSI test sheet. In the SUSSI test, closed questions are scored on a 5-point Likert scale. In the case of negative questions among the closed questions, the scores are reverted in the opposite direction before statistical processing. Open-ended questions are evaluated based on SUSSI rubrics. In this study, the test results were analyzed through pre and post paired sample t-tests using the SPSS 20.0 program.

3 Result

According to the results of the SUSSI test that was conducted to examine students' understanding of the NOS, the scores for closed questions were statistically significantly higher on the post-test than on the pretest (Table 1).

Table 1. Changes in the degree of understanding of the NOS for closed questions in the SUSSI test

	n (Person)	M (Point)	SD	t
Pretest	30	75.35	7.508	-6.561 **
Posttest	30	86.19	9.057	

**p< .01

Although the scores for the open-ended questions increased from 9.77 points to 10.29 points, there was no statistically significant effect of program administration. Given the resultant scores of students' answers to open-ended and closed questions, it can be said that the SSI program is effective for the development of understanding of the NOS.

4 Conclusion

Through the results of this study, it could be seen that SSI education programs are effective for elementary school students' understanding of the NOS. In addition, the results of this study indicated that the provision of concrete teaching–learning materials to support SSI-related classes in the school can provide actual assistance for instructors' teaching activities.

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