

# Developing an Effective Science Ethics Education Program: A Socioscientific Issues-based Approach

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## Introduction

This study develops a Science-Technology-Society (STS)-based science ethics education program for high school students majoring in or planning to major in science and engineering. Our education program includes the fields of philosophy, history, sociology and ethics of science and technology, and other STS-related theories.

## Research Question

Does an STS-based science ethics education help participants develop both their epistemological beliefs and moral judgment?

## Method

We used a qualitative method—semi-structured essay writing. Students were asked to complete an essay on the nature of scientific knowledge (for epistemological belief measurement) and moral dilemmas (for moral judgment measurement). This essay consisted of five questions, which can be separated into two parts: one on epistemological beliefs and another on moral judgment.

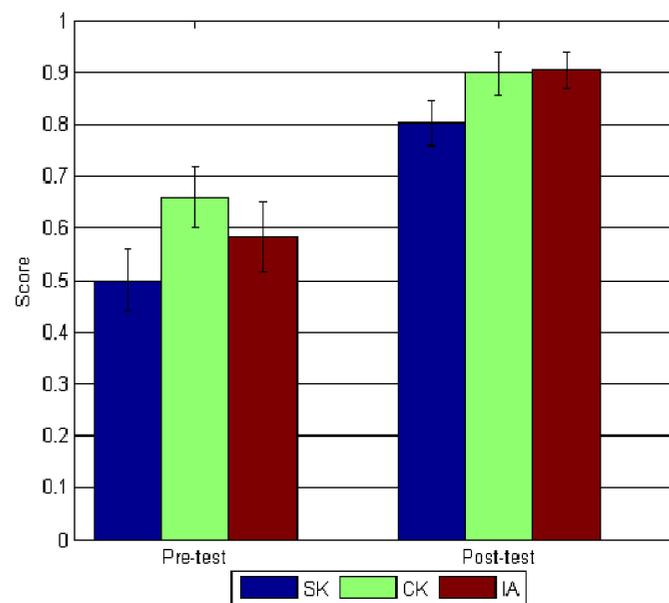
## Sample

Our semester-long class focusing on science ethics started in mid-February and ended in mid-June. High school science students gifted in science and engineering took the class as a major-elective subject for two hours each week. There were 13 male students and 2 female students. All of them were in the 11 grade and majoring in science and engineering, including mathematics, physics, chemistry, bio science, earth science or computer science and engineering.

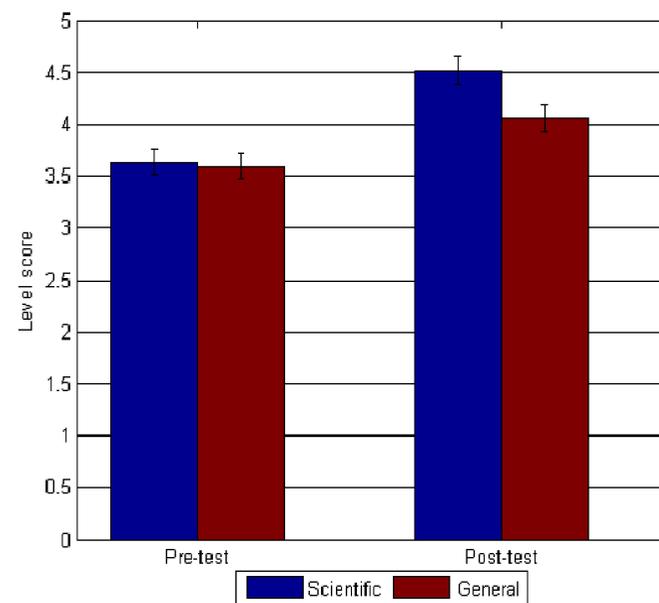
**Table 1. T-tests between pre- and post-test epistemological beliefs and moral judgment**

	N	M	SD	N	M	SD	t	p
	Pre-test	Pre-test	Pre-test	Post-test	Post-test	Post-test		
SK	44	0.50	0.39	48	0.80	0.04	5.31	< .0001
CK	41	0.66	0.06	44	0.90	0.04	21.84	< .0001
IA	42	0.58	0.07	42	0.90	0.04	25.72	< .0001
Sci. Moral	36	3.64	0.13	29	4.52	0.14	26.21	< .0001
Gen. Moral	32	3.59	0.13	34	4.06	0.13	14.68	< .0001

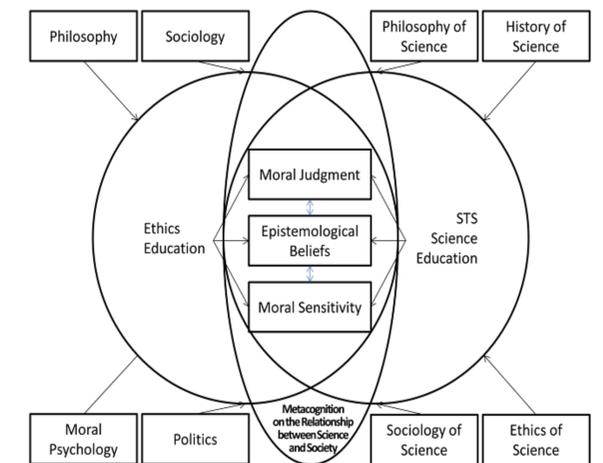
**Fig 1. Changes in students' epistemological beliefs**



**Fig 2. Changes in students' moral judgment levels**



**Fig 3. Class structure**



## Conclusion

We applied the STS-based curriculum for a semester to a group of Korean high school students gifted in science and engineering. All of these students submitted intensive essays about their epistemological beliefs and moral judgment about scientific and technological issues for a pre- and post-test. The results showed that there were statistically significant developments in students' both epistemological beliefs and moral judgment competence.

## Limitations

Due to its small sample size and quasi-experimental design, the generalizability and reliability of our results are limited. As a result, future studies should improve upon our research design, develop a new quantitative measurement based on our essay measurements, and apply this new design and measurement to a much larger group to correct the limitations of our study.