How Publics' Knowledge of Nuclear Energy Influences Their Emotions, Social Distance, and Risk Perceptions: Implications for Effective Nuclear Communication Programs

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1. Introduction

While nuclear energy has contributed to the economic development of Korea by producing reliable electricity for the last several decades, the use of nuclear energy has become one of the controversial topics for public discussion [1]. As observed through the decision making process on the construction of Shin-kori units #5 and #6, however, general public's knowledge regarding nuclear energy or nuclear power plants may not be comprehensive enough to understand the system of nuclear applications. This study investigates the level of knowledge regarding nuclear energy among general publics, and how such knowledge influences their emotional responses to nuclear power, NPP benefit and risk perceptions, trust in nuclear applications, and finally social distance toward nuclear experts.

2. Methods and Research Questions

A professional research institution sent an online survey to 2,000 Seoul citizens in August 2017, and a total of 400 respondents participated in this study. NE knowledge was measured by ten questions as follows: (1) How many nuclear power plants do we have in Korea? (2)Where is not the location of nuclear power plant in Korea? (3)Which country has Korea first exported nuclear power plants? (4)What is the proportion of nuclear power generation in total electricity production in Korea? (5)Which country has the first commercial nuclear power plant that began operating in 1956? (6)Which of the following energy sources is the least costly? (7)What is the raw material used in nuclear power generation? (8)Which of the following is produced in the spent fuel reprocessing process? (9)Which authority is responsible for permitting the construction of nuclear power plants in Korea? (10)What are the energy sources that have the lowest GHG emissions among the power generation sources listed below? The number of correct answers was added to compose a total score of NPP knowledge ranging from 0 to 10.

In addition to the NE knowledge, respondents' emotional response to nuclear energy (i.e., positive, negative, hope, anger, fear, and anxiety), NPP benefit and risk perceptions, trust in nuclear applications (i.e., the level of trust in NP technologies, NP experts, NPP operator, and NP-related governmental organizations)[2], and social distance [3] toward nuclear experts were measured.

Correlations analyses using SPSS22 program were performed to answer a series of research questions.

RQ1. How is the level of NE knowledge correlated with emotional response to nuclear energy?

RQ2. How is the level of NE knowledge correlated with NPP benefit perceptions?

RQ3. How is the level of NE knowledge correlated with NPP risk perceptions?

RQ4. How is the level of NE knowledge correlated with the level of trust in nuclear power (i.e., NP technologies, NP experts, NPP operator, and NP regulating government organizations)?

RQ5. How is the level of NE knowledge correlated with social distance toward nuclear experts?

3. Results

The results of correlations analyses showed the statistically significant correlations between the level of NE knowledge and other variables.

First, the level of NE knowledge was positively correlated with positive emotions toward nuclear energy ($p < .01$, $r = .17$), and negatively correlated with negative emotions toward nuclear energy ($p < .01$, $r = -.113$). That is, the greater level of knowledge of nuclear energy, the more positively did individuals tend to feel about nuclear energy applications in Korea.

Second, the level of NE knowledge was positively correlated with NPP benefit perceptions ($p < .01$, $r = .19$). That is, the greater level of knowledge of nuclear energy, the more did individuals tend to evaluate the benefit

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perceptions about nuclear energy applications in Korea.

Third, the level of NE knowledge was negatively correlated with NPP risk perceptions positive emotions toward nuclear energy ($p < .01$, $r = -.15$). That is, the greater level of knowledge of nuclear energy, the greater risk perceptions did individuals tend to have regarding nuclear energy applications in Korea.

Fourth, the level of NE knowledge was positively correlated with the level of trust in different dimensions of nuclear energy applications. Specifically, the level of NE knowledge was positively correlated with the level of trust in Korean NE technologies ($p < .01$, $r = .26$) and the level of trust in NE experts ($p < .01$, $r = .19$). That is, the greater level of knowledge of nuclear energy, the greater level of trust did individuals tend to have in Korean NE technologies and experts. However, it was not statistically correlated with the level of trust in NPP operator (i.e., KHNP), and NP-related governmental organizations.

Finally, the level of NE knowledge was negatively correlated with the social distance perceptions toward experts working in the Korean nuclear industry ($p < .01$, $r = -.17$). It was also found to be negatively correlated with the stigma perceptions against experts working in the Korean nuclear industry ($p < .01$, $r = -.17$). That is, the greater level of knowledge of nuclear energy, the closer did individuals tend to perceive experts working in the Korean nuclear industry. In contrary, the less level of knowledge of nuclear energy, the greater stigma perceptions did individuals tend to have against experts working in the nuclear field in Korea.

4. Conclusion

This study empirically demonstrated the impact of nuclear energy knowledge on public's cognitive and affective responses toward nuclear energy applications in Korea. The greater level of knowledge regarding nuclear energy applications was significantly correlated with public's positive emotions toward nuclear energy, greater NPP benefit perceptions, and less NPP risk perceptions. It was also found that the individuals with the greater level of nuclear energy knowledge tend to have the higher level of trust in Korean nuclear technologies and experts. The individuals with the less level of nuclear energy knowledge tend to express the greater social distance and stigma perceptions toward experts working in the Korean nuclear field.

The findings of this study showed general public's knowledge level in nuclear energy applications is limited and needs to be improved. Considering the significant impact of nuclear energy knowledge on public's perceptions and evaluations, this study suggests that more comprehensive efforts to increase public's knowledge in nuclear energy applications are critical for effective nuclear communication program.

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