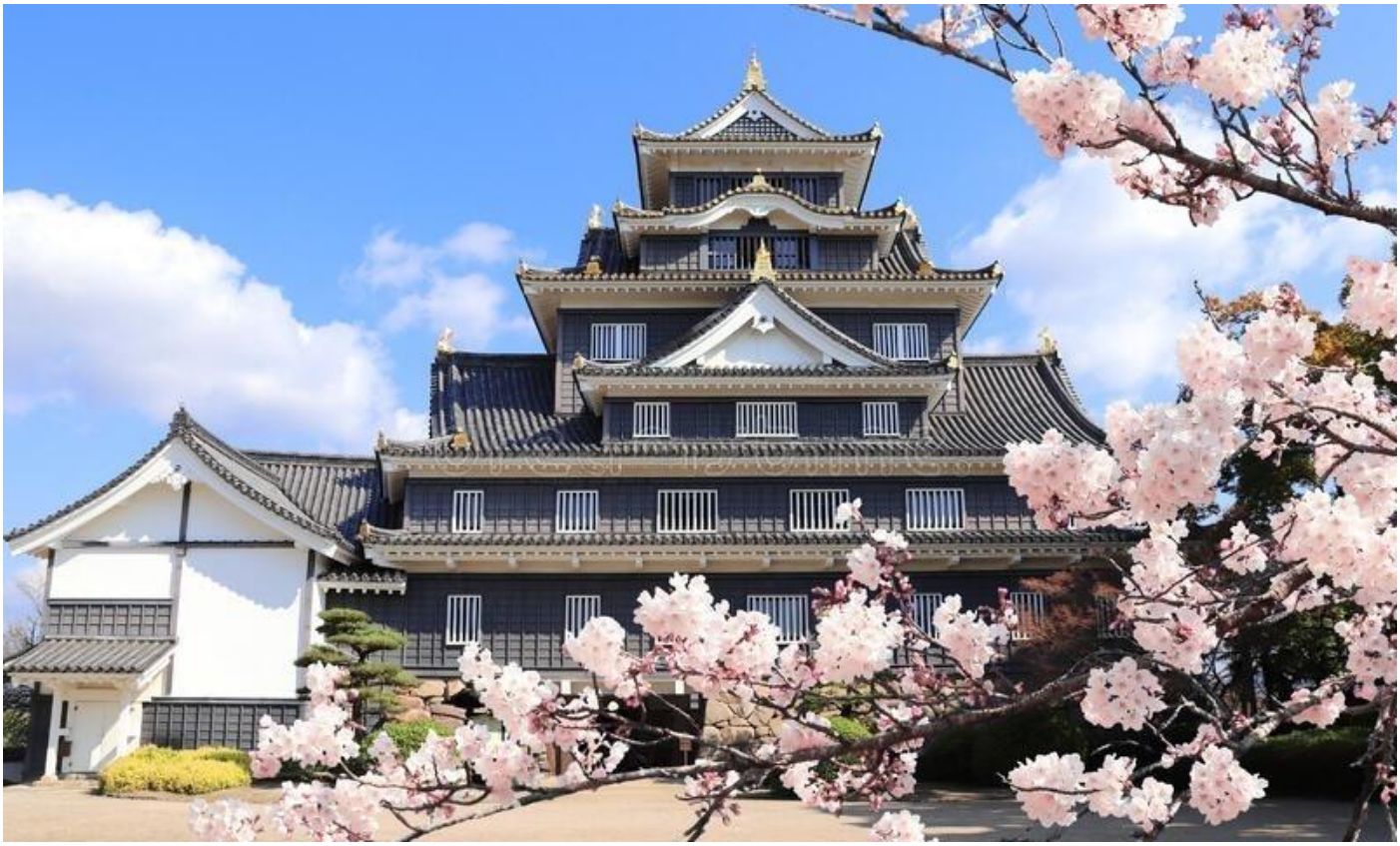
OKAYAMA UNIVERSITY

University of Ljubljana

Core-to-Core Programme Second Joint Seminar

Bridging Ideas Between Asia and Europe for Promoting Education for Sustainable Development in Higher Education



Co-organized by Okayama University, Japan and University of Ljubljana, Slovenia and Supported by Japan Society for the Promotion of Science (JSPS), Japan and Slovenian Research Agency (SRA), Slovenia

13-17 March 2023, Okayama, Japan

Seminar Book

JSPS Core-to-Core Program FY 2021-2024

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA IZOBRAŽEVANJE, ZNANOST IN ŠPORT

Welcome Message

Dear colleagues and guests,

We are delighted to welcome you to the second Joint Seminar of the Core-to-Core Programme "**Bridging ideas between Asia and Europe for Promoting Education for Sustainable Development in Higher Education."** This seminar is co-organized by Okayama University, Japan and University of Ljubljana, Slovenia, with the support of Japan Society for the Promotion of Science (JSPS), Japan, and Slovenian Research Agency (SRA), Slovenia. The seminar will take place at the Faculty of Education, Okayama University, from March 13th to 17th, 2023. We would like to extend a special welcome to colleagues to participate in this event.

The purpose of the seminar is to discuss recent progress in a whole-institution approach to ESD and to develop good examples of this approach to mainstream ESD in all aspects of teacher education institutions. We hope that the seminar will encourage international cooperation in this field and stimulate endeavors in Asia, Europe, and other regions.

We deeply appreciate your presence and contribution to this unique and memorable experience in Okayama, Japan.

Sincerely,

Hiroki Fujii, Ph.D.
Okayama University
Japanese Coordinator of the Core-to-Core Programme "Formation of Center of Excellence to Promote Teacher Education for ESD: Towards Achieving the SDGs"

Gregor Torkar, Ph.D
University of Ljubljana
Slovenian Coordinator of the Core-to-Core Programme "Formation of Centre of Excellence to Promote Teacher Education for ESD: Towards Achieving the SDGs"

Second Joint Seminar "Bridging Ideas between Asia and Europe for Promoting Eucation for Sustainable Development in Higher Education"
Co-organized by Okayama University, Japan and University of Ljubljana, Slovenia
Supported by Japan Society for the Promotion of Science (JSPS), Japan and Slovenian Research Agency (SRA), Slovenia
(Okayama, 14-17 March 2023)

General Information

1. Background

Education for Sustainable Development (ESD) occupies a prominent place in the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) adopted by the United Nations (UN). It is "a vital means of implementation for sustainable development" and "a key enabler" of all the SDGs, as affirmed by the UN General Assembly in its resolution 72/222. Educators including teachers have a crucial role to play in this global pursuit of sustainable development through education. As UNESCO's new ESD promotion measure "ESD for 2030" recognizes, educators are "key actors in facilitating learners' transition to sustainable ways of life." They can facilitate learning for sustainable development.

Recognizing the critical importance of educators in the SDGs, Okayama University, the only UNESCO Chair on ESD in Asia, launched the JSPS Core-to-Core Programme (Type B. Asia-Africa Science Platforms) (FY 2017-2019). It established core research exchange institutions for ESD teacher education and their academic network in Asia and contributed to building the capacities of the next generation of researchers. Subsequently, the University obtained a grant sponsored by the Japanese National Commission for UNESCO (FY 2018-2019), and it developed the "Asia-Pacific ESD Teacher Competency Framework" and a guide for effectively disseminating the framework in collaboration with 34 institutions in 16 countries across the Asia-Pacific region and with the support of UNESCO Bangkok and Asia-Pacific Cultural Centre for UNESCO. The framework currently comprises a programme guideline for developing ESD teacher education in the Asia-Pacific region and its research and educational achievements.

On the other hand, University of Ljubljana has participated in the UNESCO/UNITWIN Network in Education for Sustainable Lifestyles and conducted various researches for promoting teachers' ESD competency in collaboration with 27 institutions in 18 countries in Europe. An academic journal edited by the University published a special issue on "Sustainable Development in Education" and reported fruitful results of research and practice on ESD (see CEPS Journal, 3(1), 2013). The University has energetically developed teacher education for ESD through various activities, including incorporating ESD into existing teacher training programmes and courses, a green campus, and a student club on sustainability.

The whole-institution approach, directly linked to the institution's organizational culture and the leadership and management of students and faculty staffs, is the key to mainstreaming ESD in all aspects of teacher education institutions. This approach, however, has not advanced sufficiently in any teacher education institution worldwide, not just in Japan and Slovenia. As stated by UNESCO, achieving a breakthrough in mainstreaming ESD necessitates teacher education institutions to provide good examples of the whole-school approach.

2. Objectives

The overall goal is to organize an event that will promote the collaboration between Okayama University in Japan and University of Ljubljana in Slovenia, both of which have outstanding achievements in ESD teacher

education in Asia-Pacific and Europe, respectively, and to develop good examples of a whole-institution approach in ESD teacher education.

Specifically, the event is also aimed to achieve the following objectives:

- To better understand how to incorporate sustainability and ESD into all aspects of higher education institutions, particularly teacher education institutions.
- To report on progress in the development, implementation, and evaluation of teacher education programmes and courses that is a critical component of a whole-institution approach to ESD.
- To train young researchers on how to align their academic research with sustainability and ESD to ensure the approach's continued development.

3. Expected outputs

- Reports on the successes and lessons learned from integrating ESD into teacher education programmes and courses, including a framework of indicators for evaluating such integration.
- Sharing information between young researchers on their research and its alignment with the overarching theme of sustainability, ESD, and the whole-institution approach.
- Suggestions and recommendations for fostering environments conducive to transforming teacher education for sustainable development via a whole-institution approach.

4. Participants

The event will bring together approximately 50 participants onsite from Okayama University, University of Ljubljana, and other universities, as well as online participants from partner institutions in Asia, Europe, and other regions of these universities.

5. Time, venue, and programme overview

13 – 17 March 2023 at Okayama University, Okayama, Japan

Day 1: Opening ceremony, invited speeches, research presentations, meeting, workshop, welcome function

Day 2: Students' seminar, workshop, ESD Excursion

Day 3: School visit

Day 4: ESD excursion

Day 5: Meeting, closing ceremony

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Programme Schedule

University professors and graduate students from Asia and Europe who are interested in Education for Sustainable Development (ESD) in higher education, especially teacher education, will participate in this seminar either on-site or online.

Monday, 13 March 2023	
8:30 – 9:00	**Registration**
9:00 – 9:15	**Opening Ceremony** Room: 5101 Moderator: Hiroki Fujii (Okayama University, Japan) and Gregor Torkar (University of Ljubljana, Slovenia) Opening remark by Atsushi Takase (Dean, Faculty of Education, Okayama University, Japan) Opening remark by Janez Vogrinc (Dean, Faculty of Education, University of Ljubljana, Slovenia)
9:15 – 10:00	**Agenda 1: Invited speech** Room: 5101 Moderator: K. F. Ardh (Okayama University, Japan) **The University of Ljubljana on the way to sustainable development and a green environment** Janez Vogrinc & Matej Vošnjak (University of Ljubljana, Slovenia)
10:00 – 10:45	**The development and validation of an instrument for assessing science teacher competency to teach ESD** Ari Widodo & Eliyawati (Indonesia University of Education, Indonesia) online
10:45 – 11:15	Coffee Break

11:15 – 12:15	**Agenda 2: Research presentation** Room: 5101 Moderator: Stojan Kostanjevec (University of Ljubljana, Slovenia) **Developing preschool teachers' environmental education competences through DiSSI modules** Iztok Devetak (University of Ljubljana, Slovenia) **New programmes for ESD teacher education at Okayama University: From undergraduate to doctoral level** Hiroki Fujii (Okayama University, Japan)
12:15 – 13:45	Lunch
13:45 – 14:15	**Agenda 3: Signing ceremony** Floor: Dean's room *Professors will participate in the signing ceremony of the MOU between the Faculty of Education of Okayama University and the Faculty of Education of University of Ljubljana.*
14:15 – 15:00	**Agenda 4: Meeting for Professors** Floor: Dean's room *Professors will discuss the whole-institution approach to promoting ESD teacher education.*
15:00 – 15:15	Coffee Break
15:15 – 17:30	**Agenda 5 Workshop for all participants** Room: 219 Moderators: Taro Harada & K. F. Ardh (Okayama University, Japan) *Participants will enjoy botany experiments using familiar plants.*
19:00 –	**Welcome function (Japanese restaurant "Ryoutei")**
	Stay Okayama

Tuesday, 14 March 2023	
9:00 – 10:00	**Agenda 6: Students' seminar** Room: 5101 Moderator: Karen Onodera (Kyoto Koka Women's University, Japan) *Students will give brief introduction on their research and make poster presentations.* First session **Ocean Acidification: Integrating Sustainability into Secondary Science Education through Modified Textbook Experiments** Manato Ichii, K.F. Ardh, & Hiroki Fujii (Okayama University, Japan) **Tailoring Primary Science Lesson to Accommodate Children's Different Climate Awareness Profile** Yusuke Ookouchi, K.F. Ardh, & Hiroki Fujii (Okayama University, Japan) **Developing Environmental Literacy of Chemistry Teachers through Inquiry-based Learning in the Context of Hydrosphere Pollution** Luka Vinko & Iztok Devetak (University of Ljubljana, Slovenia) **The "Strongest" Invasive Alien Species: A Lesson Plan for Secondary School Science** Tetsuya Ida & K.F. Ardh (Okayama University, Japan) **Using Climate Action Simulation to Foster Future Thinking Competency Among Secondary School Students** Chihiro Kameyama, K.F. Ardh, & Hiroki Fujii (Okayama University, Japan) **Exploring the Use of Systems Thinking in Teaching Climate Change in Secondary School Science** Ruriko Kanai, K.F. Ardh, & Hiroki Fujii (Okayama University, Japan)
10:00 – 11:00	Second session **Methods and Issues in Evaluating Changes in Children's Thinking in a Law-Related Education Program Aimed at Developing Decision-Making Skills** Ayuha Miyamoto (Okayama University, Japan) **Developing Research Competence among Pre-service Teachers to Achieve Quality Education as one of the Sustainable Development Goals** Miha Matjašič & Janez Vogrinc (University of Ljubljana, Slovenia)

	Global Citizenship Education in University Service-Learning Curriculum: An Analysis of StFX Service-Learning in Canada Liu Xinyu (Okayama University, Japan) **Self-Assessment of the Components of the Study Process from the Perspective of Higher Education Students from Vulnerable Groups** Karmen Javornik & Milena Košak Babuder (University of Ljubljana, Slovenia) **Study on the Development of Global Citizenship through the Learning of the United Nations in Elementary School Social Studies** Yu Tsutsui (Okayama University, Japan)
11:00 – 12:00	Third session **Promoting System Thinking using Climate Change Education for Pre-Service Science Teacher Education Program in Mongolia** Dulguun Jargalsaikhan & Hiroki Fujii (Okayama University, Japan) **Contextualizing Muscle Training into Physics Lessons to Improve Students' Attitudes towards Physics** Takumi Shiba (Okayama University, Japan) **Elective Subject about Animal Species Diversity for Educators** Luka Praprotnik, Žan Rode, & Gregor Torkar (University of Ljubljana, Slovenia) **Plants, People, Planet: Development and Validation of a Sustainability-Oriented Botanical Module for Prospective Science Teachers** K. F. Ardh & Hiroki Fujii (Okayama University, Japan) **The Use of Folktales in Elementary School Science: Students' Perceptions of Folktales at the Teacher Training Stage** Karen Onodera (Kyoto Koka Women's University, Japan) & Hiroki Fujii (Okayama University, Japan)
12:00 – 13:30	Lunch
13:30 – 14:30	**Agenda 7: Students' workshop** Room: 5101 Moderator: Zhou Xingxing (Okayama University, Japan) *Participants will learn multi-cultural education through the workshop.*
14:30	Move to Okayama Korakuen Garden

15:30 –	**Agenda 8: ESD Excursion (1)** Participants will visit *Okayama Korakuen Garden* to learn about nature and history of Okayama.
	Stay Okayama
Wednesday, 15 March 2023	
7:45	Move to Kurayoshi, Tottori Prefecture
10:40 – 14:00	**Agenda 9: School Visit** *Participants will visit Kurayoshi-nishi junior secondary school in Tottori Prefecture on the Sea of Japan side and learn about community-based school activities.*
14:00 – 19:00	Move to Hiroshima after passing through *Daisen National Park*
	Stay Hiroshima
Thursday, 16 March 2023	
AM	**Agenda 10: ESD excursion (2)** *Participants will visit Hiroshima Peace Memorial Park and learn about peace education, a primary area of ESD.*
PM	**Agenda 11: ESD excursion (3)** *Participants will travel to Miyajima island, home of Itsukushima Shrine and Miyajima Aquarium, where they will learn about World Heritage education and biodiversity education, primary areas of ESD.*
	Stay Hiroshima
Friday, 17 March 2023	
7:45	Move to Kyoto
10:30 – 12:30	**Agenda 12: Meeting for Professors** Room: *Taishido*, Faculty of Child Education, Kyoto Koka Women's University *Professors will discuss further collaboration based on their experiences at this seminar.*
12:30-12:45	**Closing Ceremony** Room: *Taishido*, Faculty of Child Education, Kyoto Koka Women's University
	Stay Kyoto

Invited Speech

The University of Ljubljana on the Way to Sustainable Development and a Green Environment

Janez Vogrinc & Matej Vošnjak
Faculty of Education, University of Ljubljana, Slovenia

Our societies face many challenges in the economic, social and political fields, as well as concerns for the future of our planet. Universities also urgently need to respond to the challenges important for a sustainable future. The University of Ljubljana is trying to respond to the challenges of today's society by participating in the “Plan for recovery and resilience” project, which aims to reform the professional higher education study programmes towards a green and resilient transition and Society 5.0. The project also aims to develop students' competences for digital and green transformation. The changes are planned on three levels: content (renewal of the curriculum with the introduction of competences crucial for green and digital transition), normative (design of study programmes and sufficient number of enrolment places to the society's needs) and infrastructural (increased use of ICT, development of a sustainable and smart lecture hall, use of smart devices, etc.). The aim of the presentation is to describe the methodological plan for monitoring the implementation of the project and to present the current state of climate literacy, energy literacy, biodiversity and sustainable development literacy among pre-service teachers at the Faculty of Education, University of Ljubljana. In addition, students´ knowledge, attitudes and behavioural practices in these areas will be presented. The results show that the average achievement of pre-service teachers on items related to sustainable development, climate literacy, energy literacy, and biodiversity was 19%, 44%, 39%, and 56%, respectively. The average percentage of agreement with the statements related to attitude about sustainable development, climate literacy, energy literacy, and biodiversity was 81%, 73%, 73%, and 92%, respectively. The results provide an important insight into the knowledge and awareness of pre-service teachers at the Faculty of Education and shows the need to educate students in these areas to achieve green and resilient transition.

Keywords: green environment, sustainable development, climate literacy, energy literacy, biodiversity

Invited Speech

The Development and Validation of an Instrument for Assessing Science Teacher Competency to Teach ESD

Ari Widodo & Eliyawati
Faculty of Mathematics and Science Education, Indonesia University of Education, Indonesia

Promoting the implementation of education for sustainable development (ESD) in schools is necessary to educate future generations about sustainability. In cases where ESD is integrated into science lessons or ESD has to be taught by science teachers, science teachers have to integrate ESD teaching competencies with their science teaching competencies. The absence of an instrument to assess science teacher competencies to teach ESD makes it difficult for schools to assign the right science teacher to teach ESD or to support science teachers to integrate ESD into their lessons. This study aims to develop an instrument for measuring science teacher competencies to teach ESD. The instrument was developed by combining frameworks of science teacher competencies and ESD teacher competencies issued by several countries and ESD teacher competencies proposed by Okayama University ESD Promotion Center. A four-scale questionnaire comprising 96 statements was developed to assess seven competencies, i.e., content knowledge, content pedagogy, inquiry, professional practice, professional development, assessment and evaluation, and attitude. The instrument was tested on 234 science teachers nationwide, consisting of 166 females and 68 males from different schools, teaching years, and educational levels. The results show that the Cronbach's alpha of the instrument is 0.99 (very good category), person reliability 0.96 (good category), and item reliability 0.67 (fairly good category). Based on explanatory and confirmatory factor analysis, six competency dimensions are identified. The score of explanatory factor analysis based on Kaiser– Meyer–Olkin (KMO) was 0.966 and the significance on Bartlett's test of sphericity was 0.00. This means that there are significant correlations among the items. This suggests that the instrument is suitable to identify science teachers' competencies as indicators of their readiness to teach ESD.

Keywords: science teacher competencies, ESD teacher competencies, ESD, sustainability

Research Presentation

Developing Pre-school Teachers' Environmental Education Competences through DiSSI Modules

Iztok Devetak
Faculty of Education, University of Ljubljana, Slovenia

Current study program of pre-school education at University of Ljubljana, Faculty of Education does not comprise any courses with the emphasises on green transition, sustainable development and environmental literacy. In this 3-year-programme students had to select between different elective courses for 20 ECTS. For that reason, we decided to develop five elective courses devoted to the sustainable development education. The purpose of these courses is to develop of the pre- and in-service preschool teachers' competences in accordance with the guidelines of sustainable development and green transition that European commission stated as priorities for the next 10 years. In cooperation with other Faculties of University of Ljubljana we are developing five courses entitled (1) Aspects of natural sciences for sustainable development and green transition, (2) Aspects of social sciences for sustainable development and green transition, (3) Education and training for sustainable development and green transition, (4) Good practices for promoting sustainable development and green transition and (5) Practical education for sustainable development and green transition. The course with the most natural science content is developing following the principles of authentic science instruction with a given problem or scenario and inquiry-based science education (IBSE) approach. Therefore, the approach that was developed in ERASMUS+ project "Diversity in Science towards Social Inclusion – Non-formal Education in Science for Students' Diversity" (DiSSI), where DiSSI learning modules that include IBSE and the analysis of their impact on chemistry learning of lower and upper secondary school students was implemented also in development of elective courses. The purpose of this presentation is to illustrate how the "Environmental chemistry – water pollution" DiSSI learning module for teaching chemistry in the context of the IBSE approach in an in-formal educational settings for gifted students was developed and how some findings were used for the purposes of the pre-service and in-service pre-school teachers' elective courses development.

Keywords: pre-school teacher education, education for sustainable development, DiSSI modules, elective courses

Research Presentation

New Programmes for ESD Teacher Education at Okayama University: From Undergraduate to Doctoral Level

Hiroki Fujii
Okayama University, Japan

Education for Sustainable Development (ESD) occupies a prominent place in the 2030 Agenda for Sustainable Development and Sustainable Development Goals (SDGs) adopted by the United Nations in 2015. Indeed, ESD is integral to achieving all of the SDGs, as stated in the UN General Assembly's 72/222 resolution. Teachers play the important role in the global pursuit of ESD. In UNESCO's new ESD promotion measure, "ESD for 2030" (2020–2030), the expansion and development of ESD teacher education is emphasized as a priority action area. Recognizing the critical importance of teachers in the context of SDGs, Okayama University established ESD teacher education network in Asia and contributed to building capacities of the next generation of teachers. Subsequently, the University developed the "Asia-Pacific Framework of Teacher Education for ESD" and a guide for the effective dissemination of the framework in collaboration with 34 institutions in 16 countries across the Asia-Pacific region. The framework currently comprises a programme guideline for developing ESD teacher education in the Asia-Pacific region, as well as its research and educational achievements. Programmes for ESD teacher education at the undergraduate to doctoral level at Okayama University will be renewed starting in Fiscal Year 2023. First, a new education programme will launch at the undergraduate level, consisting of three sub-programmes: ESD/Education for the SDGs, STEAM/Creativity, and Psychological Data Science. This programme will offer a compulsory course "Learning for Sustainability" (first year, 2 credits) and "Creating Learning for Sustainability" (third year, 1 credit) for all undergraduate students. In addition, the ESD/Education for the SDGs sub-programme will train professionals to teach cross-curricular and integrated learning in schools. Second, at the master's level, the Master of Education programme will offer a compulsory course "Designing Learning Across Subjects and Disciplines (ESD)" (2 credits). Finally, at the doctoral level, a doctoral training programme specializing in ESD/GCED/Education for the SDGs was established two years ago, and training of ESD researchers has begun. The next generation of ESD researchers trained here will lead academic research and teacher education in ESD.

Keywords: ESD, GCED, Education for the SDGs, teacher education

Workshop for All Participants

Introduction to Botany Experiments for Science Education

Taro Harada & K.F. Ardh
Okayama University, Japan

1. Fast Plants

Fast Plants (*Brassica rapa*)[1] are well-known teaching materials used worldwide for hands-on plant science. Some researchers have made efforts to introduce the plants into Japan. Dr. Harada's former teachers translated an original English textbook about Fast Plants into Japanese, which has been referenced by many users of the plants in the country. Now a domestic distributer manages the official website for Japanese teachers.

<Activity>

(1) Watching short movies as an introduction to Fast Plants
(2) Observing the life cycle of Fast Plants at 3 days, 10 days, 17 days, and 24 days old.
(3) Pollinating with a "bee-stick" and observing pollens under the microscope.
(4) Confirming Mendel's law of segregation[2] by counting F_2 seedlings[3] with either a purple or green hypocotyl[4].

2. Plant Growth under Anoxia[5]

In general, a lack of oxygen (O_2) inhibits the growth of plants. However, some plants exhibit a high tolerance for low-oxygen stress and can grow anoxically.

<Activity>

Observing the seed germination of Fast Plants and rice (*Oryza sativa*), as well as the turion[6] elongation of pondweed (*Potamogeton distinctus*) incubated for 3 days under aerated[7] or anoxic conditions using a gas through-flow apparatus[8].

3. Carnation

Carnation (*Dianthus caryophyllus*) is one of the most significant commercial flowers globally. In Japan, it is very popular as a symbol of Mother's Day. Carnation has been studied as a model for flower senescence[9] caused by a gaseous plant hormone, ethylene (C_2H_2)[10]. With the availability of the plant's whole-genome information[11], carnation has become a model organism[12] for ornamental flower.

<Activity>

(1) Observing petal wilting[13] caused by ethylene and the effects of silver thiosulfate (STS)[14], an inhibitor of ethylene action[15].
(2) Observing of decelerated flower opening through modified atmosphere packaging (MAP)[16], and measuring the concentrations of ethylene, oxygen and carbon dioxide (CO_2) inside the bags.

BOTANY WORKSHOP GLOSSARY

1. Fast Plants - A type of *Brassica rapa* plant (field mustard) developed at the University of Wisconsin–Madison, in the United States of America, and used as a teaching material for plant science worldwide due to their short growth cycle and ease of cultivation.
2. Mendel's Law of Segregation states that genes separate randomly during reproduction, resulting in a 3:1 ratio of traits in offspring.
3. F_2 seedlings - The offspring of the F_1 plants, which are the first generation resulting from crossbreeding.
4. The hypocotyl is the stem of a plant embryo that connects the cotyledons (seed leaves) and the radicle (embryonic root).
5. Anoxia - A condition where there is a complete lack of oxygen.
6. Turion - A type of asexual bud found in some aquatic plants that allows them to survive harsh conditions by becoming dormant (inactive).
7. Aerated - Refers to a system or environment that contains oxygen or air.
8. Gas through-flow apparatus - An apparatus used to control the environment around plants or other organisms, where gases such as air and nitrogen are continuously flowed in and out.
9. Senescence - The natural aging process in plants or other living organisms.
10. Ethylene - A gaseous plant hormone that can cause leaf abscission (natural shedding), flower senescence, and fruit ripening.
11. Whole-genome information - Information about the complete set of genes in an organism, which can be useful for scientific research.
12. Model organism- a species that is widely studied in scientific research because it is easy to handle and reproduce quickly, providing insights into biological processes that are common to many other organisms
13. Petal wilting - A process where flower petals become limp and droopy.
14. Silver thiosulfate (STS) - A chemical compound used to inhibit cut flower senescence by blocking ethylene action. The STS helps to prevent the flower from wilting and keeps them looking fresh and vibrant for longer.
15. An inhibitor of ethylene action - A substance that can slow down or stop action (not biosynthesis) of ethylene in plants.
16. Modified atmosphere packaging (MAP) - A technique used to slow down the aging process of fruits and vegetables by controlling the concentrations of gases such as ethylene, oxygen, and carbon dioxide.

Ocean Acidification: Integrating Sustainability into Secondary Science Education through Modified Textbook Experiments

Manato Ichii, K.F. Ardh, & Hiroki Fujii
Okayama University, Japan

Introduction: This research proposal aims to address the lack of opportunities for students to apply problem-solving skills for socially relevant scientific problems in school. To achieve this, the study examines experiments related to chemistry in three Japanese junior high school science textbooks to identify opportunities to incorporate elements of sustainability. **Lesson Design:** "Acids and bases" is chosen as the subject matter, and a lesson plan titled "Is seawater acidic or basic?" will be developed to incorporate ESD and SSI elements. The lesson focuses on ocean acidification, its global impact, and the effects on marine life using actual seawater collected from different regions. **Future Direction:** The lesson will be designed for third-year secondary school students and will utilize tables and drawings to explain pH levels. Students will record the conditions of the place where the seawater was collected, including whether it was near an industrial area or a natural area. The lesson will highlight the correlation between pH levels and the environment, and students will be asked to consider the impact of human activity on the environment. Finally, teacher support is emphasized to ensure that students understand the concepts being taught. Teacher will be provided with clear data on seawater acidification, and guidance on how to conduct the experiment.

Keywords: junior high school science textbooks, sustainability, ocean acidification

Tailoring Primary Science Lesson to Accommodate Children's Different Climate Awareness Profile

Yuusuke Ookouchi, K.F. Ardh, & Hiroki Fujii
Okayama University, Japan

Introduction: Climate change is a major challenge facing the world, and educating children on their attitudes and concepts of climate change can have a significant impact on mitigation policy. The research proposal aims to tailor primary science lessons based on children's different climate awareness profiles. **Previous study:** A questionnaire survey was administered to 181 fifth- and sixth-grade students in Hiroshima Prefecture, which classified their conceptions of climate change into four clusters. **Future Direction:** The aim of this proposed research is to generalize the data obtained by expanding the survey to include elementary schools throughout Japan. The survey will be conducted among UNESCO Associated Schools to ensure a high response rate. The results will be used to analyze the characteristics of each cluster and develop climate change education appropriate for each one. This research will help in the development and implementation of climate change education lessons in primary schools.

Keywords: primary school science, primary school children, climate change education

Developing Environmental Literacy of Chemistry Teachers through Inquiry-based Learning in the Context of Hydrosphere Pollution

Luka Vinko & Iztok Devetak
Faculty of Education, University of Ljubljana, Slovenia

Due to the various environmental problems that we are dealing with as a society, it is very important to educate environmentally conscious individuals with appropriately developed environmental literacy. Chemistry teachers play a big role in this, as they directly address their students when teaching environmental content. In the education programs of future chemistry teachers, special emphasis should be placed on the development of their environmental literacy in combination with education for sustainable development. Our study will investigate environmental literacy (about hydrosphere) of 100 in-service teachers as well as development of environmental literacy (about hydrosphere) of 50 pre-service chemistry teachers. In doing so, the learning process will be actively pursued throughout the semester with a learning module (Moodle activity that will be developed in the first phase of the research and will include six different tasks about actual environmental problems in the context of hydrosphere pollution, all based on inquiry-based learning) and by measuring independent (individual interest, working memory capacity, formal-logical thinking...) and dependent variables (situational interest, environmental literacy). The research will be a combination of quantitative and qualitative research approach. Our data will consist of questionnaires, document analysis, and observations. It is expected that, based on the results of this research, it will be determined how environmentally literate are in-service chemistry teachers in the field of hydrosphere and what affects the development of environmental literacy, in the field of the hydrosphere, among pre-service chemistry teachers when using the inquiry-based learning approach. It can be expected that the completed research will contribute to the development of the profession in the field of chemistry and natural science didactics and to the improvement of practice in chemistry and natural science lessons. A new instrument for measuring environmental literacy in the field of hydrosphere will also be developed.

Keywords: hydrosphere pollution, environmental literacy, inquiry-based learning, pre-service teachers, in-service teachers

The “Strongest” Invasive Alien Species: A Lesson Plan for Secondary School Science

Tetsuya Ida & K.F. Ardh
Okayama University

Introduction: Invasive Alien Species (IAS) pose a serious threat to global biodiversity. However, public awareness and understanding of the issue remain low, hindering efforts to prevent their spread. Science education is recognized as a useful tool for improving public understanding and behavior change regarding IAS. Previous study found that a drawing activity for college students was effective in teaching in-depth knowledge about IAS. Aims and Methods: Building on this approach, a science class for junior high school students was designed and implemented to enhance their understanding of IAS. The lesson was divided into three parts: (1) ecosystems and their importance for biodiversity, (2) IAS and their negative impact on native ecosystems, and (3) imagining and drawing the "STRONGEST" invasive species. Results: Qualitative content analysis of the students' drawings of the "STRONGEST" invasive species revealed their knowledge and attitudes towards IAS and their impact on ecosystems. The majority of animal drawings depicted mammals, while the majority of plant drawings depicted flowering plants. Few animal drawings included reproductive features, whereas many plant drawings did. Additionally, a significant number of drawings in both the animal and plant groups included characteristics related to toxicity and other harmful traits of IAS. The paired-sample t-test revealed significant changes in negative perceptions of IAS and their impact on ecosystems, as well as understanding of the role of reproduction in contributing to invasiveness. Discussion: This study’s results highlight the effectiveness of interactive science education in improving public understanding of IAS. However, further education is needed to improve students' understanding of reproductive characteristics. Comprehensive programs on IAS are crucial for raising public awareness and preventing the spread of invasive species. Efforts to combat IAS should involve not only scientists and policymakers but also the general public, who can play an important role in preventing the introduction and spread of invasive species. By increasing public understanding and engagement, we can protect the world's biodiversity and ecosystems from the threats posed by IAS.

Keywords: invasive alien species, biodiversity education, secondary school science

Using Climate Action Simulation to Foster Future Thinking Competency among Secondary School Students

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Introduction: This research proposal focuses on exploring how science education can foster future thinking. The study is based on a previous research project that developed a lesson on climate change using simulation software called En-ROAD and worksheets. **Previous study:** The lesson was effective in promoting a future-oriented approach, and the study methodology involved measuring the effectiveness of the class through class content, questionnaires, and reflections. Using this research as a basis, the current study aims to investigate how science education can cultivate future thinking in seemingly unrelated units. **Future direction:** While the climate change unit was appropriate for clarifying future scenarios using software, the study will explore other units and their potential to foster future thinking. Additionally, the study will consider the possibility of developing further abilities by discussing specific measures for each item after the class. Overall, this research proposal seeks to explore ways of cultivating future thinking in science education. Keywords: Future thinking, climate action simulation, secondary school science.

Keywords: future thinking, climate action simulation, secodnary school science

Exploring the Use of Systems Thinking In Teaching Climate Change in Secondary School Science

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Introduction: The research proposal focuses on exploring the use of systems thinking in teaching climate change in secondary school science. UNESCO has identified eight key competencies for sustainability, and the systems thinking competency is one of them. **Aims and Methods:** The goal of the study is to develop lessons that foster this ability, which is highly valued in science education and can contribute to achieving goals 13, 14, and 15 of the SDGs. The research methodology involves creating and practicing a lesson on climate change that is not a knowledge-imparting class, but a class in which students can set their own tasks and work on activities independently. The research will collect information through questionnaire surveys and analyze the effects of the class. **Future Direction:** Two key points will be emphasized in creating the class: the System Thinking Hierarchical (STH) model and the eight emergent hierarchic characteristics of system thinking. The STH model suggests that it's necessary to understand the stages of the target students and conduct lessons according to their stages. The eight characteristics of systems thinking will be considered when creating the class, with a focus on the seventh characteristic. Finally, the study will need to define how much of the limited school education time should be spent on system thinking education, and how to define and measure "mastering system thinking."

Keywords: system thinking, geoscience education, secondary school

Methods and Issues in Evaluating Changes in Children's Thinking in a Law Related Education Program Aimed at Developing Decision-Making Skills

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This poster clarifies how the transformation of children's thinking is assessed in social studies and what the problems are. In decision-making learning, while progress has been made in developing programmes based on educational principles, the educational evaluation of such programmes has not yet been clarified in many cases. This poster refers to previous research on how to assess the transformation of thinking in Law-Related Education and then discusses the issues involved. Inoue (2018) examined the differences between the opinions of the self and others from the students' statements on worksheets and in discussions, and assessed the transformation into a self that acknowledges these differences and takes into account different positions. One of the issues with this assessment method is that it does not reveal a step-by-step thinking process. It is not possible to evaluate how the children's thinking changes in the process of transforming their position in forming their opinions from 'we' as those who simply know the location of the disaster prevention warehouse to 'we' as those who would use the warehouse in the event of a disaster. This evaluation method cannot be used to evaluate how children are changing their thinking. In order to solve this problem, the author will carry out research based on the following research. Firstly, the author will continue to analyze from the perspective of evaluation how children's development is being measured in decision-making learning. In addition, suggestions for evaluation research in social studies will be obtained. Based on this, the author will develop a Law-Related Education programme to see the transformation of children's thinking. Here, the emphasis is not so much on the educational principles as on the evaluation of how children's thinking is transformed by them. Specifically, the focus will be on value adjustment, the subject of my own research, and how children make standards for value adjustment. The content of the teaching materials will be based on the subject of sales contracts between individuals and will be developed in conjunction with consumer education and put into practice with high school students.

Keywords: law-related education, decision making, assessment method

Developing Research Competence among Pre-Service Teachers to Achieve Quality Education as one of the Sustainable Development Goals

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Developing research competence in pre-service teachers is a crucial step toward achieving quality education as one of the Sustainable Development Goals. Research competence refers to the ability to engage in systematic inquiry to gain new knowledge, insights, and solutions to problems. There are various definitions of research competence, but its basic elements are the set of research knowledge, research skills, and research attitude that the student has. Research competence is vital for promoting lifelong learning among pre-service teachers. They will be better equipped to adapt to changing teaching methods and technologies and, more importantly, to develop their skills and knowledge throughout their careers. As a result, we can improve the quality of education in the long term, which is essential for achieving the Sustainable Development Goal of providing equitable, inclusive and quality education for all. The purpose of this study was to measure the perceived development of research competence of pre-service teachers at the beginning of the master study programme who had not received a research training (group 1) and compare it to the perceived development of research competence of pre-service teachers who had completed a research course (i.e., had received research training) (group 2).. The results revealed that there was a statistically significant difference in the perceived developed research competence of the two groups. The mean value of perceived research competence of group 1 was significantly lower than the mean value of perceived research competence of group 2. The results of this study suggest that research training in teacher education programs develops perceived research competence and therefore plays a crucial role in achieving quality education as one of the Sustainable Development Goals.

Keywords: research competence, pre-service teachers, quality education, sustainable development goals, lifelong learning

Global Citizenship Education in University Service-Learning Curriculum: An Analysis of StFX Service-Learning in Canada

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Global Citizenship Education (GCED) as a transformative education framework that emphasizes the cultivation of learners to be aware of the wider world and their role in the world, to respect and value diversity, to commit to social justice, to participate in local and global efforts, to work towards equitable and sustainable peace, and to be responsible for their own action. In order to provide students such global perspective and experiences, service-learning is a particularly effective curricular method which reflecting on the service activity in such a way as to gain further understanding of course content. As well as gain a broader appreciation of courses, and an enhanced sense of personal values and civic responsibility. The National Council for social studies in Canada affirms that students who participate in service-learning are more likely to be committed to improving society and working within the democratic process. St. Francis Xavier University (StFX) was the first university in Canada to develop service-learning as an academic based, experiential learning program for undergraduate students. There are two kind of programs weeks, and local Course Based Service Learning (CBSL): promotes student service placements in the local community that complement academic assignments to enrich classroom learning. In Japan, private universities represented by International Christian University (ICU) are also developing service-learning curriculum. ICU, for example, offers Community Service-Learning, International Service-Learning and JSSL programs for its students. In contrast, many NPO organizations or universities without service-learning curriculum are also actively launching experience activities which related to service learning. For example, the PBL curriculum of Okayama University. The purpose of this presentation is to compare the situation of service-learning in Canada and Japan, and to identify what qualifications and abilities are being developed for students in service-learning.

Keywords: Global Citizenship Education service-learning

Self-Assessment of the Components of the Study Process from the Perspective of Higher Education Students from Vulnerable Groups

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Inclusion in education is a commitment that is part of Sustainable Development Goal (SDG) 4. It is a key principle and process that promotes inclusion, participation, and optimal educational outcomes for individuals at all levels of the education system, and thus their successful integration into the broader and narrower community (UNESCO, 2021). In higher education (HE), there is an increasing emphasis on inclusion and respect for diversity, opening new pathways and opportunities for all those willing and interested in studying, and significantly improving their employment prospects. Across Europe, the number of students enrolled at HE has grown significantly, and the number of students from vulnerable groups is also increasing. In our study, involving 93 HE students studying in Slovenia, we focused on two groups of vulnerable students: Students with dyslexia and students whose mother tongue is not Slovenian. Using a four-point rating scale based on self-assessment of the components of the study process, we found, among other things, that students with dyslexia had statistically significantly higher level of problems than students without dyslexia in the components related to taking notes and listening to lectures at the same time, the amount of study literature, completing administrative procedures properly, seeking help and support and having their individuality understood and considered by study colleagues. Students whose mother tongue is not Slovenian have statistically significantly higher level of problems than those for whom this is not the case in the communication-related components, such as presenting content in public, taking oral exams or preliminary exams, and communicating with HE teachers. In the context of inclusion, it is crucial to ensure equal opportunities for all students and to pay special attention to those who belong to vulnerable groups in order to enable them to participate fully and actively in all aspects of life.

UNESCO. (2021). *Global Education Monitoring Report 2021 – Central and Eastern Europe, the Caucasus and Central Asia – Inclusion and education: All means all*. UNESCO.

Keywords: components of the study process, HE students whose mother tongue is not Slovenian, HE students with dyslexia, inclusion

Study on the Development of Global Citizenship through the Learning of the United Nations In Elementary School Social Studies

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The pandemic of the Corona disaster has made the problems of the world more visible, including conflicts between countries, human rights issues, and sustainability. These are issues that the international community should work together and the United Nations, aiming for peace and development of the world, plays an important role in its efforts. In light of these circumstances, it is increasingly important to learn about the United Nations and to develop the qualities as a global citizen who can take responsibility for thinking and taking action on the world's challenges (global-citizenship), below. However, the current problems with education about the United Nations include: (1) education centered only on understanding knowledge of the United Nations; (2) learning content that deviates from the actual efforts of the United Nations, which focuses on conflict resolution (not including modern issues such as human rights and sustainability) and (3) It is difficult for students to connect their learning contents to their own lives only through outlining learning about the United Nations(Yatabe 2000). This situation of the education about the United Nations is the challenge that must be overcome in order to realize the development of the global-citizenship. Based on this awareness of the problem, this study aims to clarify the structure of classes for United Nations study aimed at fostering global citizenship. In addition, I am going to develop a specific class unit and verify its educational effectiveness. The qualities to be developed in social studies must be developed through continuous learning consistently with elementary, junior high and high schools. And the study at the elementary school stage, which is the foundation for developing the qualities, is important. Therefore, in this study, the unit to be developed is positioned as an elementary school social studies department.

Keywords: Global-citizenship, the United Nations

Promoting System Thinking using Climate Change Education for Pre-service Science Teacher Education Program in Mongolia

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At present, climate change is the most urgent problem facing all mankind. The task of educational practitioners is to arouse their attention to climate change issues through climate change education for students and teachers and take active actions to respond to and deal with climate change problems at the same time. Climate change is currently the most pressing issue facing all of humanity. Educators' role is to educate students and teachers on climate change to raise their awareness of climate change, respond to climate change, and take proactive measures to solve it. The ATECCE project is expanding the concept of climate change education in the Asian region and developing the educational challenge. Our research is aimed at the students at the Mongolian National University of Mongolia, which is the main teacher training institution in Mongolia. The results of the 6-week program for pre-service science teacher students at the NUM will be presented. This program integrates systems thinking-based sustainable development education, including key themes of climate change, and teacher competencies. Before the start of the training, students were asked a sample questionnaire and focus group interview to determine their level of knowledge. The questionnaire included questions and feedback to determine students' knowledge and skills about climate change. As a result of the survey, it was clear that there is an urgent need for education and training on climate change. Then, to develop the basic knowledge of climate change education, we planned the main content training activities such as energy conversion, circulation of carbon-nitrogen, food chain, ecosystem, and carbon dioxide. We present the current results of our developed training programs and activities.

Keywords: system thinking, climate change, science teacher competency, ESD teacher competency

Contextualizing Muscle Training into Physics Lessons to Improve Students' Attitudes towards Physics

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Introduction: Japanese students are generally uninterested in physics despite ranking high in scientific literacy survey. The probable cause of the disinterest is a lack of connection between the physics education and their daily lives. A Context-Based Physics (CBP) that emphasizes "concepts and process skills in real-world contexts that are relevant to student", is a possible solution. **Aims and Methods:** In this study, we develop CBP lessons for high school students and determine whether CBP improves students' attitudes toward physics. This study was conducted from late October to early November 2022. 24 second-year students at a public high school in Okayama Prefecture participated in the lessons. The lessons were implemented as the part of the "Rigid Body Equilibrium" unit for four hours each. Questionnaire surveys were administered at the beginning of the first lesson and at the end of the fourth lesson. The questionnaires were answered on a Likert scale (1-4). The questionnaire items were consisted of five factors. Intervention Lesson: In this study, we developed a lesson using muscle training as a context in the high school physics unit "Rigid Body Equilibrium". Each lesson lasted 45 minutes for a total of four periods. A paired t-test was run on the responses to the pre- and post-survey to see whether the lessons had an impact on the students' views toward physics. **Results:** When compared to the mean values prior to the lessons, the mean values for the "Enjoyment in learning" and "Instrumental motivation" variables were significantly greater after the lessons. The mean values increased for the other factors, but there were no statistically significant differences. **Discussion:** Students' attitudes toward physics were enhanced by the CBP lessons using the context of muscle training that was established in this study. Not all of the variables, though, indicated a change in attitude. We think that studying physics in a variety of settings in additional units might be necessary. Also, this study did not look into how CBP affected other facets of students' attitudes. So, it is essential to assess the lessons from a variety of angles, including the effects of learning. Future plans include developing lessons for different units and contexts based on the study's findings and conducting more thorough evaluations of CBP lessons.

Keywords: muscle training, context-based physics, students' attitudes towards physics

Elective Subject about Animal Species Diversity for Educators

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New elective subject entitled Children in the Animal Kingdom (4 ECTS) for university students of various study programmes was introduced in study year 2021-22 at the University of Ljubljana's Faculty of Education in order to promote biodiversity education, which is a very important aspect in reaching the Agenda 2030 for Sustainable Development, Sustainable Development Goals (SDGs) and targets of the Convention on Biological Diversity's Kunming–Montreal Global Biodiversity Framework. Participating students (n=17) were asked to rate their situational interest (9 items on a 5-point Likert scale) after five different workshops, and also to rate which SDGs they are developing in the courses. From the data collected, it can be highlighted that the students' interest in the topics is very high (M = 4.65, SD = 0.01). Students considered the topics important and were also satisfied with the presentation style. The SDGs most frequently mentioned (by more than one-third of participants) were: SDG 4 - Quality Education, SDG 13 - Climate Action, SDG 14 - Life Below Water, and SDG 15 - Life on Land. This was to be expected, as the topics directly relate to animal species, their habitats and general biology, as well as the teaching of knowledge about and attitudes towards animals in schools and kindergartens – thus ensuring quality education.

Keywords: elective subjects, SDGs, situational interest, biodiversity

Plants, People, Planet: Development and Validation of a Sustainability-Oriented Botanical Module for Prospective Science Teachers

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Introduction: Plant conservation is often overlooked in favor of animal conservation, despite the critical role plants play in supporting life on our planet. This is partly due to plant blindness, which is the tendency to undervalue the importance of plants in our environment. Plant blindness contributes to this disparity and hinders attainment of the Sustainable Development Goals (SDGs). Therefore, it is crucial for teacher education programs to prioritize raising awareness of plant blindness and the importance of plant conservation. **Aims and Methods:** This study evaluated the effectiveness of a botanical module in preventing plant blindness and fostering plant awareness among undergraduate students (N=91) in a science teacher education program in Indonesia. The module was developed based on the concept of "Plants, People, Planet," which is an interdisciplinary concept that recognizes the centrality of plant in sustainability. The study used a quasi-experimental sequential research design and mixes quantitative and qualitative data collection and analysis. Results: The analysis of reflective journals revealed that participants had active engagement and a positive response to the module. The survey results indicated that the module had a small effect (Cohen's d=0.277 and 0.274, p=0.005) on attention and attitude but a large effect (Cohen's d=0.700 and 1.309 p<0.001) on relative interest and self-efficacy to teach about plant, which are components of plant awareness index. The focus group interview provided valuable information that participants found narrative-based learning, the Socratic method, and reflective journaling, some features of the developed module as useful pedagogical tools that helped them during the course of the module implementation. Limitation and implications: Despite the study's limitations in sample size and timeframe, the study highlights the effectiveness of the developed sustainability-oriented botanical module in preventing plant blindness. This emphasizes the importance of incorporating similar approaches into teacher education programs, which could have far-reaching implications for plant conservation and the sustainable development.

Keywords: science teacher education, sustainability-oriented botany, plant blindness

The Use of Folktales in Elementary School Science: Students' Perceptions of Folktales at the Teacher Training Stage

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Today, in science education and Education for Sustainable Development, students are required to develop ideas about the coexistence between nature and humans to create a sustainable society. In the field of Place-Based Education, it is stated that to build a relationship between nature and humans, it is important to learn about local nature not only from the perspective of science but also from the perspective of history and culture (e.g., Greenwood, 2013). It has also been pointed out that providing students with opportunities to explore ancestors' views regarding nature effectively facilitates their understanding of the relationship between nature and humans (e.g., Shimono, 2007). Focusing on folktales as a teaching tool for learning about ancestors' view of nature, many of them are based on local nature, which includes scientific, historical, and cultural perspectives, and reflect ancestors' view of nature. Therefore, the use of folktales in science education is effective in promoting learning about the relationship and coexistence between nature and humans (Onodera & Fujii, 2018). In this study, to devise a course at the teacher training stage that makes use of folktales from various regions in Japan that express the wisdom and ideas of ancestors regarding coexistence with nature, a questionnaire survey was conducted to ascertain to what extent students were able to grasp ancestors' views on nature, especially the idea of coexistence between nature and humans, as seen in the folktales. Of the 45 students surveyed, about one-third were able to grasp their ancestors' ideas about the coexistence of nature and humans from the folktales, such as 'It is impossible for humans to live alone, and life depends on other life forms'. The contents of the ideas were varied and included many viewpoints about the coexistence between rivers and humans today. If we can devise lessons for the teacher training stage based on these students' perceptions, the use of folktales in science and integrated learning will be realistic and attractive to students.

Keywords: science education, folktales, coexistence between nature and humans

Core-to-Core Programme Second Joint Seminar

Bridging Ideas Between Asia and Europe for Promoting Education for Sustainable Development in Higher Education

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