

# Brief measure for fostering manufacturing engineers with Universal Design mind

- Effect of special subsidiary company tour for engineering students -

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**Abstract.** Mature society of economy and welfare is any individual advocacy is generally accepted, along with movements for individualization. At this society, providing opportunities to learn techniques is important to support a person with disability for engineering students. In order to touch welfare situations for students, we thought some educational values of a special subsidiary company (SSC). The SSC employs not only many persons with disabilities but also experienced engineers, and has various universal design environments such as a barrier-free workspace environment especially for wheelchairs with no steps at the entrances, wide passages and elevators, modified workbenches to mention a few, and so on. To investigate educational values of SSC, we have decided to perform company tour for engineering students. As a result of questionnaire survey after company tour, students found the importance of universal design mind for engineers and educational values of the SSC. Then, the SSC is one possible way for growing universal design minded students.

**Keywords:** Educational Design for Engineers, Assistive Technology, Knowledge Management

## 1. Introduction

In an increasingly globalized world, we need to realize an inclusive society in which individuals can improve the ability and can demonstrate the ability. In order to persons with disabilities to demonstrate their abilities, it is necessary to implement systems to support them and fostering scientists and engineers in such fields as welfare and medical care. In the future the support and agency to technology for the functions impaired mind and body will become more diverse in need. By a support technology being used for such an individual treatment, it is hoped that it leads to the switch of the economic structure to the sustainable direction.

Therefore, we think that providing opportunities to learn techniques is important to support a person with disability for engineering students. As one of opportunities, an internship program in companies gives various experiences and identity construction to students. To educate an engineer with a universal and an inclusive design in mind, a special subsidiary company (SSC) is one of the best companies, because it employ not only many persons with disabilities but also experienced engineers, and has various universal design environments. The company is a practice unknown to other countries, and is unique to Japanese welfare system. We attempted to perform a company tour as an educational method to foster inclusively minded engineers.

"National Institute of Technology, Japan" called KOSSEN, is also unique educational organization which five-year engineering education from 15 years old students. In Japanese school system, the KOSEN covers high school level education and the first-two-years curriculum of the university. In order to provide high-quality early technical education, the students generally have equal or higher ability compared with university students. And then, it has two-year course where higher education in engineering is conducted. Most graduates in the course receive bachelor's degrees from the National Institution for Academic Degrees and University Evaluation. Having graduated from college, each alumnus started individually working at a company, or proceeding with two-year advanced courses program at college, or transferring to a university as a third-year student. In present, the number of graduates of engineering as whole higher education in Japan is about 390,000 included 51,000 KOSEN graduates by a year. We introduce in this paper the internship program with the company from a sixth grade student and consider its effect through several surveys of students.

In addition, the number of students studying in engineering fields in Japan is about 410,000 students within 51,000 KOSEN students. So, the KOSEN trains over ten percent engineers in Japan. Thus, the development of new engineering education method at KOSEN may

have an impact on university engineering education. In this report, we treat company tour of a special subsidiary as a pilot case to find an educational value of SSC and to encourage a universal design mind for students efficiently.

## 2. Special subsidiary company (SSC)

The special subsidiary company system was established to facilitate the hiring of handicapped people as one of unique Welfare Employment System of Japan since 1976. A company having more fifty employees is required to employ handicapped persons of more than 2.0 percent of whole employee by law. As an exception, when a company established its SSC considered for handicapped people, it can calculate employing them at the subsidiary as same employing in the whole parent company and corporate group. As of May 2015, there are 421 SSC in Japan.

A representative SSC, OMRON KYOTO TAIYO, which established as a joint venture company of OMRON Corporation and the Social Welfare Organization Japan Sun Industries in 1985. Japan Sun Industries has been providing jobs for people with disabilities since 1965. At the closing ceremony of the 1964 Tokyo Paralympics, Dr. Yutaka Nakamura was determined that "the days of giving charity were over and, from that moment, independence and active participation in society through employment were key". Japan Sun industries was established one year later at the 1964 Tokyo Paralympics and, since then, has continued to provide opportunities to people with disabilities.

OMRON KYOTO TAIYO has 167 employees of which 127 are disabled persons and produces industrial machinery products such as sockets, sensors, relays, health equipment and PLC power supply units. The situation of factory is shown in Table 1.

Table 1: The situation of factory

Floors	Contents	Items
3F	Production lines	Programmable controllers Health-care equipment Heat regulator accessories
2F	Manufacturing lines	Surface mountings Sensors
1F	Working areas	Switch accessories Sockets Sensor accessories Machine shop

And it fosters a barrier-free workspace environment especially for wheelchairs with no steps at the entrances, wide passages and elevators, and modified workbench

es to mention a few. Figure 1 and figure 2 show respectively a wide aisle for wheelchairs and an optimum workspace environment based on universal design. In addition, there is also an Engineering Division adapting each machine to compensate for lost physical functions of a worker. One of the universal support tools, bagging apparatus of sensor accessories, for a disability person developed by Engineering Division's engineer is shown in figure 3.



Figure 1: A barrier-free aisle environment



Figure 2: A optimum workspace environment



Figure 3: A bagging apparatus of sensor accessories

Most educational institutions have few resources with universal design environment and universal support tools, so a SSC is one of the best places to learn these resources.

### 3. Company tour and Questionnaire survey

To investigate educational values of OMRON KYOTO TAIYO, we have decided to perform an hour company tour for engineering students. And, we conducted a survey of 4 KOSEN students (fifth-grade man and woman (20 years old), second-grade advanced course two men (22 years old)) and 1 foreign student from Thailand (third-grade woman (24 years old)) for a short-term stay after the tour. In addition, fifth-grade students and a foreign student majored in Electronics and Information Science, and other second-grade advanced course students majored in Mechanical and Control Engineering.

The exit questionnaire was consist of 15 questions shown in table 2, and it was carried out in four point scale such as "Strongly agree", "Agree", "Disagree" and "Strongly disagree".

Table 2: Questions of questionnaire

No.	Contents
Q1	How much did you know special subsidiary company?
Q2	How much did you know a concept of universal design?
Q3	How much did you know a concept of inclusive design?
Q4	By factory tour, your understanding for employment of disability people has been expanded.
Q5	By factory tour, your perspective of disability has been changed.
Q6	By factory tour, you have enlarged your view.
Q7	By factory tour, you want to get a job with special subsidiary company in the future.
Q8	By factory tour, a special subsidiary company is one of your future job placements.
Q9	By factory tour, you want to develop welfare devices and support equipment in the future.
Q10	By factory tour, you want to do the internship in special subsidiary company in the future.
Q11	A tour of special subsidiary company helps engineer cultivation.
Q12	A tour of special subsidiary company helps learning of universal design mind.
Q13	A tour of special subsidiary company helps learning of inclusive design mind.
Q14	An internship in special subsidiary company helps engineer cultivation.
Q15	You want to be an able engineer in the future.

### 4. Results and Discussion

The result of questionnaire is shown in figure 4 as a bar graph. The vertical line shows the question number.

ers and the horizontal the degree of agreements in figure 3. The ninth questions are similar trends for all students except on Q1, Q2, Q3, Q7, Q8 and Q13 in figure 3.

In Q1 and Q3, each one shows most students didn't know a special subsidiary company and inclusive design mind respectively. Foreign student didn't know the term of universal design. It indicates the term of universal design is popular, but the one of inclusive design is not popular for students. However, most students learned not only universal design and inclusive design but also disability people and employment of them by SSC tour in Q4, Q5, Q12 and Q13. Then, they felt enlarged their view in Q6. In Q7 and Q8, They also liked SSC likewise. Furthermore, students have several cravings for developing some welfare devices or becoming engineers in Q9 and Q15. And, they want to try something new, as in order to gain experience as engineers. It indicates that they felt the educational value of SSC tour from Q11 to Q13. As a result, we found that SSC tour is one of the ways to learn universal design and inclusive design as engineer for students.

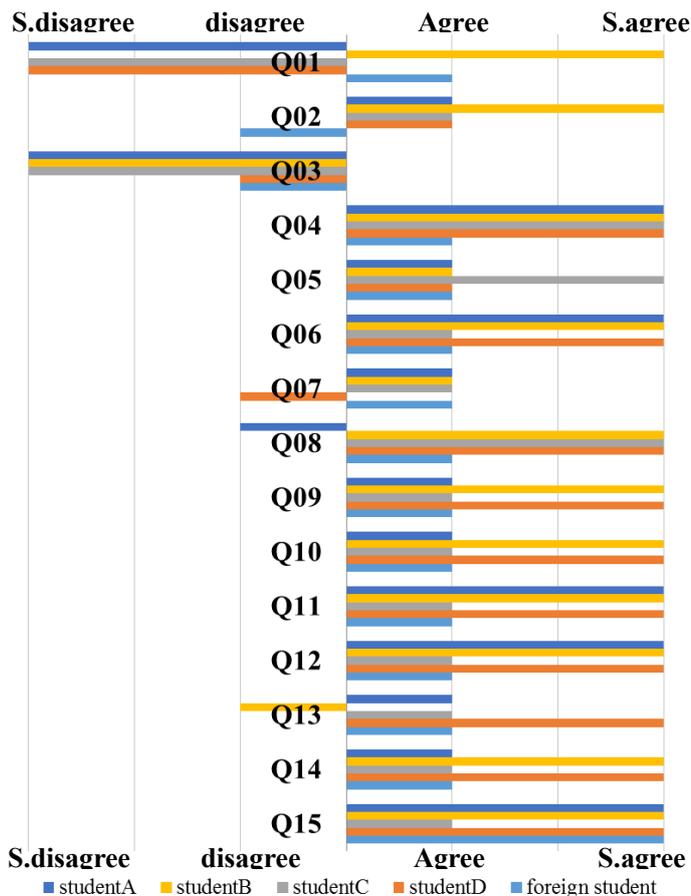


Figure 4: A result of questionnaire

## 5. Conclusions

To realize the “mature society”, especially including children with disabilities, it is very important to understand the concept of “inclusive society.” In order to touch welfare situations for students, we thought some educational values of a special subsidiary company (SSC).

We performed company tour of OMRON KYOTO TAIYO Co. Ltd. for engineering students to investigate educational values of SSC as a pilot case. As a result of questionnaire survey after the tour, students found the importance of universal design and inclusive design for engineers and educational values of the SSC. Then, the SSC is one possible way for growing universal design minded students. However, we have to tackle not only more holding tours but also developing a quantitative assessment method of the tour in cooperation with the SSCs.

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