Experiment Training Program for Nuclear Safety Research at KAERI

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1. Introduction

According to a report by the World Atomic Energy Association released in May 2019, the capacity of nuclear power plants that do not generate greenhouse gases is forecast to continue to increase over the next 20 years to cope with climate change [1]. The report on overseas trends in nuclear R&D shows that the demand for nuclear safety research personnel abroad will continue to increase as R&D for improving safety is actively pursued regardless of differences in the country's nuclear policies [2]. As uncertainty in the supply of nuclear energy has been increasing in Korea since the change in the energy conversion policy and the trend of reducing the inflow of new workers into nuclear power fields, increasing the training of key professionals and strengthening of educational infrastructure in order to foster future experts has been highlighted as an issue [3]. The Korea Atomic Energy Research Institute has been operating experiment training program for college students majoring in nuclear engineering using national nuclear research facilities and professional research personnel as instructors that is difficult to have in universities for more than 50 years, which is clearly different from university education programs in terms of educational effectiveness. However, the experiment training for undergraduate students consisted of less relevant practical subjects, which raised the need for the development and operation of advanced practical courses for nuclear research and development personnel. To this end, a project to foster nuclear safety research specialists has been established, and the KAERI has been carrying out tasks in the field-specific professional human resources development since the second half of 2018.

In this study, we developed advanced practical training for R&D personnel majoring in nuclear engineering, provided education for graduate students and undergraduates who are scheduled to enter graduate schools. After the completion of education, we compared and analyzed the results of the post-education questionnaire to find improvements in educational content and operation methods

2. Methods

In consultation with researchers in the field of nuclear safety research at Korea Atomic Energy Research Institute, we selected curricula for graduate students of nuclear power engineering and conducted a survey on demand from 16 universities in which nuclear engineering was established. After consulting professors on the results of the demand survey, six experiment training courses were developed through meetings with the instructors in each field at KAERI reflecting recommendations from the advisory council.

The education process development plan was prepared in accordance with the ISO-29990 regulation procedure to set the operation direction and sent education information and attached documents were delivered to 16 universities and separately notified at the home page of the nuclear energy education center to recruit students. In order to improve the quality of education, the requirements for self-introduction were strengthened to support students with knowledge of nuclear energy majors by establishing a self-introduction document in an application for education and obtaining signatures from a guidance professor or department head. After the completion of each field of education, the results of the survey were analyzed and used as improvement data by surveying the expectations for education, overall education, new knowledge and skills acquisition, timing of implementation, instructor and lecture content, satisfaction with the educational environment, good points and improvement points.

3. Results

In order to improve the practical skills of R&D personnel majoring in nuclear engineering for nuclear safety research, six advanced courses have been developed for each field. The outline of each course is as follows.

Operation of Nuclear power plant provides specialized training throughout the operation of the nuclear power plant system using Compact nuclear simulator to improve the on-site practical performance. Probabilistic safety assessment fosters the ability to perform probabilistic safety assessments of virtual scenarios and interpret the results. Measurement and Evaluation of Individual radiation dose improves the individual radiation protection skills through exposure dose measurement and evaluation practice. Evaluation of Material aging in nuclear components fosters the practical ability of the site to cope with the deterioration of materials in the nuclear power plant environment.

Nuclear thermal hydraulics safety provides specialized education and training for safety of nuclear power plant systems using PC-based Nuclear reactor simulator to enhance understanding of nuclear power plant protection and control systems. Thermal hydraulics and Safety analysis of Advanced reactor is mastered by using GAMMA+ code, a safety analysis code of the

reactor system developed independently by the Korea Atomic Energy Research Institute.

Both textbook and questionnaire were newly organized for each curriculum. The duration of the education program is 3 to 5 days, regarding the schedule of individual curriculum. A total of 126 students from 13 universities participated from November 2018 to August 2019 in six courses (Table 1). The participants were 79 graduate students and 47 college students, with more than 60 percent of them being graduate students.

The analysis of the questionnaire received after completion of the course showed that the education satisfaction level is high in all fields. The average analysis of the results of the post-education curriculum by adding up the results of the survey results showed high educational satisfaction with 4.3 expected degree out of 5 points, 4.5 overall satisfaction, 4.6 new knowledge acquisition, 4.7 instructor and lecture content, and 4.5 educational environment, as shown in Figure 1. The difference between graduate students and college students in expected degree for the education was 4.4 and 4.3, overall satisfaction 4.5 and 4.4, new knowledge acquisition 4.6 and 4.5, instructor and lecture content 4.7 and 4.5, and educational environment were both high satisfaction in both groups. The higher level of educational satisfaction among graduate students confirmed that the development and operation of the practical training for nuclear safety research centered on graduate students were conducted well.

Table I: Operation Results for Nuclear Safety Research

Order	Curriculum	Training period	Completed students (persons)	Participation University (number)
1	Operation of Nuclear power plant	2018.11.05~09	11	6
		2019.02.11~15	9	4
		2019.02.18~22	10	5
2	Probabilistic safety assessment	2019.01.21~25	16	5
3	Measurement and Evaluation of Individual radiation dose	2019.01.28~ 02.01	23	5
4	Evaluation of Material aging in nuclear components	2019.07.01~05	16	6
5	Nuclear thermal hydraulics safety	2019.07.08~12	24	7
6	Thermal hydraulics and Safety analysis of Advanced reactor	2019.08.12~14	17	5
Total	8 courses	-	126	-

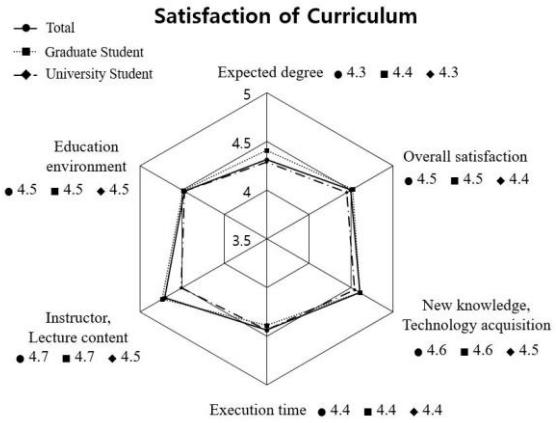

Fig. 1. Comparison of Educational Satisfaction between Graduate Students and University Students

4. Conclusions

We developed and operated six nuclear experiment training program using the national nuclear facilities available at KAERI. This hands-on experiment training

programs were considered to be effective based on the high satisfaction scores obtained. We expect that the students have valuable experience and broaden their view for future course through the program. We will modify and operate continuously for improvement of experiments and training courses of nuclear safety research. We will also enhance the education development regarding a new education courses.

In order to improve the professionalism of R&D personnel majoring in nuclear engineering, advanced practical training courses were developed for the first time. Graduate education is specialized and subdivided, so it was difficult to recruit students because it was difficult to properly inform graduate students in need of education. The introduction of experiment training program for Nuclear safety research at KAERI, which is provided free of charge to R&D personnel majoring in nuclear engineering who need on-site training through this study, is expected to greatly help foster nuclear safety research specialists with many students applying.

The hands-on training course for nuclear safety research, which is developed and operated for graduate students and university students in nuclear engineering, will expand the base of nuclear industry and research personnel and contribute to the active development of nuclear energy fields.

REFERENCES

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