

論 説

## Study on High School-Industry-College Collaboration: Focusing on Energy Education

Noriko IRIE (Environmental Design)

入 江 賀 子 (環境デザイン学科)

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### Abstract

Education through collaboration among universities, high schools, and industries is valuable and high-quality, as it would be based on both theory and application, enabling students to obtain various perspectives on the multiple stakeholders within society. However, such collaboration may face challenges in terms of ensuring stakeholders are in agreement regarding objectives and collaborative activities, and managing cumbersome administrative procedures. This study introduces a method of double collaboration between high school-college and industry-college while focusing on energy education and examines its significance and challenges.

### 要旨

高大連携や産学連携での教育は、理論と実践の両方に基づいた教育となる点や、学生が多様なステークホルダーの視点を学ぶことができる点で、質の高い貴重な教育となる。一方で、高大連携や産学連携は、関係者の意識合わせや事務作業の煩雑さの点の課題もある。この論文では、エネルギー教育のテーマでの、高大連携と産学連携のダブル連携の取組を紹介し、当該取組の重要性と課題について検討する。

## 1. Background and overview of high school-industry-college collaboration.

### 1.1 Background

High school-industry-college collaboration regarding energy education was initiated as a single industry-college collaboration. The collaboration was a part of project exercises implemented by the Faculty of Collaborative Regional Innovation, Ehime University along with Shikoku Electric Power Co. Inc. There was no precedent for collaborative activities between the faculty and the electricity company, and it was considered challenging.

Nonetheless, the possibility and merits of collaboration between the university and the electric company were discussed. Moreover, a strong interest was observed among students in the department to collaborate with the electric company on any topic, which accelerated the collaboration.

The collaboration was analyzed so that the third-year students, who had little expertise on any topic, could sufficiently engage with it within half a year

of starting the project. After assessing various possibilities, we noted that provision of education from university students to high-school students could be both probable and interesting. Thereafter, the idea of collaboration with an interested high school was explored, which altered the framework into high school-industry-university collaboration. Although the institutes were not finalized and the initiative was challenging, it was necessary to decide on an idea for collaborative activities. The themes of collaboration, repeatedly consulted among the three university students and the electric company, included "energy-mix", "supplying a stable electric power" and "advancing environmental preservation activities" in light of CSR and SDGs.

Then, the Institute for Collaborative Relations at Ehime University approached Misaki high school, an Ehime prefectural high school, for collaboration. The consultations among the high school, the electric power company, and the three students determined the collaborative activities, which would be a debate

on energy-mix among the high school's 55 first-year students moderated by the three university students. The content would include a discussion on future energy-mix. Although energy choice, which is indispensable for everyday life, is an important concern, information about its production, procurement, and merits and demerits of alternative energy choices may not be well known. Energy education to harness this knowledge is important and can be effective in educating high school students.

### 1.2 Overviews of the collaboration

The collaboration was undertaken from April to August in 2021 as part of project exercises for third-year students in the Faculty of Collaborative Regional Innovation. The content for the debate on energy-mix was complicated, and the three students moderators needed to have sufficient prior knowledge about the topic before the debate. Therefore, while students and the electric company closely examined the content and schedule, from April to July for about 10 hours, the three students learned about energy issues, taught by the electric company. Most of this pre-education was conducted through online video conferences due to COVID-19, but the university allowed some lectures to be provided face-to-face to improve students' incentives. The energy lessons taught to students from the company included the merits and demerits of various power production methods, professional knowledge regarding energy mix, and other energy issues. The interpretation of energy-related news and their discussions among the students and the electricity company further increased students' knowledge and interest in the subject. Moreover, they participated in a pre-debate to prepare for the possible problems that may arise during the debate.

Two pre-studies on general energy topics were also provided to high school students to participate in the debate sufficiently well. The three university students were the ice-breakers during the pre-studies to make them enjoyable. Finally, the energy-mix debate was conducted in the high school (Picture. 1). After the debate, high school students engaged in self-introspection, and an overall evaluation meeting was held.

### 1.3 Content and evaluation of the debate

The debate was conducted on July 14, 2021, with 55 first-year students from Misaki High School in



Picture. 1 Debate in the high school

three classrooms. The university students were moderators for the three classes, with one student assigned to each class. One person from the electric company was also present in each class. The high school students were divided into three groups with different types of electricity production methods. They discussed the merits of these methods and criticisms. They also defended their power production methods by rebutting the criticisms. When the debate did not proceed well because of insufficient information, students searched for relevant effective information using the Internet during the debate. The debate was completed within 100 minutes and voting was used to decide the most preferable electricity production method.

For an effective debate on energy-mix, several perspectives were needed. The pre-studies conducted by the electricity company for the three university students provided the necessary information or viewpoints regarding the amount of power generation, land area required for energy facility siting, stability of fuel procurement, amount of CO<sub>2</sub> emission, and facility costs of alternative power generation methods. These viewpoints were also shared with high school students to help them understand energy issues before conducting the debate. These perspectives can be difficult to comprehend for high school students and general adults, and pre-studies may not be sufficient in helping students understand such issues correctly; however, the students in the study seemed to learn that there were various types of energy production methods, each with various merits and demerits. A staff of Misaki high school later informed that the debate and collaboration with university students also stimulated the high school students. Moreover, the three university students found their

experiences studying and discussing with the power company, moderating the debate, and watching high school students' ardent participation as valuable. All three students participated in their initiative with a sense of responsibility until the end of the debate. The above-mentioned findings suggest that this collaborative activity provided a considerably favorable educational opportunity for high school and university students.

## 2. Discussion: Significance and challenges of collaboration

High school-industry-college collaboration has become an effective device for students' self-learning. Additionally, students can grasp practical and societal knowledge that is difficult to obtain through university lecturers, and which could be valuable for their future.

However, the collaboration also has challenges. First, it is difficult to ensure that institutes are in agreement regarding the objectives and collaborative activities and managing cumbersome administrative procedures, especially when the collaboration involves new themes and institutes. However, such collaborations would be most effective because they could provide fresh learning experiences and more findings. Collaborative activities with the same themes among the same institutes for multiple years would render fewer new findings; furthermore, the initiative could become mechanical, although there could be some gradual accumulation of knowledge and experiences.

However, ensuring an effective new collaboration is also challenging as collaborative aims and activities will need to be sufficiently well-defined from the outset. Each collaborative institute participates in activities with various aims, and the institutes usually take time to understand each other's aims. Moreover, after understating the collaborative aims among the institutes, deciding on collaborative themes is not easy as it requires trial and error, which needs additional time. There is a risk of the collaboration being unsuccessful, which should be accounted for at the outset.

Second, the adjustment of schedules among the collaborating institutes is difficult and cumbersome. In general, collaboration with many institutes would make the activities more effective, but

scheduling becomes more difficult and relevant office work increases. This may seem trivial but it can be a significant hurdle for the involved parties. The additional office work generated because of collaboration would further increase the burden on the collaborative staff, including teachers and lecturers in high schools and universities. Enhancement of support systems should be seriously considered to increase effective collaboration.

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