

RESEARCH ON SUPPORT METHODS FOR HIGH SCHOOL TEACHERS EDUCATING SDGS WHILE UTILIZING DESIGN METHODS

Yanfang ZHANG¹, Christian CRUZ², Leon LOH¹, Moe SHIMOMURA¹ and Noriko TAKANO¹

¹Faculty of Design, Kyushu University, Japan

²Faculty of Global and Science Studies, Yamaguchi University, Japan

ABSTRACT

As society slowly moulds the planet into a sustainable world in response to natural disasters and social injustices, human resources must be fashioned to meet the new challenges that such a future requires. The Sustainable Development Goals (SDGs) are obstacles that nations strive to achieve, and it is necessary to teach younger citizens how to accomplish them. This study approaches this type of education in a novel manner by applying design thinking. An SDGs Challenge project took place in a high school with support from a university to identify problems in SDGs education, devise a strategic support plan to carry out this specialized education, and observe the effects of such an implementation all while using a design approach. It was found that there are specific issues that arise in inquiry-based learning that must also be addressed in a unique way. The support system created through the project showed instructing educators to utilize design thinking improved their abilities to teach students, and also improved students' output in identifying and solving SDGs related problems. The results show how much of an impact the design methodology can have on education and the positive implications for applying such teaching support methods in high schools worldwide.

Keywords: Design thinking, SDGs education, teaching support

1 INTRODUCTION

In order to respond to rapid changes in society and the economy, it is necessary to develop human resources who understand the SDGs [1], can proactively propose solutions, and obtain skills based on conventional knowledge-oriented education. To meet this “zest for life” required by society, Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) announced in their 2018 revised Courses of Study for High School, that the new “Period for Inquiry-Based Cross-Disciplinary Study” will be implemented in high schools by 2022 [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.

Currently the "Survey on High School Education Reform 2021" report conducted by Recruit College Preparatory Research Institute states that 93% of high schools in Japan have already introduced the "Period for Inquiry-Based Cross-Disciplinary Study"[3]. However, those in charge of the programme are deeply troubled in the face of the high demanding standards of “inquiry” [4]. It was suggested that in implementing inquiry-based learning with the SDGs, it is necessary to develop the environment, such as appropriate assessment methods, effective teacher assignments and time for activities, and to provide information on how to promote inquiry activities, to name a few of the concerns [5]. There is an urgent need for teachers to know how to support students in learning about the SDGs as the world moves towards global sustainability.

2 PURPOSE

The aim of this study is to propose a support method that will help teachers to solve the challenges they face in SDGs education for high school students by utilizing design thinking.

In 2021, Kyushu University, in partnership with Fukuoka Municipal Fukusho High School, conducted a study on SDGs education by implementing an “inquiry-based cross-disciplinary learning period” for high school seniors. Special attention was given to the problem-finding stage of this process and the difficulties faced by teachers placed in charge of this education programme were articulated. The findings from this case study are the basis of the support proposal.

3 RESEARCH METHODOLOGY

3.1 From the results of 2021 research

The SDGs Challenge Project of Japan Fukusho High School conducted in 2021 was used as a case study. A total of 27 high school teachers from various fields such as language, social studies, and art were instructed on SDGs education for third-year high school students. Teachers were given a questionnaire survey inquiring about difficulties in identifying social issues in this context and 314 students completed a feedback questionnaire survey.

The data collected showed most of the instructors reflected with respect to (the difficulty of) understanding the educational process and the incorporation of design thinking, particularly in 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 [6].

The second type of challenge that many instructors responded was to the facilitation of the group work; groups working at different speeds, lack of motivation, and poor communication between students in the group was evident.

3.2 Pre-questionnaire before the SDG education programme in 2022

Because teachers in charge of SDG education programmes in high schools may change every year, it was necessary to conduct a preliminary survey to find out how much design understanding teachers in charge have. In 2022, 27 teachers assigned to this programme from different disciplines such as math, social studies and physical education were asked in advance about their educational experience in design, their understanding of design thinking, and their confidence in facilitating group work. The results of the survey include answers from 24 of the 27 teachers. Only one of the 24 teachers had teaching experience in design. It was found that this teacher had an understanding of design thinking, while the other teachers had little or no understanding. Regarding their confidence in teaching group work, 18% of the teachers were found to be a little confident, while the others were not so confident. The results of the above two surveys were summarized and suggestions for support methods were collected to ensure that the 2022 SDG education programme would proceed smoothly.

4 PROPOSALS FOR SUPPORT METHOD

In response to the findings, it was found that support is needed for teachers' lack of understanding of design thinking and their lack of confidence in facilitating active teamwork activities. Addressing this issue directly by helping teachers solely at this stage cannot solve the overall problem. In order to be able to better support the students, an overall support structure is needed that is tailored to the educational process. Specifically, together with an education officer and an education supporter, a proposal for a support structure that includes who, when and how to support (Figure 1) was made. Apart from the education project actors Fukusho High School and Kyushu University, this support approach is also intended to incorporate other parties to fulfil the role of third-party evaluators. The idea is also to be able to support a high school in its entirety before, during, and after the educational programme in line with the educational curriculum of the high school.

Figure 1 displays the three stages of support proposed: a) before the programme, b) during the programme, and c) after the programme. The roles of the support system of Fukusho High School, Kyushu University and external supporters were identified. Fukusho High School will carry out educational activities. Kyushu University will utilize design thinking and provide overall support for educational activities. The external supporter will provide comments on the students' presentations.

Regarding the lack of understanding of the educational process incorporating design thinking, especially the difficulty of problem identification and facilitation of group work, the most effective method found to solve such difficulties in a short period of time is a workshop for teachers. Teachers are put in the same position as students; they experience the process of problem identification and problem solving and formulate their own solutions as to how to proceed with the class. Workshops for teachers require

both pre and post-workshops. These two workshops are conducted by teachers from Fukusho High School and Kyushu University together; A3 is a pre-workshop for teachers to understand design thinking, the SDG education process, and specific methods. This workshop can also be described as a mock class. C3 is a workshop after the end of the education programme, which is useful for evaluating the programme as a whole and organizing areas for improvement.

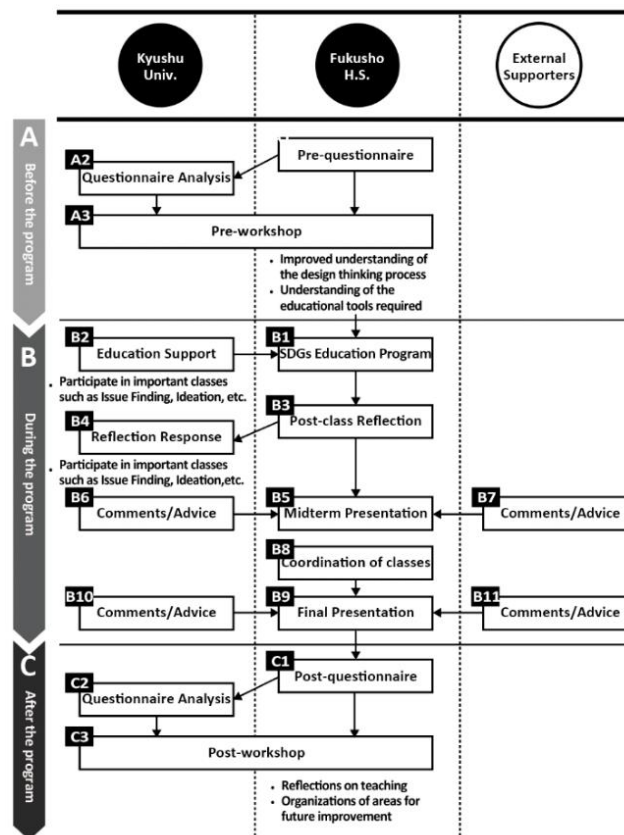


Figure 1. Support method for SDGs education

5 VERIFICATIONS

Questionnaire surveys and interviews of the teachers in charge of the programme were conducted after the classes. In addition, a questionnaire survey of 301 students who participated in this education programme was conducted to verify whether this support method was effective.

After the SDG education programme, the same questionnaire was given to teachers (17 teachers in 2021, 24 in 2022) who participated in the study. Figure 2 shows how responses compared between the years regarding educational outcomes.

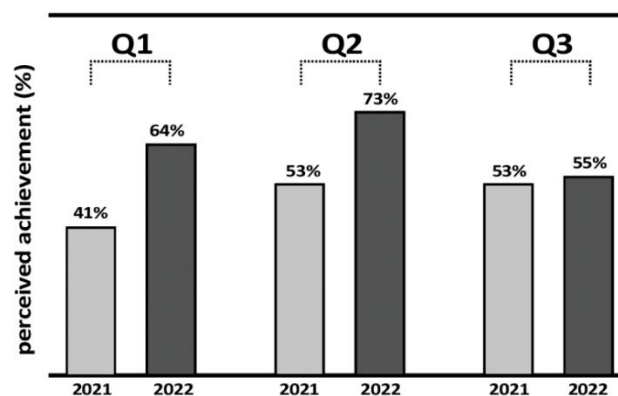


Figure 2. Post-questionnaire responses 2021 and 2022 after SDGs education training

Question 1 asked: How much do you think you have achieved in terms of “knowledge and skills?” Forty one percent of the teachers in 2021 responded *very good* and *good*. For the 22 teachers in charge in 2022, 64% responded *very good* and *good*. Question 2 asked: How much do you think you have achieved in terms of “thinking, judgement, and expression skills?” In 2021, 53% responded *very good* and *good*. In 2022, 73% of teachers perceived their achievements as *very good* to *excellent*. Question 3 asked: How much do you think you have achieved in terms of “ability to learn and exemplify human nature?” For the 2021, 53% responded *very good* and *good*. While for teachers in 2022, 55% responded *very good* and *good*.

The above results show that the perceived educational outcomes of the teachers in charge in 2022 were higher than in 2021. In particular, the improvement in educational outcomes was found to be greater with regard to “knowledge and skills” and “ability to think, judge and express.” The SDGs education training appears to have improved the understanding of design thinking of the 2022 teachers from 2021 and thus is reflected in their responses. Learning is conducted in stages, and it is easy to see the effect in terms of acquiring knowledge and skills first.

However, the application of design thinking appears to be ineffective in developing the “ability to think, judge and express.” This may be due to the idea that in contrast, human nature is based on complex content, so no significant results were seen this time.

6 CONCLUSIONS

Based on the validation results, the proposed support method (Figure 1) is considered to be effective. There are three important points in this support method.

1. This support method involves the participation of SDG education programmes and design specialists as supporters in addition to the educational cooperation partners Fukusho High School and Kyushu University. Involving outside parties in the interim and final presentations for the purpose of providing objective comments and advice on the students' proposals will have a positive impact on the teaching methods of the teachers in charge of the students.
2. A support system for the entire educational process before, during, and after the programme was created. It is very important to see in advance how the design thinking process will unfold in educational activities and to understand why such a methodology is necessary. It is also important to provide overall support so that after the class, educators can look back, clarify what is good and what needs to be improved, and create a good cycle that can be applied to the next class.
3. From a co-design perspective, Fukusho High School, Kyushu University, and outside supporters will cooperate to create a support system that facilitates teachers to conduct classes, so that even with various educational specialties and experiences, all teachers will be involved to ensure that the SDGs education programme proceeds smoothly. It is important to create a system that allows teachers to create tools according to their own needs in accordance with the educational process, practice them in class, and further improve them, whilst using the design method to create educational tools. A number of previous studies on SDG education methods and educational tools for high school students have discussed the importance of educational tools [7] [8].

In addition to the support structure diagram in Figure 1, the development of support tools according to the educational process was found to be very important in order to be able to better aid the students. We tried to create a support structure with educational tools as shown in Figure 3.

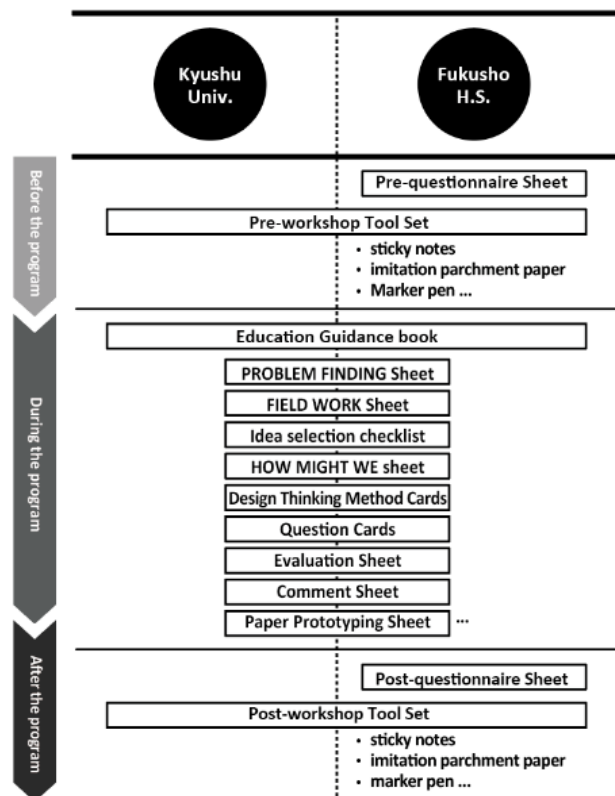


Figure 3. Support tools of SDGs education programme

Future research can be further developed with teachers on the SDGs education programme with the cooperation of Kyushu University and Fukusho High School, with a view to specific development methods for educational tools.

This research is aimed at high school educators in diverse areas working on social issues. As education on social issues such as the SDGs is promoted in the future, this study is significant because it contributes to the development of human resources who can proactively propose solutions by solving the issues identified by this study. This study proposes a creative method that creates a nexus between “design thinking” and the SDGs. In addition, the results can aid society by, for example, creating educational materials based on this support proposal to be available online freely, which can be used in other educational settings.

REFERENCES

- [1] United Nations, *The 17 goals*. Available: <https://sdgs.un.org/goals> [Accessed on 2022, 10 March], (2022) 17 February.
- [2] Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). *Period for Inquiry-Based Cross-Disciplinary Study*. Available: https://www.mext.go.jp/content/1407196_21_1_1_2.pdf [Accessed on 2021, 10 June], (2018) July.
- [3] Recruit College Preparatory Research Institute. *High School Education Reform 2021 report*. Available: http://souken.shingakunet.com/research/kaikaku2021_houkoku.pdf [Accessed on 2022, 14 March], (2021) June.
- [4] Mizuno M. Trends in Deep Learning in "Period for Inquiry-Based Cross-Disciplinary Study". *Tokai Gakuen University Educational Research Bulletin* No. 5, pp.86-95, 2019 August 2001, pp.283-290 (Professional Engineering Publishing, Bury St Edmunds).
- [5] Sugio K. and Miyaguni Y. An Analysis of Perceptions of the SDGs for Project-Based Learning: A Case Study on a High School. *Graduate School of Education, University of the Ryukyus Bulletin of Advanced Teaching Profession Practice (Graduate School for Teacher Education)* Vol.4 2020, pp.85 -95 <http://newmediamonthly.co.uk/2011/06/10/global-studio-brings-international-flavour-for-northumbria-design-students/> [Accessed on 2011, 10 July], (2011) 10 June.

- [6] Zhang Y. F., Loh W. L., Takano N., Shimomura M. and Cruz C. Identifying issues in teaching the problem-finding stage faced by instructors - a case study on SDGs Challenge project in high school. *Proceedings of the 23rd International conference on engineering and product design education(E&PDE)*. 2021.
- [7] Shimomura M., Loh W. L. and Zhang Y. F. Co-creation of Education Tools for SDGs Design School - Based on a Pilot Programme in Collaboration with Fukuoka Municipal Fukusho High School -. *Cocreationology*, Vol.4, No.1, P1-11, 2022.
- [8] Loh W.L., Shimomura M. and Zhang Y. F. Unlocking Creative Minds to Engage SDGs Through Design Education in Japanese High School. *Proceedings of the 22nd International conference on engineering and product design education(E&PDE)*. 2020.