

Designing Deliberative Learning for Sustainability Using the Nature Futures Framework: A Case Study in Secondary Education in Japan

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Research Overview

This study investigates the design and implementation of a deliberative learning program based on the Nature Futures Framework (NFF) in secondary education. It examines how scenario-based simulations and structured discussions support students' understanding of socio-ecological trade-offs and their engagement in future-oriented regional decision-making.

Purpose of Study

Achieving sustainable regional societies requires future-oriented decision-making processes grounded in local contexts. In this regard, fostering young people's capacity to participate in such decision-making can be considered a central goal of environmental education and Education for Sustainable Development (ESD). To address complex sustainability challenges, inquiry-based and place-based approaches have been widely adopted. For example, the authors previously developed and implemented a three-year educational program in a rural secondary school in Japan aimed at fostering local human resources for sustainable community development. A longitudinal questionnaire survey revealed significant improvements in students' understanding of sustainability and their awareness of regional issues (Yatagawa & Kurishima, 2025). In addition, the authors have implemented a "Future Mayor Workshop" for secondary school students and reported its outcomes (Yatagawa & Kurishima, 2023). However, these programs have not sufficiently addressed the complex socio-ecological trade-offs involved in future-oriented decision-making.

The Nature Futures Framework (NFF) conceptualizes relationships between people and nature through three interconnected perspectives: Nature for Nature, Nature for Society, and Nature as Culture (Pereira et al. (2020). By structuring alternative futures around these perspectives, NFF provides a pathway for learners to engage with multiple values and competing priorities in sustainability contexts.

This study aims to explore:

- (1) How a deliberative learning program based on NFF can be designed for secondary school students; and
- (2) Whether such a program enhances students' understanding of the values of nature and socio-ecological trade-offs.

Research Methods

This study was conducted on Sado Island, Japan, through the design and implementation of an educational program integrated into a "Future Mayor Workshop" for secondary school students. The workshop is structured around expert-based forecasts of regional futures for the year 2050. Based on these projections, students consider what actions should be taken in the present to shape desirable futures. They then develop policy proposals addressed to the current mayor from the perspective of future mayors in 2050. In this study, an NFF-

based component was incorporated into this workshop.

First, experts developed alternative regional policy scenarios focusing on abandoned farmland and forest management, based on the three NFF value perspectives. Future simulations were conducted to estimate environmental, economic, and social impacts of each scenario. Visualization materials, including radar charts, were created to clearly illustrate trade-offs and synergies among scenarios.

During the workshop, students were introduced to the regional context and NFF perspectives, and were guided in interpreting the simulation results. In 2025, students additionally engaged in structured small-group deliberations, comparing scenarios and discussing desirable future directions for their region. Facilitation emphasized logical reasoning, justification of choices, and consideration of multiple perspectives.

Educational effects were assessed using pre- and post-questionnaires measuring (1) conceptual understanding of nature's values, (2) recognition of value pluralism, and (3) engagement in discussions on future-oriented regional decision-making.

Results and Discussion

In 2024, 71.4% of students reported difficulty understanding the materials, indicating challenges in communicating complex socio-ecological relationships. In response, the 2025 program revised the materials by simplifying content, reducing information load, and introducing structured discussion time for each scenario. As a result, the proportion of students reporting difficulty decreased to 34.5%, while 44.8% reported that the content was not difficult. The proportion of students reporting an understanding of the values of nature increased from 44.8% before the program to 93.1% after participation. Recognition of value pluralism was strengthened for 96.6% of students.

Furthermore, 93.1% of students positively evaluated their participation in discussions on future-oriented regional decision-making, with 44.8% reporting very high levels of engagement. These findings suggest that the combination of simulation-based visualization and structured deliberation effectively supports students in understanding complex sustainability issues and engaging in value-based reasoning.

From an educational perspective, the results indicate that NFF can function as a learning framework that enables students to organize multiple perspectives and critically examine trade-offs inherent in sustainability challenges. The integration of expert-developed scenarios and participatory discussion appears particularly effective in bridging abstract sustainability concepts and concrete decision-making processes.

Future research will continue to explore and implement NFF-based educational programs in diverse contexts.

References

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Keywords

Nature Futures Framework; environmental education; workshop; socio-ecological trade-offs; secondary education