

IDENTIFYING ISSUES IN TEACHING THE PROBLEM-FINDING STAGE FACED BY INSTRUCTORS - A CASE STUDY ON SDGs CHALLENGE PROJECT IN HIGH SCHOOL

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ABSTRACT

The purpose of this study is to clarify the difficulties instructors from different subject disciplines faced during the problem-finding stage, especially during the 'Period for Inquiry-Based Cross-Disciplinary Study' ("spirit of inquiry" as verbatim meaning), when conducting the SDGs Challenge Project, a pilot programme using design thinking methods with Fukusho High School. Pre- and post-questionnaire surveys were conducted to clarify the challenges faced by instructors in identifying social issues and the issues related to support. Before the programme started, the instructors had major issues with the understanding of the SDGs, design thinking, and the overall progress. Once the project got started, it was realized that the presence of even more specific issues such as student communication, use of digital tools, and use of design thinking strategies such as the KJ method. The challenges in implementing the programme can be categorized into (1) understanding the educational process of using design thinking, (2) facilitating group work, (3) using educational tools, and (4) others. Issues (1) and (2) were particularly prevalent.

Keywords: SDGs, design process, design thinking, problem-finding

1 INTRODUCTION

We are commencing the 21st century and the world is already facing several challenges of social nature, for example racial discrimination, income inequality, forced migration, among many; others such as major environmental catastrophes originated in the (human influenced) instability of the climatic systems; or digital (deliberate) man-made risks such as information warfare in the form of information manipulation and disinformation, such as the so-called "fake news" or "alternative facts". These have generated massive social and economic changes, and in order to deal with them, it is necessary to develop a new breed of human resources who have the competence to understand and currently manage the only solution at hand, the Sustainable Development Goals (SDGs) [1] by proactively proposing solutions complementing the existing base of skills derived from conventional knowledge-oriented education.

According to the Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) revised courses of study for high school in 2018, the new "Period for Inquiry-Based Cross-Disciplinary Study" will be implemented in high schools in 2022 to foster the "zest for life" required by society [2]. Hence, students need to develop the qualities and abilities to better identify and solve problems while considering their own way of being and living through independent, interactive and deep learning.

According to the "Survey on High School Education Reform 2021" report conducted by Recruit College Preparatory Research Institute, 93% Fukusho High schools in Japan have introduced the "Period for Inquiry-Based Cross-Disciplinary Study" [3]. The main areas of focus for implementing the new curriculum guidelines are to enhance classes from the perspective of improving students' abilities to be independent and interactive deep learners and to think, judge, and express themselves, in addition to improve the instructors' ability to develop teaching materials and design lessons. While each school has

begun to work toward such quality learning, there are several studies [4] on teachers' concerns and lack of teaching methods.

The implementation of this “spirit of inquiry”, which fosters students to become active learners, is difficult to achieve only by improving educational methods in a localized manner and based on individual initiatives, on the contrary, it needs larger systemic changes related to the organizational theory of what kind of school should be built [5]. In order to implement inquiry-based learning compatible with the principles of Sustainable Development Goals (SDGs), it was suggested the need of an environment with appropriate evaluation methods, effective teacher assignments, and sufficient time for activities, as well as to provide information on how to promote inquiry activities [6].

As seen in the Governmental White Paper on Science and Technology (2013 edition) [7] and various government policies on science and technology innovation, the characteristics of design as a discipline that provides effective and efficient systematic tools and methods for generating innovation is gathering a lot attention at the moment of considering the candidates for developing new mechanisms of education. Design thinking is a way of thinking (processes systematization) that uses design concepts and methods to find solutions to arising problems and issues [8]. The main methodological structure is comprised of three steps: problem-finding, ideation, and realization. It has been adopted by Japanese companies since the early 2010s, following the trend from Europe and the United States. Currently, it is widely used in new market development, customer creation, and service and product development [9]. There is research done on the subject of using design to teach students about solving social problems [10] and incorporating design programmes into Japanese high school education to enhance awareness of SDGs, develop 21st century competencies (21CC), and social-emotional learning (SEL) [11]. However, there is still no research relevant to the difficulties faced by instructors in using design thinking methods for the new "Period for Inquiry-Based Cross-Disciplinary Study" that is to be implemented in 2022.

The Faculty of Design of Kyushu University established the SDGs Design Unit in April 2019. As members of the Design Unit, the authors of this academic document began an SDGs Challenge Project with Fukusho High School in 2019. The SDGs Challenge Project aims to nurture students' ability (develop design thinking) to identify and solve problems, work independently, think, judge, and express themselves while producing proposals with a strong and broad orientation toward society and its most pressing issues. The programme started with a small group of 17 students in 2019, following 50 students in 2020. In 2021, for the first time, the SDGs Challenge Project was adopted into the "Period for Inquiry-Based Cross-Disciplinary Study" for 314 third grade students with 27 teachers of various ages, for Japanese Language, Social Studies, and Art among the eight subjects included.

2 PURPOSE

Using Fukusho High School as a case study, this paper aims to clearly identify the difficulties teachers from different subject disciplines faced during the problem-finding stage when conducting the SDGs Challenge Project during the "Period for Inquiry-Based Cross-Disciplinary Study".

3 RESEARCH METHODOLOGY

3.1 Programme overview

The people involved in this programme were as follows:

Fukusho High School: 1 teacher-in-charge and 2 committee members. 27 teachers teaching the programme (5 Japanese Language, 2 Mathematics, 4 English Language, 5 Social Studies, 4 Science, 4 Health and Physical Education, 1 Art, 2 Home Economics)

Kyushu University, Faculty of Design: 4 members.

The programme was conducted from mid-April to mid-October 2021, with a total of 17 lessons. All lessons were conducted in a workshop format of 50 minutes, not including the introduction and presentation. There were 314 students involved, who were divided into 61 groups. Each teacher supported (as facilitators) 3 or 4 groups. In addition to the above mentioned three (macro) steps of Design Thinking, ‘Problem-finding’, ‘Ideation’ and ‘Realization’; ‘Sharing the problem findings and ‘Divergence and Convergence of Ideas’ were added between ‘Problem-finding’ and ‘Ideation’, and ‘Ideation’ and ‘Realization’, respectively.

3.2 Methodology

The research methodology used were pre-and post-questionnaire surveys with the instructors teaching the subjects.

There were two pre-questionnaire surveys conducted among the 27 instructors. The purpose of the first survey was to discover the instructors' level of understanding of the SDGs and Design Thinking concepts. Instructors were asked to rate their own level of understanding of SDGs and Design Thinking considering 5 levels, with level 1 as don't understand at all (not understanding SDGs' definition and concepts) and 5 as understanding very well (understanding SDGs' definition and concepts).

The purpose of the second survey was to determine the level of anxiety, concerns, and support needed to implement the subject. There were two questions asked. The first question was, - 'How anxious are you about teaching the General Inquiry?'-. Instructors were able to rate their anxiety level, with level 1 as not anxious, level 2 as a little anxious and level 3 as very anxious. The second question was, - 'What are your concerns in conducting the general inquiry lesson?'-. They were given 5 (multiple selection) options, "I did not understand the process of the project", "I did not know how to facilitate the discussion", "I am not confident in using Information and Communication Technology (ICT)", "I did not understand the SDGs", and "I did not know how to implement the lessons".

The pre-questionnaire surveys allowed the team to develop interventions to help the instructors. After each lesson, post-questionnaire surveys were conducted to find out the specific issues instructors faced in conducting each lesson. For this study, investigating the difficulties teachers met in the problem-finding stage, post-questionnaire surveys of 4 lessons related to problem-finding were used for analysis. The survey had open-ended questions for instructors to list the challenges they faced or state any comments or questions they had besides the ones provided by the question themselves.

4 RESEARCH FINDINGS

4.1 Results of pre-questionnaire surveys

The first pre-survey was conducted among 27 instructors, with 24 surveys completed. Instructors who rated themselves with level 1 and 2 are considered as having a low level of understanding. Teachers who rated themselves as level 4 and 5 are considered as having a high level of understanding. Of the 24 teachers who completed the survey, 16.7% had a high level of understanding of the SDGs, and 33.3% had a low level of understanding. Regarding design thinking, 8.3% of the instructors had a high level of understanding, and 83.3% had a low level of understanding.

The second pre-survey was given to 27 instructors, with 17 surveys completed. For the question -'How anxious are you about teaching the General Inquiry?'- Of the 17 instructors who completed the survey, 0% were not anxious, 65% indicated having a high level of anxiety, and 35% as having a little anxiety. For the question on -'What are your concerns in conducting the general inquiry lesson?'-. Of the 17 instructors who completed the survey, 29% did not understand the process of the project, 14% did not know how to facilitate discussions, 24% were not confident in using ICT, 12% did not understand SDGs, and 21% did not know how to implement the lessons.

4.2 Support system

Based on the results of the pre-questionnaire surveys, the Kyushu University Faculty of Design members and Fukusho High School committee members devised the following support system to address the instructors' concerns before implementing the programme. (Figure 1).

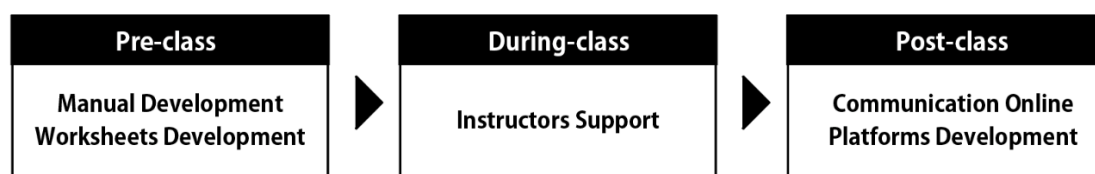


Figure 1. Support system

1. Developed an instructor's manual with relevant information such as the purpose of the SDGs Challenge Project, the design process, etc.
2. Designed worksheets for instructors' use in the lessons.

3. Fukusho High School committee members circulated around the classrooms providing assistance to the instructors during lessons.
4. Developed communication digital tools using online platforms such as Google Forms for instructors to share the issues faced, comments or questions after the lessons (post-questionnaire surveys), Google Jam board to share ideas between instructors and students, and Google Classrooms to communicate between instructors and students.

4.3 Post-questionnaire surveys analysis

There were a total of 35 issues, comments, or questions that surfaced after the 4 lessons related to problem-finding. These were sorted and compiled as shown in Table 1.

Table 1. Post-questionnaire surveys results

	Issues Faced	Issues count
1	Facilitation for problem-finding	8
	• Problem discovery (5)	
	• Problem definition (3)	
2	Facilitation for groups that progress at different speed	6
3	Motivating students	5
4	Promoting communication within the group	4
5	Using the KJ method	2
6	Explaining the lesson process to the class	2
7	Using digital tools	2
8	Using the worksheets	2
9	Understanding the content of the manual	1
10	Answering questions from students	1
11	When to give the homework assignments	1
12	Means to collect information	1

Table 1 shows that the highest response was the issue of facilitation for problem-finding. The instructors who responded to this issue explained that they faced challenges in facilitating problem discovery where students needed to expand on the theme to identify more problems. The students did not have enough experience or knowledge themselves, consequently, they could not empathize or discover other people's problems, e.g., the elderly, troubled family composition (divorced families), etc. In addition, some faced difficulties in facilitating the problem definition where students had to decide on a problem to attack based on its seriousness, that is to say, the hierarchy of the problem prioritization. The next high response issues, were the ones in which the instructors were not sure how to do facilitation among groups with different speeds, keep students motivated, and encouraging group discussions. The challenges in supporting teamwork are due to the differences in the students' understanding of the SDG education programme based on their personalities and communication skills.

5 DISCUSSIONS

For this programme, the curriculum is organized along the lines of the design thinking process, starting with 'Problem Finding', arguably the most fundamental stage and proportionally the most challenging one, it immediately set the tone of difficulty for the instructors. The analysis of the surveys shows that the major hurdles are as follows:

Prior to the programme start, the instructors had "strategic" (macro level) hurdles; major issues with the understanding of the SDGs, design thinking, and overall progress. As they proceeded, the realization of more "tactical" (micro level) issues set in, e.g., student communication, use of digital tools, and use of design thinking strategies such as the KJ method [12]. The challenges in implementing the programme can be categorized into (1) understanding the educational process of using design thinking, (2) facilitating group work, (3) using educational tools, and (4) others, as shown in Table 2. Issues (1) and (2) were particularly prevalent.

Table 2. Classification of the issue of facilitation for problem-finding

Issued faced	Classification of Issues
Facilitation for problem-finding	Understanding the educational process of using design thinking
Using the KJ method	
Explaining the lesson process to the class	
Answering questions from students	
Facilitation for groups that progress at	Facilitating group work
Motivating students	
Promoting communication within the group	
Using digital tools	Using educational tools
Using the worksheets	
Understanding the content of the manual	
When to give the homework assignments	Others
Means to collect information	

Most of the instructors reflected with respect to (the difficulty of) understanding the educational process and the incorporation of design thinking, particularly the problem-finding stage. From the findings, it is very clear the difficulties rely not only on the problem definition alone, but rather on the procedural aspects of the facilitation process itself. The cause of the difficulty might depend on the lack of understanding of the purpose of design thinking, thus leaving them (instructors) in the difficult position of not being able to explain the lesson process to the class nor competently using strategies such as the KJ method. Though an instructors' manual was developed in discussions with the Fukusho High School committee after the pre-questionnaire surveys (83.3% has a low understanding of Design Thinking), the lack of understanding of the manual's contents and guidance on how to put the manual into practice rendered this initiative mostly useless. The lack of a support system is considered the root cause of the problem.

The second type of challenge that many instructors responded to, is the facilitation of the group work. As a consequence, groups working at different speeds, lack of motivation, and poor communication between students in the group was evident. In high school education, most lessons are instructor centred. Communication is usually unidirectional. In this workshop-style class where student initiative is important, communication in both ways is fundamental, not many instructors are capable of handling this condition and find it difficult to overcome or at least catch up with years of "traditional" teaching.

The third type of issue that instructors face is using educational tools. The instructors' manual and worksheets were designed and prepared by the members of Kyushu University and the Fukusho High School instructor-in-charge and committee members. The 27 instructors who carried out the lesson were not involved in creating these materials. As such, they may not understand very well the materials provided. The other issue could be that the content in the manual may not be sufficient for the lesson to be efficiently and effectively carried out. Key points, examples, among others, could be added to make it more comprehensive. In addition, after distributing the instructors' manual, there is no opportunity to communicate (and gather relevant information) with the instructors to discover and shed light on their concerns and (or) questions.

6 CONCLUSIONS

The purpose of this study is to identify the difficulties instructors from different subject disciplines faced during the problem-finding stage when conducting the SDGs Challenge Project, a pilot programme using design thinking with Fukusho High School, during the "Period for Inquiry-Based Cross-Disciplinary Study".

There are issues that need to be addressed by the committee's instructors in charge, including (1) understanding the educational process of using design thinking, (2) facilitating group work, (3) using educational tools, and (4) others. In particular, issues (1) and (2) are shown more frequently. It was also found that instructors with a low understanding of the SDGs had more issues than those with high levels of understanding.

Based on the results of this study, more diverse support is needed in the future during discussions with Fukusho High school committee's instructors-in-charge and members. The following are some suggestions.

- Provide hands-on workshops for instructors to understand design thinking.
- Provide a variety of support tools other than manuals, such as instructional videos.
- Facilitate communication among instructors.
- Fukusho High School to nurture mentors within the high school.

In future research initiatives, in order to expand the gamut of possible solutions to other stages beyond the problem-finding one, it will be necessary to identify issues in the 'ideation' and 'realization' stages. In addition, it may also be necessary to pinpoint the characteristics of the instructors in relation to the issues faced. For example, will the length of teaching experiences or the different subject backgrounds of the instructors affect the kind of problems faced?

For this programme to be successful, it is also necessary to understand the effect of external factors such as the Japanese educational system in its entirety, and the level of digital literacy of the instructors, this last one a point of great relevance since the outbreak of the COVID-19 pandemic and the adoption of digital tools beyond common messaging system and information boards by schools in general. This sudden massive embrace caused major struggles in a generation of instructors who are for the most part (44% of the surveyed instructors) in their 50s or older and whose digital competence is not up to the current digital trends, especially those related to massive multi-communication live platforms such as Zoom, WEBEX, MIRO, among others. In addition, the mentoring necessary to level this digital illiteracy is not up to the demands of the current situation and the instructors are left to rely on each-other's basic, segmented, and limited comprehension.

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