An Experiment of Innovation Education in a Japanese University

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Abstract
A knowledge-based society is urging universities to change education. There are three factors to consider for this change: construction of knowledge, the power of groups, and design-based learning. Although East Asian students usually study hard to earn good scores in paper tests, their learning is often solitary and passive. This is a serious issue in a knowledge-based society where innovation requires inner motivation, engagement, and cooperation among peers. Seven professors decided to work together for four experimental innovation courses at Kanazawa University in 2019 to develop an innovative mind. This paper will discuss the first two of the four courses, how students changed, and their implications for the future of higher education. In the first course, the students learned communication skills through discussion and presentation, made a simple business proposal, and learned how to revise their ideas through the interaction with other students. In the second course, the students made an effort to put their ideas into reality by making prototypes with cardboard and Styrofoam. In this type of education, learning is different in three ways. First, students find their topics based on their curiosity and social needs. Second, they try to find solutions in groups with a series of exchanges with others. Third, they obtain knowledge and skills by themselves after fully understanding their necessities. Although this is a simple experiment, it is a beginning to transform learning at the university.

Keywords: Higher Education, Innovation, Design Thinking

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Introduction

Shown in the results of PISA and TIMSS, Japanese secondary education is famous for its achievements in STEM education (Table 1). This is a good aspect of Japanese secondary education. Nevertheless, according to the attitude survey of PISA, Japanese pupils like to study neither science nor mathematics in spite of their performance(Table 2). The same contradiction can be found among other East Asian countries. This is a puzzling issue for educational scholars outside East Asia.

Among educational scholars in East Asia, such a contradiction is considered to be understandable. There is a strong pressure to enter prestigious universities to lead a successful life in East Asia. Since universities require entrance examinations, education is often focused on the training for test-taking, which explains the great performance in international tests. It is a great system of coercion for study but often neglects the other purposes of education such as engagement, individual development, curiosity, communication skills, and collaboration (Freeman, Marginson, and Tyler 2015: 33-80).

	PISA(Math)	PISA(Science)	TIMSS(Math)	TIMSS(Science)
	15-Year-Old (2012)		8th Grade (2015)	
1	Shanghai	Shanghai	Singapore	Singapore
2	Singapore	Hong Kong	South Korea	Japan
3	Hong Kong	Singapore	Taiwan	Taiwan
4	Taiwan	Japan	Hong Kong	South Korea
5	South Korea	Finland	Japan	Slovenia

Table 1: International Tests

	TIMSS Do Not Like Learning Mathematics	TIMSS Do Not Like Learning Science
	8th Grade (2015)	
1	Croatia	South Korea
2	Taiwan	Taiwan
3	Belgium	Japan
4	Finland	Israel
5	South Korea	Australia

Table 2: Attitude Questionnaire

At this age of knowledge-based society, examination-focused education is detrimental. Paper tests usually accompany the memorization of knowledge, routine operations, coercion, orders from teachers, individual performance, and perfect answers. Those qualities correspond to the characteristics of the industrial age where hard work and precision of operations are valued, and do not meet the demands of the knowledge-based society which emphasizes knowledge construction, praise, inner motivation, engagement, group collaboration, and design (Thomas and Brown 2011).

Accordingly, the demands of industries to workers are changing. Companies are now asking for not only hard work and strict disciplines but also innovation skills such as motivation, engagement, collaboration, life-long learning, boundary-crossing, and

challenge. Furthermore, the organizational structure of corporations is also changing. The structure of companies used to be hierarchical and to divide workers into different units where communication between units is difficult. Currently, companies are introducing an agile development where different specialists work together in a small group and cover a wide range of tasks from product design through marketing. Since the boundary between different tasks is diminishing, the scope of workers is expanding, and they need to know design, customer needs, and costs regardless of their specializations.

Therefore, universities are urged to change their education to cope with the knowledge-based society. Japanese universities have a great tradition of senior thesis which gives undergraduate students research experience. There is, however, a great room for improvement for the lower division of undergraduate education which is dominantly one-way lecture. Currently, Project Based Learning, Student Project, and Internship are added to undergraduate curriculum, but most course works are intact.

Those are the backgrounds of this experiment. To transform the learning of students who are accustomed to memorization and individual study, the experiment emphasizes soft skills including engagement, inner motivation, and attitude. The experiment is a part of electives among general education courses. It intends to provide the basis for university education and life-long learning rather than specialization and innovation itself.

Body

In 2019, six professors and one professor from Kanazawa University of Art agreed to offer four courses for innovation education in Kanazawa University, Japan (Table 3). Kanazawa University is a regional national university which houses ten thousand students and one thousand faculty members. It is usually placed at the twentieth in university rankings, and the qualities of the students are well above the national average.

Quarter	Title	Instructors
1	Learning Design	Two Faculty Developers & Health Scientist
2	Creative Mind & Methods	Product Designer
3	Medical Innovation	Mechanical Engineer & Medical Doctor
4	Prototyping & Design Thinking	Electrical Engineer

Table 3 Course List

“Learning Design” focused on the development of soft skills. It started with self-introduction, the lecture on the necessity of the transformation from teaching to learning in education, and the multiple intelligent test to know themselves. The course was offered for six students in an active learning studio. The students worked in a group of three for discussion, presentation, concept mapping, feedback, and reflection. Although students hesitated to express themselves in the beginning, soon they became active in conversation and graphic presentation such as affinity diagram. For most students, it was their first time when they studied something without the

guidance of professors, expressed their opinions, and persuaded other students with logic and rhetoric.

One small project of this course is the proposal of a business plan. After the initial presentation, the students revised their ideas with the feedback from other students. Since this was a practice to present and revise ideas, the proposals themselves rather lacked originality and feasibility (Table 4).

#	Topic
1	Work Child Rearing Balance
2	Anti Food Loss Project
3	Mental Support for Children
4	Ride Share
5	Community Building with SNS
6	Smart Ring

Table 4: Business Plan

Figure 1 is the self -assessment of soft skills among six students before and after the course. Interestingly, the students thought that their soft skills were well-rounded in the beginning, but in the end, they felt that they did not have enough soft skills. This indicates that for most students, ideation, leadership, communication, and self-understanding were abstract ideas, but after a series of group works and communication, they fully understood that they were short in those skills.

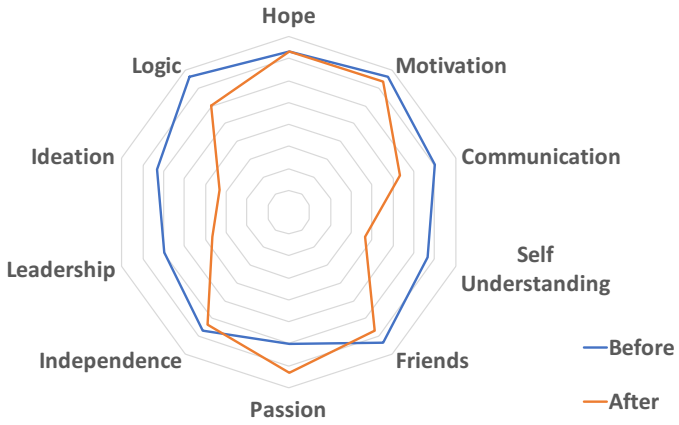

Figure 1: Self Evaluation

“Creative Mind & Methods” is a practice of design thinking which consists of empathize, define, ideate, prototype, and test (Figure 2). The students were divided into two groups of five and were given the topic: developing a product which carries out the task with one hand. One group chose to develop a cloth hanger, and the other group did a wrapping opener. To empathize, the students tried to hang a cloth or to unwrap a candy with one hand. Then they analyzed their observation to make a customer journey map which is a matrix of behavioral sequence, and emotion, thinking, and tasks. Based on the matrix, the students identified the location of problems, exchanged ideas, made prototypes with cardboard and styrofoam, and tested them. At the end of the course, the students made a presentation with their

products and received reviews. The role of the instructor was minimal. He left the class open for the trail and errors of students. The students worked spontaneously, were fascinated by prototyping, and felt a sense of achievement for their products. Making a product promotes communication and collaboration much more than abstract discussion. This type of prototyping requires no special knowledge and skills, however, it maximally drew the students' engagement The instructor commented that the enthusiasm of the students was no different from that of his art university.

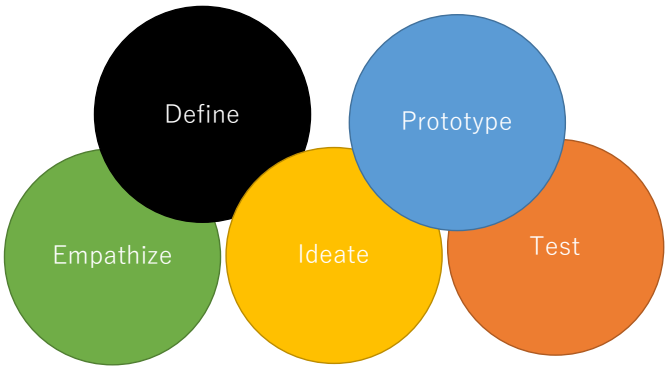

Figure 2: Process of Design Thinking

Conclusions

From the first two experiments of the innovation education at Kanazawa University, it can be said that the passive attitude toward learning and the weak communication skills of Japanese students can be improved significantly. The students simply do not have a chance to develop soft skills during their secondary education and higher education. Particularly, hands-on experiences are effective. All the universities have to do is to build active learning studios, to offer classes with small students, and to give faculty members a proper guidance for hands-on learning.

In most course works, students do not have enough chance to develop soft skills nor to pursue their originality. This is a serious problem at the age of knowledge-based society where originality is valued more than anything else. Along with research experience in senior thesis, Japanese university education should give more hands-on experience to students at an early stage of undergraduate education. These days, Project-Based Learning and student projects are gradually added to undergraduate curriculum, however, they often stand alone and lack a coordination with the system of specialization. There is a great room for interaction and engagement in Japanese higher education, both of which active learning is working on.

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