ACTIVITY REPORTING FORM
FOR ICSU/ISC GRANTS PROGRAMME 2016-2019

FINAL ACTIVITY REPORTING 2017-2019

(Deadline for completion: 17 January 2020)
To be sent to Grants Team (grants@council.science)

Name of ISC body: International Union of Biological Sciences, IUBS
Title of activity: TROP ICSU Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding

Each project is requested to submit a final activity report reflecting over the whole period of the project (2017-2019) using the template provided below. The final narrative report should include a summary of the project’s main goals, findings and outcomes, a description of the main achievements of the projects, how the scientific community or other stakeholders benefited from the work, how the thematic focus and ICSU/ISC's strategic priorities were served, along with a summary of any follow-on activities that were seeded by this project.

The maximum length of the report should be 8-pages.

The report will be reviewed by the Grants Team. The intention is that this activity report will be made publicly available on the ISC website.

1. Project summary

Climate change is one of the most significant issues of our times. It affects the sustainable and equitable development of all countries and their citizens. Solutions require populations to be aware of the issues. As the nature of the impact is not the same across the world, measures to mitigate the effects of climate change will involve solutions that are locally rooted but based on global science. The integration of climate change education into the formal education system, therefore, can equip current and future generations across the world with key skills to determine locally relevant solutions for climate change adaptation, mitigation, and resilience.

In this context, the TROP ICSU project (https://tropicsu.org/; https://climatescienceteaching.org/) was conceived to integrate climate change-related topics into core curriculum at the school and
undergraduate levels to increase the awareness of the causes and effects of climate change among students.

To achieve the project goals, the TROP ICSU team has developed, collated, curated, and validated a repository of teaching resources (some with detailed, step-by-step guides) from across the world that can be used by teachers to teach discipline-specific topics by using examples, case studies, and activities related to climate change. The project has demonstrated the novel pedagogical approach of integrating climate change education into the existing curriculum.

A detailed methodology has been adopted to ensure the scientific validity and seamless integration of climate change topics with curricular topics. Thus, the use of the TROP ICSU educational resources will help teachers to improve the quality of learning while increasing climate change awareness among students, without deviation from the core curriculum.

Based on the feedback from the reviews of TROP ICSU educational resources by teachers and educators at our workshops, > 80% of the respondents found the reviewed educational resource to be very effective or moderately effective in explaining the topic in discipline, > 80% of the respondents found the integration of discipline-specific topic with a climate topic to be very effective or moderately effective in the reviewed educational resource, and > 90% of the respondents indicated that they would use the reviewed educational resource as is or with some modifications in their classrooms. These results validate the effectiveness and usefulness of the TROP ICSU educational resources, with scope for further enhancement and customization for specific classroom, student, teacher, and geographic requirements.

Observations and findings during the project implementation have revealed that computer skills and preferred digital teaching tool types vary among teachers and educators. To address these differences, the project website provides digital resources of different types and requiring different skill levels (ranging from basic to advanced).

The TROP ICSU project is led by the International Union of Biological Sciences (IUBS) and co-led by the International Union of Quaternary Research (INQUA). The project has 22 partners as of date: these include 8 ISC unions, 2 ISC interdisciplinary bodies, national academies of various countries, national research centers, and United Nations agencies. The TROP ICSU Working Group (https://tropicsu.org/about/), representing all partners, regularly advised and supported the project implementation team. The implementation team includes Dr. Rahul Chopra, Ms. Anita Nagarajan, Ms. Aparna Joshi, Dr. Megha Nivsarkar (all working full-time on the project) and Dr. L. S. Shashidhara (President, IUBS) and Dr. Nathalie Fomproix (Executive Director, IUBS) as advisors.

Summary Statement of Major Outcomes/Achievements
The TROP ICSU team

- has created and maintained 2 project websites: https://tropicsu.org and https://climatescienceteaching.org (the latter with a more user-friendly and visual interface);
- has curated approximately 150 teaching tools (https://tropicsu.org/resources/pedagogical-tools-examples/) and has created and published more than 70 detailed lesson plans (https://tropicsu.org/resources/lesson-plans/) that teachers (high school or undergraduate level) across the world can use in their classrooms/laboratories to teach a topic in their discipline (Science, Mathematics, Social Sciences, and Humanities) by using examples, case studies, and activities from climate science/climate change;
• has organized and conducted 17 TROP ICSU workshops for approximately 740 high school and undergraduate-level teachers in 10 countries across the globe and 4 TROP ICSU workshops for approximately 54 climate experts;
• has 3 project-related publications; and
• has established strong ongoing collaborations and partnerships with various organizations, including UN organizations such as UNCC: Learn, the World Meteorological Organization (WMO), and the World Climate Research Programme (WCRP).

2. Thinking of the entire grant period, did the project achieved its main objectives?

During the entire grant period, the project successfully achieved all its main objectives, as described below:
Details of Major Outcomes/Achievements

Validated Repository of Educational Resources (Teaching Tools and Lesson Plans) that Integrate Topics in Climate Science and Climate Change Across Disciplines:
The TROP ICSU team has curated approximately 150 teaching tools (https://tropicsu.org/resources/pedagogical-tools-examples/) and has created and published more than 70 detailed lesson plans (https://tropicsu.org/resources/lesson-plans/). The validated suite of educational resources (teaching tools and lesson plans) for various disciplines (Sciences, Mathematics, Social Sciences, and Humanities) is available on the project website for use by teachers/educators and students/self-learners.
Each Teaching Tool is typically a single computer-based tool such as an interactive visualization, a model or simulator, a video micro-lecture, a classroom/laboratory activity, or a game or mobile app. The teaching tools are classified according to Discipline, Climate Topic, Tool Type, Grade Level, Language, and Region or Location. For each teaching tool listing on the website, the project team provides a brief description of the resource and some sample questions for evaluating students’ learning.
A Lesson Plan is a topic-specific guide containing teaching tools and a write-up describing how to teach a particular topic in the curriculum of a discipline/subject by using examples, case studies, and exercises related to climate change. For each Lesson Plan on the website, the project team provides learning outcomes, detailed step-by-step guidelines, and sample questions for evaluating students’ learning.
A detailed project methodology and a project policy document were created and published on the project website.
The project team provides templates and ideas for lesson plans to help teachers create and contribute new lesson plan ideas that they would like to use in their classrooms. This facilitates the move toward the project’s eventual goal of educational resource development “by teachers, for teachers” across the world and exchange of ideas through an online community of teachers and educators.

Teacher-submitted Lesson Plan Ideas and Frameworks
The educational resources published on the project website include contributions from teachers and climate experts from various countries.
New lesson plan ideas/frameworks were submitted by teachers at the TROP ICSU workshops or during continued engagement efforts. These initial versions were further refined and developed into complete lesson plans in collaboration with the TROP ICSU team. The content has also been progressively refined based on suggestions and feedback from experts in pedagogy, teachers, and experts in climate science. The teaching resources have been validated by teachers and educators across the world from the pedagogy and ease-of-use perspectives. They have also been validated by climate experts for scientific correctness.

Survey of Educators:
A preliminary survey of educators was created and disseminated among teachers and educators in different countries to understand how topics related to climate change are currently discussed in the classroom in different parts of the world and to make them aware of the TROP ICSU project. This survey was also translated into different languages with the help of partner networks.

TROP ICSU Workshops with Educators, Teachers, and Climate Experts Across the World:
TROP ICSU workshops for teachers were conducted across the world with valuable support from local partners. Overall, the participants included approximately 740 high school and undergraduate-level teachers and educators of various disciplines/subjects from Austria, India, Uganda, Bhutan, Egypt, South Africa, Australia, France, UK, and China. At these workshops, participants learned about the TROP ICSU project and its resources, provided review comments and feedback on the educational resources, created new frameworks for lesson plans, and exchanged ideas with colleagues. Workshops were also held for climate experts; they provided valuable ideas and feedback from the climate science and climate change perspective. Focused lesson plan development workshops were also conducted.

(Note: Details of the reports on the major TROP ICSU workshops for teachers are provided in Annexure-I)

Participation in Forums, Events, and Symposia on Climate Change and Education:
- **UN Forums and Events**: The project team presented their educational efforts at the Science Education events during the 4th UN STI Forum 2019 on 14-15 May 2019 and at the High Level Political Forum on Sustainable Development 2019 (HLPF 2019) on 11 July 2019 in a session titled "Practices and Approaches on quality education towards environment and climate action.” These sessions were held at the UN headquarters in New York.
- **COP 24**: The project was represented at four sessions on climate change education at COP 24 in Katowice, Poland, on 13 and 14 December 2018.
- **International Symposium on Climate Change and the Role of Education**: The project was presented at this symposium organized at Bishop Grosseteste University, Lincoln, UK, on 12 April 2019.
- **ASE Futures Conference 2019**: TROP ICSU participated in the ASE Futures Conference 2019 in Sheffield, UK, on 5 July 2019. A short workshop, "Climate Across the Curriculum," was facilitated by IUGS, one of the key project partners.
- **COP 25**: TROP ICSU participated in three sessions on climate education at COP 25 in Madrid, Spain in December 2019.

Creation and Maintenance of TROP ICSU Websites
**Creation and Development of the Website https://tropicsu.org**: This website was created and maintained as a portal for the suite of educational resources and as a source of all project-related information.
Creation and Launch of the New TROP ICSU Website: [https://climatescienceteaching.org](https://climatescienceteaching.org)
The new TROP ICSU website with improved accessibility and a user-friendly visual interface was launched in August 2019 and is accessible at [https://climatescienceteaching.org](https://climatescienceteaching.org). This new website has been developed in collaboration with IMAGINARY. All TROP ICSU educational resources (teaching tools and lesson plans) are being added to the new website and additional features are being implemented.

Establishment of New Partnerships and Regular Meetings with Experts and Collaborators:

- **Partnership with WMO and Collaboration with UN CC:Learn**: In August 2019, a Memorandum of Understanding for collaboration on climate change education was signed between the TROP ICSU project, represented by the International Union of Biological Sciences (IUBS), and the World Meteorological Organization (WMO), the United Nations system’s specialized agency for meteorology (weather and climate), operational hydrology, and related geophysical sciences. The aim of the collaboration is to achieve the United Nations Sustainable Development Goals (SDGs) of Quality Education (SDG 4) and Climate Action (SDG 13) and to enrich the implementation of the One UN Climate Change Learning Partnership (UN CC:Learn).

- **Partnership with YESS**: In early 2019, the TROP ICSU project formalized its partnership with the Young Earth System Scientists (YESS) community. In addition to disseminating TROP ICSU project-related information and updates through their network, the YESS community has been assisting in the scientific review and validation of the teaching tools.

- **The First, Second, and Third TROP ICSU Working Group Meetings**: These meetings were held in Paris, France in April 2017, April 2018, and October 2019, respectively. (Note: Detailed reports on the First, Second, and Third Working Group Meetings are provided as Annexures II). At these meetings, the Working Group (WG) members and the Implementation Team members discussed project updates and progress, feedback on the implementation, opportunities for collaboration/partnership, and ideas for future work.

Project Updates and Dissemination through Monthly Newsletter and Social Media:
Project updates are regularly posted via social media channels. In addition, a monthly project newsletter is created and published to provide project-related updates to teachers, partners, collaborators, Working Group members, and others who are interested in the TROP ICSU project and its educational resources. All published newsletters are accessible at: [https://us19.campaign-archive.com/home/?u=792378e66e9138deb30c8b5a1&id=90a15471a4](https://us19.campaign-archive.com/home/?u=792378e66e9138deb30c8b5a1&id=90a15471a4).

Project Publications:


ii. Educational strategies to achieve global awareness of Climate Change and its impact. In the World Meteorological Organization e-library WMO Global Campus Innovations publication. (accepted)


Translation of TROP ICSU Content into Different Languages
With assistance from our partner networks, some TROP ICSU content—the project summary and a few lesson plans—is now available in different languages (Kannada, Spanish, French, Brazilian...
Portuguese, and Kiswahili) on our website (https://tropicsu.org/trop-icsu-in-different-languages/), thus initiating proactive efforts toward reaching out to a wider audience across the world.

3. **How the thematic focus of the 2016-2019 Grants Programme, i.e. science education, outreach and public engagement, was addressed?**

   **Science Education:** The TROP ICSU team has curated teaching tools and developed detailed lesson plans as teaching aids for teachers at the high school and undergraduate levels to teach topics in the existing curriculum of all disciplines, including the Sciences (Physics, Chemistry, Biological Sciences), with the help of an example, case study, or activity related to climate science or climate change. The use of these interactive and engaging educational resources will help students enhance their conceptual understanding of topics in the natural sciences (and other disciplines), stimulate critical thinking, and simultaneously, increase the knowledge and awareness of the science of climate change.

   **Outreach and Public Engagement:**
   - Through a series of training workshops conducted across the world, the TROP ICSU team has disseminated the idea of integrating climate change education in several countries, introduced the TROP ICSU educational resources, and encouraged the creation of new resources by participants. The project team has organized and conducted 17 TROP ICSU workshops for approximately 740 high school and undergraduate-level teachers in 10 countries across the globe and 4 TROP ICSU workshops for approximately 54 climate experts.
   - The project objectives and resources have also been presented to educators, climate science experts, policy makers, and other audiences in talks and sessions at various science education conferences and events across the world—such as the 4th UN STI Forum 2019, High Level Political Forum on Sustainable Development 2019 (HLPF 2019), ASE Futures Conference 2019, four sessions on climate education at COP 24 in Poland, three sessions on climate education at COP 25 in Spain, a workshop at the Indian Institute of Tropical Meteorology, and others.

4. **How the project supported ICSU/ISC strategic priorities as defined for the grants programme?**

   **Building links and facilitating active collaboration between ICSU/ISC unions, interdisciplinary bodies, and Regional Offices; Mobilising resources for international scientific collaboration:**

   The TROP ICSU project is led by the International Union of Biological Sciences (IUBS) and co-led by the International Union of Quaternary Research (INQUA). The project partners include 8 ISC unions, 2 ISC interdisciplinary bodies, national academies of various countries, national research centers, and United Nations agencies. ISC-Regional Office for Africa is a partner and provided local support in the organization of a TROP ICSU workshop in Pretoria, South Africa. The TROP ICSU Working Group (https://tropicsu.org/about/), representing all partners, regularly advised and supported the project implementation team.

   **New partnerships and collaborations** with leading academic and research institutions in various countries (Bhutan, Australia, France, India, and Egypt) were established for the organization of TROP ICSU workshops.

   In 2019, a Memorandum of Understanding for collaboration on climate change education was signed between the TROP ICSU project, represented by the International Union of Biological Sciences (IUBS), and the World Meteorological Organization (WMO), the United Nations system’s specialized agency for meteorology (weather and climate), operational hydrology, and related geophysical sciences.
Capacity-building and science education in new interdisciplinary initiatives:
The TROP ICSU educational resources are interdisciplinary in their context, content, and usage; they can be used to teach topics in several disciplines, while seamlessly blending in a climate science or climate change topic. Teachers, educators, researchers, and scientists from various disciplines have benefited from the training workshops and have also provided their valuable inputs and feedback on enhancing the quality of the teaching tools and lesson plans.
The project has targeted and achieved capacity-building and science education through the organization of 17 TROP ICSU workshops for approximately 740 high school and undergraduate-level teachers in 10 countries across the globe and 4 TROP ICSU workshops for approximately 54 climate experts.

Reaching out to scientists and students in less developed countries:
The TROP ICSU workshops for teachers and climate experts have been conducted in developing and less developed countries such as Uganda, India, Bhutan, South Africa, Egypt, and China.

Activity targeting women, young scientists, and/or scientists from developing countries:
The TROP ICSU project established a partnership with the Young Earth System Scientists community. Young scientists from this community performed the scientific review and validation of the educational resources and their efforts were acknowledged. YESS representatives were also invited to attend the TROP ICSU workshops in their country to learn about the project and its resources and to share country or region-specific climate change information with the workshop participants.
Climate science and pedagogy experts from developing countries such as Uganda, India, Bhutan, South Africa, Egypt, and China benefited from the TROP ICSU training workshops. Approximately 550 teachers/educators and approximately 40 climate science experts from these countries have attended our workshops. The participants included a large number of women.

5. Describe the value of collaborative partnerships and benefits to the scientific community and other stakeholders.
The TROP ICSU project has established several new collaborations and partnerships in addition to working jointly with its partner unions and organizations to develop, enhance, and validate its educational resources; to conduct workshops for teachers, educators, and climate experts globally; and to disseminate and encourage a wider adoption of its resources.
TROP ICSU workshops were conducted in various countries with valuable support from IUSS (Austria); AUC (Uganda); Jesus and Mary College (India); the IUGG network, IASPEI, and CDRR and CDS, College of Science and Technology, Royal University of Bhutan (Bhutan); ISC ROA (South Africa); the Academy for Scientific Research and Technology (Egypt); the Indian Institute of Technology Tirupati (India); Monash University, the University of Melbourne, and the University of Adelaide (Australia); the Paris-Sud University (France); Vidya Valley School, Pune (India); the Beijing Institute of Genomics (China); IISER Pune (India); and the Indian Institute of Tropical Meteorology (India).
Dr. Boram Lee (WMO, WCRP) has played a key role in the establishment of project partnerships with WMO; UN CC:Learn; and the YESS community for validation and endorsement of the TROP ICSU educational resources. Dr. Chris King (IUGS) has regularly advised the team and provided inputs/feedback on the content; he also facilitated a short TROP ICSU workshop for educators at the ASE Futures Conference 2019 in the UK. He has helped the team reach out to a network of professional translators. Dr. Daniel Ramos (IMAGINARY) and Philipp Legner, in collaboration with the TROP ICSU team, are developing the new TROP ICSU website with an enhanced and user-friendly visual interface. Dr. Lucilla Spini (ISC) has provided constant advice and support to the project, and the team has made
joint presentations with her at UN events. Prof. France Caron (IMU) provides regular advice, suggestions, and feedback on simulators and modeling environments that could be included in the collection of educational resources. Ms. Valentina Rabanal and the YESS Executive Committee have helped in coordinating the validation of resources by experts from the YESS Community. Sigbert Huber (IUSS) and Keith Alverson (IUGG) gave regular inputs. Veronica Iñiguez (UTPL, Ecuador) and the Chinese National Committee of the IUBS have also assisted in translating the Educators Survey. Individual collaborators such as Raghu Murtugudde (Professor of Climate Science, Maryland, USA) and Iain Stewart (Geoscientist and Geoscience Communicator at Plymouth University, UK) have provided valuable contributions to the project and inputs to the team.

6. **Describe the planned follow-on activities in relation to the research undertaken, its results and future implications.**

**Enhancement of Suite of Educational Resources**
The implementation team will implement key suggestions received from the Working Group members to refine existing content, increase the number of educational resources, and enhance the accessibility and interface of the new website.

This will facilitate the access and usage, and increase the relevance of the TROP ICSU educational resources for a wider audience.

**Maintenance and Updates of the TROP ICSU Project Website**
The TROP ICSU project website will continue to be maintained and updated, as required, to keep the content up-to-date and relevant.

**Planning for Future Workshops and Wider Dissemination**
- The organization and facilitation of more workshops will be explored through collaboration with partner networks, teachers as ambassadors, and remote facilitation. Online video modules can be created and provided by the implementation team.
- Promotional material for the project will be created by the implementation team. This content will be shared with all partners for dissemination.
- All partners are being requested to promote TROP ICSU as a validated proof of concept.
- All partners are being requested to urge UNESCO to adopt and promote the idea of integrating climate change education across the curriculum across the world.

This will help in the dissemination of the project idea and will increase the adoption of the educational resources by educators across the world.

**Translation of Key Project Content**
The implementation team will work with partner networks for seeking translation assistance and will provide translated versions of the project overview and some educational resources on the website.

This effort will help in widening the reach of the project in countries having languages other than English as the official medium of instruction, and in increasing the adoption of the idea and the resources in more countries and regions.
Annexure I

Reports of TROP ICSU main Workshops:

- Report TROP ICSU Workshop in Adelaide, Australia
- Report TROP ICSU Workshop in Bhutan
- Report TROP ICSU Workshop in China
- Report TROP ICSU Workshop in Egypt
- Report TROP ICSU Workshop in Melbourne, Australia
- Report TROP ICSU Workshop in France
- Report TROP ICSU Workshop in Pune, India
- Report TROP ICSU Workshop in South Africa
- Report TROP ICSU Workshop in Tirupati, India
- Report TROP ICSU Workshop in Uganda

Annexure II

Reports on Working Groups meetings

1st Working Group meeting, Paris, April 2017
2nd Working Group meeting, Paris, April 2018
3rd Working Group meeting, Paris, October 2019

See additional pdf provided with the report

Annexure III

TROP ICSU Presentation 2020
See additional pdf provided with the report
Annexure I

Reports of TROP ICSU main Workshops:

Report TROP ICSU Workshop in Adelaide, Australia
Report TROP ICSU Workshop in Bhutan
Report TROP ICSU Workshop in China
Report TROP ICSU Workshop in Egypt
Report TROP ICSU Workshop in Melbourne, Australia
Report TROP ICSU Workshop in France
Report TROP ICSU Workshop in Pune, India
Report TROP ICSU Workshop in South Africa
Report TROP ICSU Workshop in Tirupati, India
Report TROP ICSU Workshop in Uganda
Report on the TROP ICSU Workshop for Teachers at Adelaide, Australia,
organized in collaboration with

The University of Adelaide, Australia
and with valuable support from
the Government of South Australia, Botanic Gardens and State Herbarium, Adelaide and Mount Lofty Ranges Natural Resources Management Board, and Adelaide Botanic High School
(30-31 May 2019)

Workshop Title: A Professional Development Workshop on TEACHING SUSTAINABILITY AS A CROSS-CURRICULUM PRIORITY: CLIMATE CHANGE RESOURCES FOR TEACHERS

Date: May 30-31, 2019

Venue: The University of Adelaide, Adelaide, Australia

Facilitators from the TROP ICSU Team: Dr. Rahul Chopra, Ms. Anita Nagarajan

Speaker(s)/Facilitator(s) from the organizing partners:
Dr. Cesca McInerney, the University of Adelaide
Dr. Bronte Nicholls, Adelaide Botanic High School
Mr. Zafi Bachar, Natural Resources Adelaide and Mount Lofty Ranges, Department of Environment, Water and Natural Resources
Dr. Stefan Caddy-Retalic, Botanic Gardens and State Herbarium of South Australia
Mr. Julian Marchant, Adelaide and Mount Lofty Ranges Natural Resources Management Board

Team of Coordinators: Dr. Cesca McInerney, Ms. Katarina Krizova

Number of Participants: 42

Disciplines/Subjects Taught by Participants: Chemistry; Civics; Digital Literacy; Earth Sciences; Education; English; Geography; Geology; HASS (Humanities and Social Sciences); Health; History; Law; Mathematics; Philosophy; Physics; Psychology; Science
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Summary of the Workshop

A one-and-a-half-day workshop for teachers at the high school and university level was conducted in collaboration with the University of Adelaide at Adelaide, Australia, on May 30 and 31, 2019. The event was also supported by the Government of South Australia, Botanic Gardens and State Herbarium, Adelaide and Mount Lofty Ranges Natural Resources Management Board, and Adelaide Botanic High School. The workshop was attended by 42 participants, including lecturers, teachers, and researchers affiliated to various universities and schools in Adelaide, and having experience and expertise in various disciplines.

TROP ICSU is grateful for the tremendous support and help from the University of Adelaide in planning and organizing all the logistics and arrangements.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching sustainability-related topics in the Sciences, Mathematics, Social Sciences, and Humanities by using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

Participants were assigned a pre-workshop homework activity of identifying one lesson plan and one teaching tool relevant to their teaching or interests, and mapping the corresponding topics to the curriculum they teach. These would be useful during the group activities and discussions at the workshop.

The workshop commenced with welcome remarks from Dr. Cesca McInerney, University of Adelaide. Next, the TROP ICSU team provided an overview of the TROP ICSU project and its teaching resources. Then, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching
resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new lesson plan ideas to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples. Group representatives presented the new lesson plan frameworks and ideas and discussed plans on the adoption of these new lesson plans in the classroom. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.

This workshop included some special events and presentations. On the evening of the first day, participants were taken on a guided tour of the Adelaide Botanic High School by Dr. Bronte Nicholls (Assistant Principal, Curriculum Innovation and Community Partnerships, Adelaide Botanic High School) to learn about and witness first-hand the unique learning environment envisioned and provided by this new school in Adelaide. The second day of the workshop began with a talk on “Tools to inform Adelaide’s adaptation choices” by Zafi Bachar (Climate Applications Coordinator, Natural Resources Adelaide & Mt Lofty Ranges, Department of Environment, Water and Natural Resources). The event concluded with presentations on “Overview of SA government education resources” by Dr. Stefan Caddy-Retalic (Manager, Learning and Visitor Experience, Botanic Gardens and State Herbarium of South Australia) and Julian Marchant (NRM Education Officer, Adelaide and Mount Lofty Ranges Natural Resources Management Board). These talks were intended to provide region-specific (South Australia) context and information about educational resources that would be useful for teachers.

Plenary Sessions at the Workshop for Teachers, Adelaide, Australia
Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new lesson plans and specifically, in the generation of lesson plan ideas that are relevant to classrooms in Australia. Each group created a framework for one new lesson plan, and participants discussed steps for adopting the usage of the lesson plan in their teaching. Peer-to-peer discussions in groups enabled an exchange of ideas across disciplines and the development of new lesson plans.
Summary of the feedback received on the lesson plans from the TROP ICSU website

Explaining the topic(s) in the discipline: 100% of the responses from the university lecturers and approximately 67% of the responses from the high school teachers stated that the reviewed lesson plan was very effective or moderately effective in explaining the topic in the discipline.

Integrating the discipline topic(s) with climate science: 100% of the responses from the university lecturers and approximately 75% of the responses from the high school teachers indicated that the reviewed lesson plan was very effective or moderately effective in integrating the discipline topic(s) with climate science.

Using the lesson plan in the classroom: 100% of the responses from the university lecturers and 100% of the responses from the high school teachers indicated that they would use the lesson plan in their classroom as is or with some modifications.

Detailed results for the lesson plan reviews are provided in Appendix II A: Review of Lesson Plans by Participants (University Lecturers) and Appendix II B: Review of Lesson Plans by Participants (High School Teachers).

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

Explaining the topic(s) in the discipline: Approximately 67% of the respondents among the university lecturers and approximately 64% of the respondents among the high school teachers thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.
A global project to integrate

*Climate Change Education across the Curriculum*

**Describing the tool:** 100% of the responses from the university lecturers and approximately 55% of the responses from the high school teachers stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** 100% of the respondents among the university lecturers and approximately 73% of the respondents among the high school teachers indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III A: Review of Teaching Tools by Participants (University Lecturers) and Appendix III B: Review of Teaching Tools by Participants (High School Teachers).

**Details of the Workshop**

**Agenda and Overall Organization**

The agenda of the one-and-a-half-day workshop was as follows:

- **Day 1 (afternoon and evening):**
  - Workshop welcome;
  - Welcome remarks by Dr. Cesca McInerney, the University of Adelaide
  - Presentations by the TROP ICSU team: Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
  - Group-based activity by the participants (groups organized by discipline): Review of discipline-specific teaching resources available on the TROP ICSU website (one teaching tool per group); providing feedback on teaching tools through online review forms
  - Tour of Adelaide Botanic High School
Day 2:
Opening remarks and setting goals for the day

Presentation by Zafi Bachar (Climate Applications Coordinator, Natural Resources Adelaide and Mt Lofty Ranges): Tools to inform Adelaide’s adaption choices

Introduction to the components of a lesson plan

Group-based activity by the participants (groups organized by discipline): Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan per group); providing feedback on lesson plans through online review forms

Group-based activity by the participants (groups organized by discipline): Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

Presentation of new lesson plans by participants: Brief summary of the lesson plan topic and tools/resources by each group

Open discussions with participants: Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU
Overview of SA government education resources: Presentations by Dr. Stefan Caddy-Retalic (Manager, Learning and Visitor Experience, Botanic Gardens and State Herbarium of South Australia) and Julian Marchant (NRM Education Officer, Adelaide and Mount Lofty Ranges Natural Resources Management Board)

Closing remarks
Lesson Plan Presentation at the Workshop for Teachers, Adelaide, Australia

Lesson Plan Presentation at the Workshop for Teachers, Cairo, Egypt

Participant Feedback and Suggestions on Existing Teaching Resources

- Provide more recent learning material
- Include a part on prior knowledge at the start of the lesson plans
- Reading material is considerably long and may not be suitable for high school students; consider replacing with shorter reading material or shorter videos
- Add country-level filters to case studies
Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Ice Age Time Machine (Earth Sciences)
- Using Literature (Anchor Point) for Exploring Climate Change in Australia (English)
- Long-term Impacts of the Industrial Revolution (History)
- International Treaties and Australia’s Obligations to International Law (through examples such as the Paris Agreement and the Kyoto Protocol) (Social Sciences)
- Greenwashing (Communication, Advertising)

Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in sustainability (specifically, climate science or climate change) with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.
- Participants found the hands-on, interactive group sessions to be very useful and engaging.
- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning through networking and linking climate change to all areas of education.
- Participants sought contextually relevant examples (Australia) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.
- Teachers recommended the mapping of teaching resource content to country-level (Australia) curriculum standards.
- Some participants suggested further modifications/customizations to make the teaching resources more useful at the high school level.
- Some feedback from participants:
  "This video is too long- we need videos that are approx 5 mins, up to 8 minutes otherwise students tune out!"
  "Fantastic opportunity to network and share ideas around climate change. Very
inspiring. Thank you!

"This resource needs specific core teaching before it can be used. It’s a good resource, but only one small aspect of a wider teaching unit"

"If possible, please add filters to the case studies (by country) so we can select local relevant examples for our students."

"This workshop has been very useful in collaborating with other staff to find the links with climate change to all areas of education."

"Thank you for sharing such an amazing set of educational tools specifically on sustainability."

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (Australia) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Chemistry; Civics; Conservation and Land Management; Digital Literacy; Earth and Environmental Science; Earth Sciences; Education; English; Geography; Geology; HASS (Humanities and Social Sciences); Health; History; Humanities; Japanese; Language; Law; Mathematics; Media Studies; Philosophy; Physics; Psychology; Renewable Energy; Science; Social Sciences; Social Studies

Others: NRM Education Officer; PhD Candidates and Post-doctoral Researchers in various fields such as Earth Sciences, Biology, and Urban Planning
Appendix II A: Review of Lesson Plans by Participants (University Lecturers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?
7 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?
7 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?
7 responses

8. Would you use this lesson plan in your classroom for your students?
7 responses
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

7 responses

Appendix II B: Review of Lesson Plans by Participants (High School Teachers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

12 responses
3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

12 responses

- Very effective: 41.7%
- Moderately effective: 33.3%
- Somewhat effective: 25%
- Not very effective: 8.3%
- Not sure: 16.7%

7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

12 responses

- Yes: 76%
- No: 16.7%
- Do not know: 8.3%
8. Would you use this lesson plan in your classroom for your students?

12 responses

100%

10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

12 responses

58.3%

41.7%
2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

3 responses

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

3 responses
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

3 responses

6. Would you use this teaching tool in your classroom for your students?

3 responses
2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

11 responses

- Very effective: 36.4%
- Moderately effective: 18.2%
- Somewhat effective: 16.2%
- Not very effective: 27.3%
- Not sure: 10.9%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

11 responses

- Yes: 54.5%
- No: 9.1%
- Do not know: 36.4%
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

11 responses

6. Would you use this teaching tool in your classroom for your students?

11 responses
TROP ICSU: Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding (https://tropicsu.org)

Report on the TROP ICSU Workshop for Teachers at Thimphu, Bhutan, organized in collaboration with

The Center for Disaster Risk Reduction and Community Development Studies (CDRR & CDS), College of Science and Technology, Royal University of Bhutan and
The Commission on Education and Outreach, International Association of Seismology and Physics of the Earth’s Interior (IASPEI) (14-15 February 2019)

Workshop Title: A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS

Date: February 14-15, 2019

Venue: Jambayang Resort, Thimphu, Bhutan

Facilitators from the TROP ICSU Team: Dr. Rahul Chopra, Ms. Anita Nagarajan, Ms. Aparna Joshi

Facilitator(s) from CDRR & CDS, IASPEI: Dr. Raju Sarkar

Team of Coordinators/Helpers from the College of Science and Technology, Royal University of Bhutan: Ms. Karma Kelzang Eudon, Ms. Sonam Choden, Ms. Sangay Choden, Ms. Namgay Om, Mr. Pravakar Pradhan, Mr. Jeewan Gurung, Mr. Regden Tenzin, Mr. Bhawani Shankar, Mr. Basant Pradhan, Mr. Bharat Kumar Humagai, Mr. Tshewang Nidup, Mr. Om Kafley

Number of Participants: 66

Disciplines/Subjects Taught by Participants:
University Lecturers: Architecture, Civil Engineering, Mathematics

High School Teachers: Dzongkha, Economics, English, Environmental Science, Geography, History, Mathematics, Science

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
Summary of the Workshops

A 2-day workshop for university lecturers and school teachers was conducted in collaboration with the Center for Disaster Risk Reduction and Community Development Studies (CDRR &CDS), College of Science and Technology, Royal University of Bhutan and the Commission on Education and Outreach, International Association of Seismology and Physics of the Earth’s Interior (IASPEI)—an association of the International Union of Geodesy and Geophysics (IUGG), which is a partner of the TROP ICSU project—at Thimphu, Bhutan, on February 14 and 15, 2019. The workshop was attended by 66 school teachers and university lecturers from Bhutan. The participants included a representative from the Young Earth System Scientists (YESS) community, the principal of a school, and the vice-principal of a school.

TROP ICSU is grateful for the tremendous support and help from the College of Science and Technology (CST), IASPEI, and the coordination team in planning and organizing all the logistics and arrangements, and in personally visiting schools to encourage teachers to participate in the workshop.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

Group Photo: Workshop for School Teachers and University Lecturers, Thimphu, Bhutan
The workshop commenced with an introduction to the College of Science and Technology, Royal University of Bhutan by Dr. Cheki Dorji, President of CST-RUB. Next, an overview of CDRR & CDS and its work, and an introduction to the work of the Commission on Education and Outreach, IASPEI, was provided. Then, participants attended a few plenary sessions for an overview of the TROP ICSU project and its teaching resources. Over the next one and a half days, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They provided review comments about the teaching resources (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in discipline-based groups to develop new lesson plan ideas to teach topics in their discipline using climate-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas. The workshop concluded with presentations on new lesson plan frameworks and ideas and an open discussion on continued engagement and collaboration with the TROP ICSU project.

TROP ICSU had also invited a member of its partner organization, the YESS community, to participate in the workshop. The Environmental Officer at the Center for Water, Climate Science and Environmental Policy, Ugyen Wangchuk Institute for Conservation and Environmental Research (UWICER), attended the workshop and participated in all the sessions. She also made a presentation on the work of UWICER, the mission and objectives of the YESS community, and climate-related topics and resources that are specific to Bhutan.
Overall, the participants were keen on learning about the usage of digital teaching resources in the classroom and to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new lesson plans and specifically, in the generation of ideas that are relevant and specific to Bhutan. Each group created a framework for one new lesson plan for their discipline. Peer-to-peer discussions in groups enabled an exchange of several ideas and the development of new lesson plan frameworks.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** 100% of the responses from the university lecturers and approximately 95% of the responses from the high school teachers stated that the reviewed lesson plan was very effective or moderately effective in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** 100% of the responses from the university lecturers and approximately 95% of the responses from the high school teachers indicated that the reviewed lesson plan was very effective or moderately effective in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** 100% of the responses from the university lecturers and 100% of the responses from the high school teachers indicated that they would use the lesson plan in their classroom as is or with some modifications.
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Detailed results for the lesson plan reviews are provided in *Appendix II A: Review of Lesson Plans by Participants (University Lecturers)* and *Appendix II B: Review of Lesson Plans by Participants (High School Teachers)*.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

**Explaining the topic(s) in the discipline:** 90% of the respondents among the university lecturers and approximately 90% of the respondents among the high school teachers thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

**Describing the tool:** 100% of the responses from the university lecturers and approximately 97% of the responses from the high school teachers stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** 100% of the respondents among the university lecturers and approximately 97% of the respondents among the high school teachers indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in *Appendix III A: Review of Teaching Tools by Participants (University Lecturers)* and *Appendix III B: Review of Teaching Tools by Participants (High School Teachers)*.

Details of the Workshop

**Agenda and Overall Organization**

The agenda of the two-day workshop was as follows:

- **Day 1:**
  - **Presentations by the College of Science and Technology (CST) and IASPEI:** Welcome remarks; introduction to CST, CDRR and CDS, and the Commission on Education and Outreach, IASPEI and their work; objectives of the workshop
  - **Presentations by the TROP ICSU team:** Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
  - **Group-based activity by the participants (groups organized by discipline):** Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms
  - **Open discussion** on the review of teaching resources
**Day 2:**

- **Presentation by YESS community representative:** Overview of the Ugyen Wangchuk Institute for Conservation and Environmental Research (UWICER) and its work; overview of the YESS community; and introduction to climate topics and resources specific to Bhutan

- **Introduction** to the components of a lesson plan

- **Group-based activity by the participants (groups organized by discipline):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

- **Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

- **Open discussions with participants:** Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

- **Closing remarks**
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Presentation of a Lesson Plan Idea at the Workshop for Teachers, Thimphu, Bhutan

Participant Feedback and Suggestions on Existing Teaching Resources

- Reduce the duration of a lesson plan
- Include more location-specific resources
- Include more resources in the “Additional Resources” section
- Add a follow-up activity such as a discussion or video at the end of a lesson plan
Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Climate Change and Biodiversity, example of Bhutan's snow leopard population (Biological Sciences)
- Climate Change and the Economic Growth of Bhutan (Economics)
- Climate-Smart Agriculture in Bhutan (Economics)
- Bar Graph Interpretation by Using Infographics on Global Warming and Sea-level Rise (Mathematics)
- Climate Change and Building Design (Civil Engineering, Architecture)
- Learning About Functions and Variables by Using Rainfall Data (Mathematics)

Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the use of digital pedagogy and the idea of using teaching resources that integrate climate topics with topics in their discipline.

- Participants found the hands-on, interactive group sessions to be very useful and engaging.

- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.

- Participants sought local and region-specific examples (Bhutan) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.

- A majority of the participants indicated a strong preference for creating and using shorter lesson plans (duration of 50-60 minutes).

- Some feedback from participants:
  “The session was helpful and effective. As a mathematics teacher our challenge is to infuse value in our lesson but after this session we ourself designed a lesson plan where we would be teaching mathematical concept with very important global issue infused in our lesson. Thank you”

  “Very informative and an enriching experience.”
“It was very useful, thought provoking and relevant program. I have enjoyed all lectures, sessions and the workshop reminded me of the importance of the Climate change and the need to include it in our curriculum…”

“Didn’t know earlier that climate change could be integrated to teach different disciplines. Will relate and use climate change information to teach different topics possible to make children more aware of climate change and its impact. Would like you look into the overall Bhutanese curriculum and suggested what are the possible climate change information that could be included or incorporated to teach different topics and where to find them.”

“The teacher participants could be asked to come with a copy of the module descriptor they teach so that they could work with something that they can take back immediately to be used in the classroom.”

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (Bhutan, Asia) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

University Lecturers:

Engineering Mathematics; Mathematics; Humanities; Research; Architecture, Urban Planning; Civil Engineering; Environmental Management; Engineering Chemistry and Environmental Science

High School Teachers:

Information and Communications Technology (ICT); Science; Social Studies; Mathematics; Biology; Geography; History; English; Commerce; Information Technology (IT); Dzongkha; Environmental Science; Physics
Appendix II A: Review of Lesson Plans by Participants (University Lecturers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?
4 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?
4 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

4 responses

8. Would you use this lesson plan in your classroom for your students?

4 responses
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

4 responses

Appendix II B: Review of Lesson Plans by Participants (High School Teachers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

21 responses
3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

21 responses

- Very effective: 57.1%
- Moderately effective: 38.1%
- Somewhat effective: 5%
- Not very effective: 3.8%
- Not sure: 0.9%

7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

21 responses

- Yes: 90.5%
- No: 9.5%
- Do not know: 0.0%
8. Would you use this lesson plan in your classroom for your students? 
21 responses

- Yes: 71.4%
- Yes, with modifications: 28.6%

10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study? 
21 responses

- Very likely: 71.4%
- Likely: 23.8%

Appendix III A: Review of Teaching Tools by Participants (University Lecturers)

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

10 responses

- Very effective: 70%
- Moderately effective: 20%
- Somewhat effective: 10%
- Not very effective: 0%
- Not sure: 0%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

10 responses

- Yes: 100%
- No: 0%
- Do not know: 0%
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

10 responses

- Yes: 100%

6. Would you use this teaching tool in your classroom for your students?

10 responses

- Yes: 70%
- Yes, with modifications: 30%
Appendix III B: Review of Teaching Tools by Participants (High School Teachers)

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

29 responses

- Very effective: 41.4%
- Moderately effective: 48.3%
- Somewhat effective: 6.0%
- Not very effective: 3.4%
- Not sure: 1.4%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

29 responses

- Yes: 96.6%
- No: 0.0%
- Do not know: 3.4%

6. Would you use this teaching tool in your classroom for your students?

29 responses

- Yes: 48.3%
- Yes, with modifications: 48.3%
- No: 3.4%
- Unsure: 1.4%
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TROP ICSU: Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding
(https://tropicsu.org)

Report on the TROP ICSU Workshop for Teachers at Beijing, China,
organized in collaboration with

The Beijing Institute of Genomics (BIG), Chinese Academy of Sciences, China
(16-17 July 2019)

Workshop Title: A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS

Date: July 16-17, 2019

Venue: Hotel Holiday Inn Express Beijing Minzuyuan

Facilitator from the TROP ICSU Team: Ms. Anita Nagarajan

Speaker(s) from BIG: Ms. Li Lan

Team of Coordinators/Helpers: Dr. Xu Wei and the team of volunteers from the Beijing Institute of Genomics (BIG), Chinese Academy of Sciences

Number of Participants: 31

Disciplines/Subjects Taught by Participants: Biology; Chemistry; Chinese; English; Environmental Protection; Geography; Mathematics; Meteorology; Museum Education/Out-of-school Education; Physics; Robotics; Science; Science and Technology Education

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Summary of the Workshop

A 2-day workshop for high school teachers and university lecturers was conducted in collaboration with the Beijing Institute of Genomics (BIG), Chinese Academy of Sciences, China, on July 16 and 17, 2019. The workshop was attended by 31 participants, including high school teachers and lecturers from schools and universities in Beijing. A representative from the Young Earth System Scientists (YESS) community also participated in the workshop.

TROP ICSU is grateful for the tremendous support and help from BIG in planning and organizing all the logistics and arrangements and for the interpretation and translation of discussions and presentations from Chinese to English and vice-versa, when required, during the workshop.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

The workshop commenced with welcome remarks from Ms. Li Lan (BIG Data Center, Beijing Institute of Genomics, Chinese Academy of Sciences). Then, the TROP ICSU team provided an overview of the TROP ICSU project and its teaching resources. While the TROP ICSU presentations were delivered in English, participants were also provided with a translated Chinese version of the slides for reference. Over the next one and a half days, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new lesson plan ideas to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples. Group representatives presented the new lesson plan frameworks and ideas and
discussed plans on the adoption of these new lesson plans in the classroom. The lesson plan presentations and discussions were in English, Chinese, or sometimes bilingual. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.

TROP ICSU had also invited a member of its partner organization, the YESS community, to participate in the workshop. The YESS representative from the meteorology field provided an overview (in Chinese) of climate-related topics and resources relevant to China.

Plenary Sessions at the Workshop for Teachers, Beijing, China
Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new lesson plans and specifically, in the generation of lesson plan ideas that are relevant to classrooms and teaching levels in China. Each group created a framework for one new lesson plan, and participants discussed steps for adopting the usage of the lesson plan in their teaching. Peer-to-peer discussions in groups enabled an exchange of ideas across disciplines and the development of new lesson plans.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** 100% of the responses from the participants stated that the reviewed lesson plan was **very effective or moderately effective** in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** 100% of the responses from the participants indicated that the reviewed lesson plan was **very effective or moderately effective** in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** 100% of the responses from the participants indicated that they would use the lesson plan in their classroom as is or with some modifications.

Detailed results for the lesson plan reviews are provided in *Appendix II: Review of Lesson Plans by Participants*.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 91% of the respondents thought that the reviewed tool was **very effective or moderately effective** in explaining the topic(s) in the discipline.

**Describing the tool:** 100% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** Approximately 82% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.
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Detailed results for the teaching tool reviews are provided in [Appendix III: Review of Teaching Tools by Participants](#).

Details of the Workshop

**Agenda and Overall Organization**

The agenda of the two-day workshop was as follows:

- **Day 1:**
  - Presentation by the Beijing Institute of Genomics (BIG), Chinese Academy of Sciences, China: Welcome remarks by Ms. Li Lan (BIG Data Center); introduction to BIG, IUBS, and TROP ICSU; objectives of the workshop
  - **Presentation by the TROP ICSU team:** Welcome remarks
  - **Introductions of the participants:** Brief introductions including name, institution/organization affiliation, and disciplines/areas of specialization, expertise, teaching, and research
  - **Presentations by the TROP ICSU team:** Introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
  - **Group-based activity by the participants (groups organized by discipline):** Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms
  - **Open discussion** on the review of teaching resources
  - **Brief discussion** on the main activity for the next day
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Group Activity at the Workshop for Teachers, Beijing, China

- **Day 2:**
  - **Introduction** to the components of a lesson plan

  **Presentation by YESS community representative:** Introduction to and overview of topics related to climate change, including impacts, examples, and resources specific to China; overview of the YESS community and its work

  **Group-based activity by the participants (groups organized by discipline):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

  **Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

  **Open discussions with participants:** Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

  **Closing remarks**
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Group Activity at the Workshop for Teachers, Beijing, China

Presentation of a Lesson Plan at the Workshop for Teachers, Beijing, China

Participant Feedback and Suggestions on Existing Teaching Resources

- Align the teaching objectives with the prescribed syllabus
- Include more effective evaluation methods
- Integrate climate-related topics with more disciplines
- Add clear teaching goals
Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Impact of Climate Change on Soil Microbes (Biological Sciences)
- Impact of Climate Change on Photosynthesis (middle school level, Biological Sciences)
- Fuel Cells and Climate Change (Chemistry)
- Global Climate Change (Geography)
- Climate Change and Pollen Allergies (Biological Sciences, Medicine)
- 气候变化了，鸟类会怎样呢？（Impact of Climate Change on Bird Migration）(Biological Sciences, Environmental Sciences)

Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in climate science or climate change with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.
- Participants found the hands-on, interactive group sessions to be very useful and engaging.
- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.
- Teachers found it helpful to listen to the ideas and presentations of participants from other disciplines.
- Teachers recommended the addition of more specific learning goals.
- Some participants thought that the time duration specified for the lesson plans was not accurate and needed further refinement.
- Some feedback from participants:
  "The teaching objectives should be based on syllabus published by authorities."
  "there's no effective evaluation methods (so you don't know whether the students have already know the knowledge)."
"Two days of study have taught us how to lead students to study common topics from different disciplines, to acquire the rich resources needed for interdisciplinary research and to carry out new approaches to instructional design."

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (China, Asia) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Bioinformatics; Biology; Chemistry; Chinese; Cytobiology; English; Environmental Protection; Genetics; Geography; Mathematics; Meteorology; Museum Education/Out-of-school Education; Nutriology; Physics; Phytology; Robotics; Science; Science and Technology Education
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

- Moderately effective
- Very effective

5 (45.5%)
6 (54.5%)

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

- Moderately effective
- Very effective

7 (53.6%)
4 (36.4%)
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

- Yes: 10 (90.9%)
- Do not know: 1 (9.1%)

8. Would you use this lesson plan in your classroom for your students?

- Yes: 7 (63.6%)
- Yes, with modifications: 4 (36.4%)
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

- Likely: 4 (36.4%)
- Very Likely: 7 (63.6%)
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

- Very effective: 9 (81.8%)
- Moderately effective: 1 (9.1%)
- Somewhat effective: 1 (9.1%)

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

- Yes: 11 (100.0%)
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

- Yes: 9 (81.8%)
- Do not know: 2 (18.2%)

6. Would you use this teaching tool in your classroom for your students?

- Yes: 4 (36.4%)
- Yes, with modifications: 2 (18.2%)
- No: 5 (45.5%)
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Report on the TROP ICSU Workshop for Teachers at Cairo, Egypt,
organized in collaboration with
The Academy of Scientific Research and Technology (ASRT), Egypt
(15-16 April 2019)

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<tr>
<th>Workshop Title:</th>
<th>A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS</th>
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<td>Date:</td>
<td>April 15-16, 2019</td>
</tr>
<tr>
<td>Venue:</td>
<td>Four Seasons Hotel Cairo at the First Residence, Cairo, Egypt</td>
</tr>
<tr>
<td>Organized under the Auspices Of:</td>
<td>Prof. Dr. Khaled Abd El-Ghaffar, Minister of Higher Education and Scientific Research</td>
</tr>
<tr>
<td>Facilitators from the TROP ICSU Team:</td>
<td>Dr. Rahul Chopra, Ms. Anita Nagarajan</td>
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<tr>
<td>Speaker(s) from ASRT and NRC:</td>
<td>Prof. Dr. Mahmoud Sakr, Dr. Sameh Soror, Dr. Moemen Hanafy</td>
</tr>
<tr>
<td>Team of Coordinators/Helpers:</td>
<td>Team from the Academy of Scientific Research and Technology (ASRT), Egypt</td>
</tr>
<tr>
<td>Number of Participants:</td>
<td>95</td>
</tr>
<tr>
<td>Disciplines/Subjects Taught by Participants:</td>
<td>Animal Science; Agricultural Sciences; Architecture; Biochemistry; Biological Sciences; Biotechnology; Chemical Engineering; Chemistry; Climate Change; Computer Science; Energy and Resources Management; Entomology; Environmental Sciences; Fisheries; Food Science and Nutrition; Forensic Medicine and Toxicology; Genetic Engineering; Infectious Diseases; Linguistics; Marine Environment and Pollution; Material Science; Mathematics; Medicine; Music Education</td>
</tr>
</tbody>
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(Piano); Physics; Poultry Breeding and Genetics; Veterinary Medicine; Virology

A detailed listing of the disciplines is provided in

[Appendix I: Disciplines/Subjects Taught by the Participants](#).

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Summary of the Workshop

A 2-day workshop for university lecturers and professors was conducted in collaboration with the Academy for Scientific Research and Technology (ASRT) Egypt at Cairo, Egypt, on April 15 and 16, 2019. The workshop was attended by 95 participants, including lecturers and professors from universities in Egypt. Two representatives from the Young Earth System Scientists (YESS) community also participated in the workshop.

TROP ICSU is grateful for the tremendous support and help from ASRT in planning and organizing all the logistics and arrangements.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

The workshop commenced with welcome remarks from Prof. Dr. Sakr, President of ASRT. Next, Dr. Sameh Soror (ASRT) and Dr. Moemen Hanafy (National Research Center, Egypt) addressed the audience comprising lecturers and professors with expertise and experience in a wide range of disciplines. Then, the TROP ICSU team provided an overview of the TROP ICSU project and its teaching resources. Over the next one and a half days, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new lesson plan ideas.
to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples. Group representatives presented the new lesson plan frameworks and ideas and discussed plans on the adoption of these new lesson plans in the classroom. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.

TROP ICSU had also invited two members of its partner organization, the YESS community, to participate in the workshop. The YESS representatives from the meteorology field provided an overview of climate-related topics for the Egyptian context.

Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new
lesson plans and specifically, in the generation of lesson plan ideas that are relevant to classrooms in Egypt. Each group created a framework for one new lesson plan, and participants discussed steps for adopting the usage of the lesson plan in their teaching. Peer-to-peer discussions in groups enabled an exchange of ideas across disciplines and the development of new lesson plans.

Group Activity at the Workshop for Teachers, Cairo, Egypt

Group Activity at the Workshop for Teachers, Cairo, Egypt

Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 97% of the responses from the participants stated that the reviewed lesson plan was **very effective or moderately effective** in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** 97% of the responses from the participants indicated that the reviewed lesson plan was **very effective or moderately effective** in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** Approximately 88% of the responses from the participants indicated that they would use the lesson plan in their classroom as is or with some modifications.
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Detailed results for the lesson plan reviews are provided in Appendix II: Review of Lesson Plans by Participants.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 97% of the respondents thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

**Describing the tool:** Approximately 95% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** Approximately 84% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III: Review of Teaching Tools by Participants.

Details of the Workshop

Agenda and Overall Organization

The agenda of the two-day workshop was as follows:

- **Day 1:**
  - **Introductions of the participants:** Brief introductions including name, institution/organization affiliation, and disciplines/areas of specialization, expertise, teaching, and research
  - **Presentation by the Academy of Scientific Research and Technology (ASRT) Egypt:** Welcome remarks by Prof. Dr. Mahmoud Sakr; introduction to ASRT and its work; objectives of the workshop
  - Welcome remarks by Dr. Sameh Soror and Dr. Moemen Hanafy
  - **Presentations by the TROP ICSU team:** Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
  - **Group-based activity by the participants (groups organized by discipline):** Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms
Open discussion on the review of teaching resources

Group Activity at the Workshop for Teachers, Cairo, Egypt

- **Day 2: Introduction** to the components of a lesson plan

  **Presentation by YESS community representatives:** Introduction to and overview of topics related to climate change, including examples specific to Egypt; overview of the YESS community and its work

  **Group-based activity by the participants (groups organized by discipline):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

  **Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

  **Open discussions with participants:** Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

  **Closing remarks**
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Group Activity at the Workshop for Teachers, Cairo, Egypt

Discussions during a Group Activity at the Workshop for Teachers, Cairo, Egypt

Participant Feedback and Suggestions on Existing Teaching Resources

- Use videos with animated content instead of videos of in-class lectures
- Include datasets and examples specific to Egypt
- Provide translated versions (Arabic) of key teaching resources

Ideas for New Lesson Plans

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TROP ICSU is funded by the International Science Council (ISC)
Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Rheumatic Heart Disease and Climate Change (Medicine)
- Alienation and Inclusion in the Context of Climate Refugees (Humanities)
- Energy and Climate Change (Environmental Sciences)
- Marine Biodiversity and Climate Change (Biological Sciences)
- Electric Vehicles on a Smart Grid (Engineering, Environmental Sciences)
- Malignant Neoplasms and Climate Change (Dentistry)

Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in climate science or climate change with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.

- Participants found the hands-on, interactive group sessions to be very useful and engaging.

- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.

- Participants sought contextually relevant examples (Egypt) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.

- Teachers recommended the addition of new disciplines (such as Health Sciences, Medicine, and disciplines in Engineering)

- A participant suggested making the evaluation/feedback forms available on the website for a wider audience of teaching experts to provide their review comments

- Some feedback from participants:
  
  “It was fantastic workshop. Please try to expand the idea to primary and prep school levels. Thanks a lot”

  “Most of Students in developing countries have no access to internet in their labs, but they can easily use their mobile phone, so we have to pay further attention to the website in mobile version”

  “[Add] More videos and games”
“It is excellent event and it better to extend the workshop for three days”

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (Egypt, Africa) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Administration; Analytical Chemistry; Animal Molecular Genetics; Animal Reproductive Sciences; Animal Science; Agricultural Sciences; Architecture; Biochemistry; Biodiversity Conservation; Biological Control; Biological Sciences; Bioremediation and Biofertilizers; Biotechnology; Cell Biology, Histology and Immunohistochemistry; Chemical Engineering; Chemistry; Climate; Climate Change; Clinical Chemistry; Computer Science; Economic Entomology; Energy and Resources Management; Electric Power Systems (Engineering) Entomology; Environmental Architecture; Environmental Hygiene; Environmental Plant Diseases; Environmental Sciences; Fisheries; Food Hygiene and Control; Food Science and Nutrition; Forensic Medicine and Toxicology; Foundation of Child Education; Freshwater Pollution; Genetic Engineering; Genetic Markers of Pollution; Infectious Diseases; Inorganic Chemistry; Islamic History; Linguistics; Marine Biotechnology; Marine Environment and Pollution; Material Science; Mathematics; Medicine (Cardiology); Medicinal Plants; Microbial Genetics; Molecular Biology; Molecular Genetics; Music Education (Piano); Oral Pathology; Organic Chemistry; Pests and Plant Protection; Pharmaceutical Chemistry; Pharmaceutics and Industrial Pharmacy; Photobiology; Photovoltaic Energy; Physical Chemistry; Physics; Plant Ecology; Plant Pathology; Plant Protection; Poultry Breeding and Genetics; Poultry Physiology; Poultry Production; Renewable Energy (Solar Energy); Veterinary Medicine; Veterinary Pathology; Virology; Wheat Molecular Genomics; Zoology (Invertebrates)

Others: Assessor - Egyptian Accreditation Council
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?
   34 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?
   33 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

33 responses

8. Would you use this lesson plan in your classroom for your students?

34 responses
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

33 responses

![Pie chart showing response distribution]

- Very likely: 48.5%
- Likely: 48.5%
- Not very likely: 3%
- Unlikely: 0%

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TROP ICSU is funded by the [International Science Council (ISC)](https://isc.org)
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

38 responses

42.1% Very effective
55.3% Moderately effective
2.8% Somewhat effective
0% Not very effective
0% Not sure

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

38 responses

94.7% Yes
5.3% No
0% Do not know
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

38 responses

- Yes: 94.7%
- No: 5.3%
- Do not know: 0%

6. Would you use this teaching tool in your classroom for your students?

38 responses

- Yes: 31.6%
- Yes, with modifications: 7.9%
- No: 52.6%
- Unsure: 0%
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(https://tropicsu.org)

Report on the TROP ICSU Workshop for Teachers at Orsay, France

organized in collaboration with

Paris-Sud University (Université Paris-Sud)
(28 June 2019)

Workshop Title: ENSEIGNEMENT ET CHANGEMENT CLIMATIQUE

Date: June 28, 2019

Venue: Paris-Sud University (Université Paris-Sud)

Facilitators from the TROP ICSU Team: Ms. Anita Nagarajan, Dr. Nathalie Fomproix (IUBS)

Facilitator from the YESS community: Dr. Mohamadou Diallo

Organizing Team from Paris-Sud University: Dr. Catherine Even-Beaudouin, Dr. Jean-Michel Lourtioz, Ms. Anaïs Vergnolle

Number of Participants: 21

Disciplines/Subjects Taught by Participants: Biology, Chemistry, Computer Science, Earth and Life Sciences, English, Mathematics, Physics

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Climate Change Education across the Curriculum

Summary of the Workshop

A 1-day workshop for high school and undergraduate-level teachers was conducted in collaboration with Paris-Sud University (Université Paris-Sud) in Orsay, France, on June 28, 2019. The workshop was conducted in French and was attended by 21 participants teaching various disciplines. A representative from the Young Earth System Scientists (YESS) community also participated in the workshop.

TROP ICSU is grateful for the valuable support from Paris-Sud University (Université Paris-Sud) in planning and organizing the workshop.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

The workshop commenced with welcome remarks by Dr. Christine Paulin (Paris-Sud University (Université Paris-Sud)). Then, Dr. Nathalie Fomproix provided an introduction to the International Union of Biological Sciences (IUBS), the International Science Council (ISC), and the TROP ICSU project. The audience comprised high school-level and undergraduate-level teachers of various subjects/disciplines. Next, the TROP ICSU team provided an overview of the TROP ICSU project and its educational resources, including teaching tools and lesson plans. The YESS representative from the climate science field provided an overview of climate-related topics and useful resources.

In the second half of the day, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness
of the content. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples.

Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy and discipline perspective.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline**: 50% of the responses from the university lecturers stated that the reviewed lesson plan was *very effective or effective*, and 100% of the responses from the high school teachers stated that the reviewed lesson plan was *somewhat effective* in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science**: 50% of the responses from the university lecturers and 100% of the responses from the high school teachers indicated that the reviewed lesson plan was *very effective or effective* in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom**: 100% of the responses from the university lecturers and 100% of the responses from the high school teachers indicated that they *would use the lesson plan in their classroom as is or with some modifications*.

Detailed results for the lesson plan reviews are provided in Appendix II A: Review of Lesson Plans by Participants (University Lecturers) and Appendix II B: Review of Lesson Plans by Participants (High School Teachers).

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

**Explaining the topic(s) in the discipline**: Approximately 33% of the respondents among the university lecturers and approximately 50% of the respondents among the high school teachers thought that the reviewed tool was *very effective or effective* in explaining the topic(s) in the discipline.

**Describing the tool**: Approximately 58% of the responses from the university lecturers and 50% of the responses from the high school teachers stated that the *tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study*.
Using the tool in the classroom: 50% of the respondents among the university lecturers and 100% of the respondents among the high school teachers indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III A: Review of Teaching Tools by Participants (University Lecturers) and Appendix III B: Review of Teaching Tools by Participants (High School Teachers).

Details of the Workshop
Agenda and Overall Organization

The agenda of the one-day workshop was as follows:

- **Welcome remarks from Paris-Sud University (Université Paris-Sud):** Welcome remarks; objectives of the workshop

- **Welcome remarks and introduction from IUBS:** Welcome remarks; introduction to IUBS, ISC, and TROP ICSU

- **Presentations by the TROP ICSU team:** Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline

- **Presentation by climate expert from the YESS community**

- **Group-based activity by the participants (groups organized by discipline):** Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms

- **Discussions** on the review of teaching resources, overall feedback on the workshop, discussion on long-term engagement of participants with TROP ICSU

- **Closing remarks**
Participant Feedback and Suggestions on Existing Teaching Resources

- Include datasets and activities that are relevant to Europe
- Include more interactive activities for students
- Add model United Nations conference-style simulations on climate change; these would require students to do personal research and represent their chosen country’s needs
- Specify a problem statement at the beginning of each lesson plan
- **Game on Fossil Fuel Usage (Teaching Tool):**
  Several participants reported that one of the teaching resources listed on the TROP ICSU website—a game on future energy requirements and the energy sources to meet these requirements—appeared to be biased toward the usage of fossil fuels.
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Comments and feedback on the teaching tool: Teachers expressed concern that the game appeared to force players to choose traditional energy sources to meet future energy demands, thus creating a bias toward the usage of fossil fuels. They also stated that, in the game, cleaner energy sources seemed to be expensive always, thereby posing a possible deterrent to the choice of these cleaner sources.

Action taken by the TROP ICSU team:
The concerns raised by the participants were recorded by the TROP ICSU team. Subsequently, an in-depth review and analysis of the teaching tool was carried out by the TROP ICSU team and climate experts.

Response from the TROP ICSU team:
Following the review and analysis, a detailed response was sent to the participants. A summary of the response is provided below:

An analysis of the game does not show a bias toward any type of fuel usage. The main objective of the game is to produce required energy to meet the world’s energy demands with available money at hand while keeping carbon emissions low enough to minimize impacts on climate. It involves exploring various scenarios so that the player will understand the implications of our actions and choices. It increases the awareness of current limitations and helps the player to think about possible ideas for sustainable solutions in the future. While the simulation was made in 2010, the underlying science is found to be robust, no bias is observed, and the game is an informative and an interesting teaching tool that shows the reality of the economics of energy sources and links to climate change.

The team expressed gratitude to the participants for their detailed feedback and indicated a willingness and openness to address any further queries and concerns.

Key Takeaways and Learnings from the Workshop

- From observations during the workshop, the key learning for many teachers was: the idea of using and creating teaching resources that integrate topics in climate science or climate change with topics in their discipline.

- The Physics teachers stated that several available teaching tools in Physics are very useful for in-class teaching and as material for learning at home. They provided a few specific suggestions for further refinement of these tools.

- Some participants indicated that one of the teaching tools did not seem to be sufficiently objective, and therefore, they recommended a detailed analysis of all the tools to ensure their objectivity.
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- Participants sought contextually relevant examples (France, Europe) for their teaching; they suggested the inclusion of more simulations and examples relevant to or customized for France and Europe.

- Some feedback from participants:

  "Pour adapter ces outils et plans de cours à l'enseignement français, il faudrait rajouter les problématiques puis donner les objectifs pédagogiques au début."

  "... il faut vraiment tester les divers outils proposés afin d'être assurés de pouvoir les réinvestir en classe en toute objectivité."

  "... j'ai apprécié les échanges avec les collègues de différentes disciplines et ai pu recueillir auprès d'eux des pistes et des idées exploitées dans mes cours."

  “Globally the applets are very useful tools both for inclass teaching and material for home training.”

Next Steps

- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants

- Addition of new resources or enhancement of existing resources to include Europe-specific examples, cases studies, and activities
Appendix I: Disciplines/Subjects Taught by the Participants

Biology, Chemistry, Computer Science, Earth and Life Sciences, Earth Sciences, English, English for Scientists, Languages, Mathematics, Physics
Appendix II A: Review of Lesson Plans by Participants (University Lecturers) (in French)

2. Comment jugeriez-vous l'efficacité de ce plan de cours pour expliquer le(s) sujet(s) dans votre discipline?

2 responses

3. Comment jugeriez-vous l'utilité de ce plan de cours pour intégrer l'enseignement du changement climatique avec un/des sujet(s) dans votre discipline?

2 responses
7. À votre avis, l'utilisation de ce plan de cours dans votre classe améliorerait-elle la compréhension des élèves sur le changement climatique?

2 responses

8. Utiliserez-vous ce plan de cours dans votre classe ?

2 responses
10. Auriez-vous envie de créer votre propre plan de cours personnalisé pour enseigner des matières fondamentales dans votre discipline en utilisant un exemple, activité ou étude de cas liés au climat ?

2 responses

- Oui, certainement.
- Oui, probablement.
- Peut-être.
- Probablement non.

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TROP ICSU is funded by the International Science Council (ISC)
Appendix II B: Review of Lesson Plans by Participants (High School Teachers) (in French)

2. Comment jugeriez-vous l'efficacité de ce plan de cours pour expliquer le(s) sujet(s) dans votre discipline?

1 response

3. Comment jugeriez-vous l'utilité de ce plan de cours pour intégrer l'enseignement du changement climatique avec un/des sujet(s) dans votre discipline?

1 response
7. À votre avis, l'utilisation de ce plan de cours dans votre classe améliorerait-elle la compréhension des élèves sur le changement climatique?

1 response

8. Utiliserez-vous ce plan de cours dans votre classe ?

1 response
10. Auriez-vous envie de créer votre propre plan de cours personnalisé pour enseigner des matières fondamentales dans votre discipline en utilisant un exemple, activité ou étude de cas liés au climat ?

1 response

100%
Appendix III A: Review of Teaching Tools by Participants (University Lecturers) (in French)

2. Comment jugeriez-vous l’efficacité de cet outil pour expliquer le(s) sujet(s) dans votre discipline?
12 responses

3. La description de l’outil explique-t-elle de manière adéquate l’utilisation d’un exemple, activité ou étude de cas liés au changement climatique pour enseigner un sujet dans votre discipline?
12 responses
5. À votre avis, l'utilisation de cet outil d'apprentissage dans votre classe améliorerait-elle la compréhension des élèves sur le changement climatique?
12 responses

6. Utiliserez-vous cet outil comme ressource pédagogique dans un cours?
12 responses
Appendix III B: Review of Teaching Tools by Participants (High School Teachers) (in French)

2. Comment jugeriez-vous l'efficacité de cet outil pour expliquer le(s) sujet(s) dans votre discipline?

2 responses

4. La description de l'outil explique-t-elle de manière adéquate l'utilisation d'un exemple, activité ou étude de cas liés au changement climatique pour enseigner un sujet dans votre discipline?

2 responses
5. À votre avis, l'utilisation de cet outil d'apprentissage dans votre classe améliorerait-elle la compréhension des élèves sur le changement climatique?
2 responses

6. Utiliserez-vous cet outil comme ressource pédagogique dans un cours?
2 responses
Report on the TROP ICSU Workshop for Teachers at Melbourne, Australia

organized in collaboration with

Monash University, Australia

(24 May 2019)

Workshop Title: Workshop on CLIMATE CHANGE IN THE CLASSROOM

Date: May 24, 2019

Venue: Royal Society of Victoria, Melbourne, Australia

Facilitators from the TROP ICSU Team: Dr. Rahul Chopra, Ms. Anita Nagarajan

Facilitators and Organizing Team from Monash University: Dr. James Driscoll, Dr. Christian Jakob, Dr. Ailie Gallant

Number of Participants: 49

Disciplines/Subjects Taught by Participants: Environmental Science; Ethics and Morality; Geography; Humanities; Mathematics; Philosophy; Physics; Psychology; Science

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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  Participant Feedback and Suggestions on Existing Teaching Resources ........................................................................ 8
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Appendix I: Disciplines/Subjects Taught by the Participants .................. 10
Appendix II: Review of Lesson Plans by Participants .............................. 11
Appendix III: Review of Teaching Tools by Participants .......................... 14
Summary of the Workshop

A 1-day professional development workshop for high school teachers was conducted in collaboration with Monash University at the Royal Society of Victoria, Melbourne, Australia on May 24, 2019. The workshop was attended by 49 participants teaching various disciplines.

TROP ICSU is grateful for the valuable support from Monash University in planning and organizing the workshop.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans. A few talks and presentations on climate science and climate change in the Australian context were also on the agenda.

The workshop commenced with welcome remarks on behalf of Monash University and the TROP ICSU team. The participants were mainly high school level teachers of various subjects/disciplines from educational institutions and organizations in Victoria. The workshop included presentations by climate experts Christian Jakob and Ailie Gallant from Monash University, and a brief talk by Prof. John Buckeridge from RMIT and the Australian Academy of Science. The TROP ICSU team provided an overview of the TROP ICSU project and its educational resources, including teaching tools and lesson plans. The team from Monash University also demonstrated the Monash Simple Climate Model. In the second half of the day, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. In these
activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples.

Christian Jakob provided a wonderful fun element to the workshop through the “Molecule Vibration” dance, which had the entire audience on their feet, pretending to be CO₂ and CH₄ molecules!

A students' Climate Strike near the workshop venue on the same day stole everyone's attention for a few moments, reinforcing the need for urgent climate action.

Plenary Sessions at the Workshop for Teachers, Melbourne, Australia
Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy and discipline perspective.

Summary of the feedback received on the lesson plans from the TROP ICSU website

Explaining the topic(s) in the discipline: 100% of the responses from the participants stated that the reviewed lesson plan was very effective or moderately effective in explaining the topic in the discipline.
Integrating the discipline topic(s) with climate science: Approximately 83% of the responses from the participants indicated that the reviewed lesson plan was very effective or moderately effective in integrating the discipline topic(s) with climate science.

Using the lesson plan in the classroom: Approximately 83% of the responses from the participants indicated that they would use the lesson plan in their classroom as is or with some modifications.

Detailed results for the lesson plan reviews are provided in Appendix II: Review of Lesson Plans by Participants.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

Explaining the topic(s) in the discipline: Approximately 54% of the respondents thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

Describing the tool: Approximately 46% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

Using the tool in the classroom: Approximately 69% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III: Review of Teaching Tools by Participants.

Details of the Workshop
Agenda and Overall Organization

The agenda of the one-day workshop was as follows:

Welcome remarks from Monash University and TROP ICSU: Welcome and Objectives of the workshop

Presentations by climate experts from Monash University: “Climate Change Knowns and Unknowns” by Christian Jakob, Monash University; “Australian Climate and Climate Change” and “Mythbusters: The top bad arguments about climate change under the microscope” by Ailie Gallant, Monash University

Presentations by the TROP ICSU team: Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
A global project to integrate
Climate Change Education across the Curriculum

Group-based activity by the participants (groups organized by discipline): Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms

Discussions on the review of teaching resources, overall feedback on the workshop, discussion on long-term engagement of participants with TROP ICSU

Closing remarks

Group Activity at the Workshop for Teachers, Melbourne, Australia

Group Activity at the Workshop for Teachers, Melbourne, Australia

Website: https://tropicsu.org  |  Email: tropicsu@iubs.org
TROP ICSU is funded by the International Science Council (ISC)
Participant Feedback and Suggestions on Existing Teaching Resources

- One of the lesson plans in the Environmental Sciences assumes considerable background understanding of Chemistry. The lesson plan may, therefore, be inaccessible to Environmental Science teachers/students who do not have this prerequisite training.
- Scaffold higher-order thinking questions
- Add links to local policy

Key Takeaways and Learnings from the Workshop

- From observations during the workshop, the key learning for many teachers was: the idea of using and creating teaching resources that integrate topics in climate science or climate change with topics in their discipline.

- Some participants found the presentations from climate experts to be useful and relevant, while other participants thought they already had a good understanding of the background/theory of climate change.

- Some participants indicated that they would have preferred to explore the TROP ICSU resources as a pre-workshop activity and then, discuss these in more detail during the workshop. They were also keen on developing new resources (an activity typically included in a 2-day workshop, but not part of a 1-day workshop)
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- Participants sought contextually relevant examples (Australia) for their teaching; they suggested the inclusion of more simulations and examples relevant to or customized for Australia.

- One suggestion was to include discussions on climate change-related methods and resources that participants in the workshop are already implementing and using in the classroom.

- Some feedback from participants:
  
  "Excellent resource modify to Australian conditions"

  "Would be useful to incorporate some local examples using the interactive models to see impacts of sea level rise."

  “Place the additional resources in the lesson and ensure they are available to students through the activity section.”

  "Spend more time having teachers research the tools and work to create more for you..."

  "The morning sessions were a highlight - hearing about the latest climate change science and getting the details about the TROP ICSU resources. I was impressed with the philosophy of helping teachers integrate climate change issues into the standard curriculum. Having reliable resources to do this makes the objective achievable. Reviewing a teaching tool and detailed lesson plan was also a useful exercise as it helped me delve deeper into the resources..."

**Next Steps**

- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants

- Addition of new resources or enhancing existing resources to include Australia-specific examples, cases studies, and activities
Appendix I: Disciplines/Subjects Taught by the Participants

Environmental Education; Environmental Science; Ethics and Morality; General Science; Geography; Global Studies; Humanities; Mathematics; Philosophy; Physics; Psychology; Science; STEM
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?
   6 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?
   6 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

6 responses

![Pie chart showing 50% Yes, 33.3% No, and 16.7% Do not know.]

8. Would you use this lesson plan in your classroom for your students?

6 responses

![Pie chart showing 68.7% Yes, 16.7% Yes with modifications, 16.7% No, and 0% Unsure.]

Website: [https://tropicsu.org](https://tropicsu.org)  |  Email: tropicsu@iubs.org
TROP ICSU is funded by the International Science Council (ISC)
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

6 responses

- Very likely: 33.3%
- Likely: 16.7%
- Not very likely: 50%
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

13 responses

30.8% Very effective
30.8% Moderately effective
23.1% Somewhat effective
7.7% Not very effective
7.7% Not sure

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

13 responses

46.2% Yes
15.4% No
38.5% Do not know

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TROP ICSU is funded by the International Science Council (ISC)
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

13 responses

6. Would you use this teaching tool in your classroom for your students?

13 responses
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TROP ICSU: Trans-disciplinary Research Oriented Pedagogy for
Improving Climate Studies and Understanding
(https://tropicsu.org)

Report on the TROP ICSU Workshop for Teachers at Vidya Valley School, Pune, India
(29 June 2019)

Workshop Title: A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS

Date: June 29, 2019

Venue: Vidya Valley School

Facilitators from the TROP ICSU Team: Dr Rahul Chopra, Dr Megha Nivsarkar

Team of Coordinators/Helpers: Mrs Kavita Marwah and the team of volunteers from Vidya Valley School

Number of Participants: 34

Disciplines/Subjects Taught by Participants: Biology, Chemistry, Physics, Computer Science, Mathematics, History, Geography, Civics, Economics, Hindi, English, and French.

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Appendix III: Review of Teaching Tools by Participants .................................................................... 13
Summary of the Workshop

A 1-day workshop for primary, middle and high school teachers was conducted in collaboration with Vidya Valley School, Pune, India, on June 29, 2019. The workshop was attended by 34 participants who teach various disciplines.

TROP ICSU is grateful for the tremendous support and help from the Principal of Vidya Valley School Mrs Nalini Sengupta and Mrs Kavita Marwah in planning and organizing all the logistics and arrangements for the workshop.

The objective of the workshop was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.

Group Photo: Workshop for Teachers, Vidya Valley School, Pune, India

The workshop commenced with welcome remarks from Mrs Kavita Marwah, Vidya Valley School. Then, the TROP ICSU team provided an overview of the TROP ICSU project and its teaching resources. Over the course of the day, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new lesson plan ideas to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples. Group representatives presented the new lesson plan frameworks and ideas and discussed plans on the adoption of these new lesson plans in the classroom. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.
Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new lesson plans and specifically, in the generation of lesson plan ideas that are relevant to classrooms and teaching levels in India. Each group created a framework for one new lesson plan, and participants discussed steps for adopting the usage of the lesson plan in their teaching. Peer-to-peer discussions in groups enabled an exchange of ideas across disciplines and the development of new lesson plans.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 78% of the responses from the participants stated that the reviewed lesson plan was very effective or moderately effective in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** Approximately 78% of the responses from the participants indicated that the reviewed lesson plan was very effective or moderately effective in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** Approximately 89% of the responses from the participants indicated that they would use the lesson plan in their classroom as is or with some modifications.

Detailed results for the lesson plan reviews are provided in Appendix II: Review of Lesson Plans by Participants.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 63% of the respondents thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

**Describing the tool:** 75% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** 100% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III: Review of Teaching Tools by Participants.
Details of the Workshop
Agenda and Overall Organization

The agenda of the one-day workshop was as follows:

- **Welcome remarks** by Mrs. Kavita Marwah (Vidya Valley School)

- **Presentations by the TROP ICSU team**: Introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline

- **Group-based activity by the participants (groups organized by discipline)**: Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms

- **Open discussion** on the review of teaching resources

- **Introduction** to the components of a lesson plan

- **Group-based activity by the participants (groups organized by discipline)**: Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

- **Presentation of new lesson plans by participants**: Brief summary of the lesson plan topic and tools/resources by each group

- **Open discussions with participants**: Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

- **Closing remarks** by Mrs Nalini Sengupta (Principal, Vidya Valley School)

Group Activity at the Workshop for Teachers, Vidya Valley School, Pune, India
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*Climate Change Education across the Curriculum*

Presentation of a Lesson Plan at the Workshop for Teachers, Vidya Valley School, Pune, India

Participant Feedback and Suggestions on Existing Teaching Resources

- Align the teaching objectives with the prescribed syllabus
- Include resources for primary and secondary school levels
- Include more hands-on activities like laboratory and classroom experiments
- Provide more resources for teaching the languages and literature
- Offer graphic organizers of lesson plans to navigate within resources
- Include a section on application of topics in discipline in real world scenarios

Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Acids, Bases, Salts and Environmental Acidification (Chemistry)
- Changing Rainfall Patterns in Maharashtra (primary school, Geography)
- मानव और जलवायु (Human and Climate) (Hindi Language)
- Global Warming and the Greenhouse Effect (Physics)
- Photosynthesis and Climate Change (Biology)
- Indian Monsoon and Climate Change (Geography)
- Urban Pollution and Climate Change (French Language)
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- Teaching Tenses through Climate Literature (primary school, English Language)
- Local Temperature Variation and Climate (primary school, Mathematics)

**Key Takeaways and Learnings from the Workshop**

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in climate science or climate change with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.

- Participants found the hands-on, interactive group sessions to be very useful and engaging.

- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.

- Teachers found it helpful to listen to the ideas and presentations of participants from other disciplines.

**Next Steps**

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop

- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants

- Addition of region-specific (Pune, Maharashtra, India) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Science (Biology, Chemistry, Physics, Computer Science, and Mathematics), Social Studies (History, Geography, Civics, Economics and Economic Applications) and Languages (Hindi, Marathi, English, and French)
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

9 responses

- Very effective: 44.4%
- Moderately effective: 33.3%
- Somewhat effective: 11.1%
- Not very effective: 11.1%
- Not sure: 11.1%

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

9 responses

- Very effective: 55.6%
- Moderately effective: 22.2%
- Somewhat effective: 11.1%
- Not very effective: 11.1%
- Not sure: 11.1%
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7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?
9 responses

- Yes: 77.8%
- No: 22.2%
- Do not know: 0%

8. Would you use this lesson plan in your classroom for your students?
9 responses

- Yes: 77.9%
- Yes, with modifications: 11.1%
- No: 11.1%
- Unsure: 0%
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

9 responses

- Very likely: 66.7%
- Likely: 33.3%
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?
8 responses

- Very effective: 25%
- Moderately effective: 50%
- Somewhat effective: 12.5%
- Not very effective: 12.5%
- Not sure: 0%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?
8 responses

- Yes: 75%
- No: 12.5%
- Do not know: 12.5%

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TROP ICSU is funded by the International Science Council (ISC)
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

8 responses

- Yes: 87.5%
- No: 12.5%
- Do not know: 0%

6. Would you use this teaching tool in your classroom for your students?

8 responses

- Yes: 75%
- Yes, with modifications: 25%
- No: 0%
- Unsure: 0%
# TROP ICSU: Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding

**Website:** [https://tropicsu.org](https://tropicsu.org)  
**Email:** tropicsu@iubs.org

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**Report on the TROP ICSU Workshop for Teachers at Pretoria, South Africa,**

organized in collaboration with

**The International Science Council - Regional Office for Africa (ISC ROA)**  
(2-3 April 2019)

<table>
<thead>
<tr>
<th>Workshop Title:</th>
<th>A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>April 2-3, 2019</td>
</tr>
<tr>
<td>Venue:</td>
<td>The Regency Apartment Hotel Menlyn, Pretoria, South Africa</td>
</tr>
<tr>
<td>Facilitator(s) from the TROP ICSU Team:</td>
<td>Ms. Anita Nagarajan</td>
</tr>
<tr>
<td>Facilitator(s) from ISC ROA:</td>
<td>Dr. Richard Glover, Dr. Daniel Nyanganyura</td>
</tr>
<tr>
<td>Team of Coordinators/Helpers from the International Science Council – Regional Office for Africa:</td>
<td>Mr. Bongani Mahlalela, Ms. Nomasomi Gasa</td>
</tr>
<tr>
<td>Number of Participants:</td>
<td>29</td>
</tr>
<tr>
<td>Disciplines/Subjects Taught by Participants:</td>
<td>Anthropology, Biological Sciences, Environmental Sciences, Finance and Investment, Medical Geology, Medical Imaging, Public Health Medicine, Sociology, Theology, Climate Change</td>
</tr>
</tbody>
</table>

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Appendix III: Review of Teaching Tools by Participants ............................................................... 15
Summary of the Workshop

**A two-day workshop for university lecturers and professors** was conducted in collaboration with the International Science Council – Regional Office for Africa (ISC ROA) at Pretoria, South Africa, on April 2 and 3, 2019. The workshop was attended by 29 participants, including lecturers and professors from universities in Pretoria and Johannesburg. A representative from the Young Earth System Scientists (YESS) community also participated in the workshop.

TROP ICSU is grateful for the tremendous support and help from ISC ROA in planning and organizing all the logistics and arrangements.

The objective of the workshop was to **introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities.** In addition, participants would be invited to **review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.**

The workshop commenced with an introduction to the International Science Council – Regional Office for Africa (ISC ROA) by Dr. Daniel Nyanganyura, Regional Director of ISC ROA. A round of brief introductions by all participants was also on the agenda. Lecturers and professors from the University of Johannesburg, the University of the Witwatersrand, Sefako Makgatho Health Sciences University, the University of Pretoria, the University of South Africa (UNISA), and Tshwane University of Technology (TUT) attended the workshop. Then, participants attended a few plenary sessions for an **overview of the TROP ICSU project** and its teaching resources. Over the next one and a half days, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various **teaching tools** and **lesson plans** from the TROP ICSU website. They reviewed the teaching resources
from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new transdisciplinary and multidisciplinary lesson plan ideas to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas that could be used across disciplines. Group representatives presented the new lesson plan frameworks and ideas and discussed plans for the adoption of these new lesson plans in the classroom. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.

TROP ICSU had also invited a member of its partner organization, the YESS community, to participate in the workshop. The YESS representative from the University of Cape Town provided an overview of climate-related and climate change-related resources that would be useful in the South African context.

Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the creation of new lesson plans and specifically, in the generation of multidisciplinary ideas that are relevant and specific to South Africa. Each group created a framework for one new lesson plan, and participants discussed steps for adopting the lesson plan in their teaching. Peer-to-peer discussions in groups enabled an exchange of ideas across disciplines and the development of new lesson plans.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** Approximately 92% of the responses from the participants stated that the reviewed lesson plan was *very effective or moderately effective* in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** Approximately 77% of the responses from the participants indicated that the reviewed lesson plan was *very effective or moderately effective* in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** 100% of the responses from the participants indicated that they *would use the lesson plan in their classroom as is or with some modifications.*
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Detailed results for the lesson plan reviews are provided in Appendix II: Review of Lesson Plans by Participants.

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

Explaining the topic(s) in the discipline: Approximately 87% of the respondents thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

Describing the tool: Approximately 93% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

Using the tool in the classroom: 100% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III: Review of Teaching Tools by Participants.

Details of the Workshop
Agenda and Overall Organization

The agenda of the two-day workshop was as follows:

- **Day 1:**
  - Introductions of the participants: Brief introductions including name; institution/organization affiliation; and disciplines/areas of specialization, expertise, teaching, and research
  - Presentation by the International Science Council – Regional Office for Africa (ISC ROA): Welcome remarks; introduction to ISC ROA and its work; objectives of the workshop
  - Presentations by the TROP ICSU team: Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline
  - Group-based activity by the participants (groups organized by discipline): Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms
  - Open discussion on the review of teaching resources
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Group Activity at the Workshop for Teachers, Pretoria, South Africa

- **Day 2:**
  - **Introduction** to the components of a lesson plan

  **Presentation by YESS community representative:** Introduction to and overview of resources and tools related to climate change, including examples specific to South Africa

  **Group-based activity by the participants (groups organized by discipline):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

  **Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

  **Open discussions with participants:** Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

  **Closing remarks**

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Development of Lesson Plan Ideas at the Workshop for Teachers, Pretoria, South Africa
Participant Feedback and Suggestions on Existing Teaching Resources

- Make it contextually relevant
- Use flipped classroom method where appropriate
- Align all materials to the same case study

Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Municipal Solid Waste and Climate Change (Environmental Engineering Science)
- Commercial Forestry and Climate Change (Environmental Sciences, Agriculture, Forestry)
- Climate Change and Biodiversity, specific to the South African context (Biological Sciences)
- Climate Change and Food Security, Climate Change and Agriculture, with examples specific to South Africa (Social Sciences, Environmental Science, Agriculture)
Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in climate science or climate change with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.

- Participants found the hands-on, interactive group sessions to be very useful and engaging.

- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.

- Participants sought contextually relevant examples (South Africa) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.

- Many participants thought that it would be more useful if the learning outcomes were placed at the start of a lesson plan.

- Teachers recommended the addition of new disciplines (such as Health Sciences, Medicines, Computer Science, and Law).

- A participant recommended the implementation of a more granular and appropriate classification of disciplines under the Social Sciences.

- Some feedback from participants:
  
  “Thank you for exposing me to a new topic and allowing the opportunity to network and work with colleagues in other domains.”

  “Great workshop, thank you. Some suggestions will be e-mailed separately.”

  “[Include] video clips relevant to specific topics”

  “The resources shown in this workshop make it easy to include climate change in our curriculum. The workshop has been an eye-opener. It exposed us to many resources.”

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
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- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (South Africa, Africa) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Anthropology; Biological Sciences; Biology Education; Engineering; Environmental Geology; Environmental Health Science; Environmental Sciences; Food Security and Environmental Management; Finance and Investment; Geography; ICT; Law; Life Sciences; Medical Geology; Medical Imaging; Public Health Medicine; Sociology; Systems Analysis and Climate Change; Theology
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?
   13 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?
   13 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

13 responses

- Yes: 84.6%
- No: 15.4%
- Do not know: 0%

8. Would you use this lesson plan in your classroom for your students?

13 responses

- Yes: 92.3%
- Yes, with modifications: 7.7%
- No: 0%
- Unsure: 0%
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

13 responses

- Very likely: 69.2%
- Likely: 23.1%
- Not very likely: 7.7%
- Unlikely: 0%
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

15 responses

- Very effective: 66.7%
- Moderately effective: 20%
- Somewhat effective: 8%
- Not very effective: 4%
- Not sure: 0%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

15 responses

- Yes: 93.3%
- No: 5%
- Do not know: 2%
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

15 responses

[Chart showing 88.7% Yes]

6. Would you use this teaching tool in your classroom for your students?

15 responses

[Chart showing 93.3% Yes]

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TROP ICSU is funded by the International Science Council (ISC)
# Report on the TROP ICSU Workshop for Teachers at Tirupati, India,
organized in collaboration with

**The Indian Institute of Technology Tirupati (IIT Tirupati), India**
(27 April 2019)

<table>
<thead>
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<th>A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: EDUCATIONAL RESOURCES FOR TEACHERS</th>
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</thead>
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<td><strong>Date:</strong></td>
<td>April 27, 2019</td>
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<td><strong>Venue:</strong></td>
<td>Indian Institute of Technology Tirupati (IIT Tirupati), India</td>
</tr>
<tr>
<td><strong>Facilitators from the TROP ICSU Team:</strong></td>
<td>Dr. Rahul Chopra, Ms. Anita Nagarajan</td>
</tr>
<tr>
<td><strong>Facilitators and Organizing Team from IIT Tirupati:</strong></td>
<td>Dr. Suresh Jain, Dr. Roshan Srivastav, Dr. Chandra Sekhar Bahinipati</td>
</tr>
<tr>
<td><strong>Team of Coordinators/Helpers:</strong></td>
<td>Team of volunteers from the Indian Institute of Technology Tirupati (IIT Tirupati), India</td>
</tr>
<tr>
<td><strong>Number of Participants:</strong></td>
<td>42</td>
</tr>
<tr>
<td><strong>Disciplines/Subjects Taught by Participants:</strong></td>
<td>Biomedical Instrumentation, Human Anatomy and Physiology; Building Materials and Construction; Chemistry; Computer Applications; Data Science, Data Mining; Concrete Technology; Economics; Electrical and Electronics Engineering; Engineering Physics; Engineering Mechanics; English; Environmental Engineering; Geology; Mathematics; Neural Engineering; Transportation Engineering; Water Resources Engineering; and others</td>
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A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Summary of the Workshop

A **1-day workshop for undergraduate-level teachers** was conducted in collaboration with the Indian Institute of Technology (IIT) Tirupati at Tirupati, India, on April 27, 2019. The workshop was attended by 42 participants teaching various disciplines.

TROP ICSU is grateful for the tremendous support and help from IIT Tirupati in planning and organizing the workshop.

The objective of the workshop was to **introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities.** In addition, participants would be invited to **review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.**

The workshop commenced with welcome remarks from Prof. K. Satyanarayana, Director of IIT Tirupati. Dr. Suresh Jain, Associate Professor, IIT Tirupati, also addressed the audience comprising undergraduate-level lecturers and professors with expertise and experience in a wide range of disciplines. Then, the TROP ICSU team provided an overview of the **TROP ICSU project** and its teaching resources. In the second half of the day, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various **teaching tools** and **lesson plans** from the TROP ICSU website. They reviewed the teaching resources from the pedagogical and ease-of-use perspectives and provided feedback (via online review forms) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in groups to develop new lesson plan ideas to teach topics in various disciplines using climate-related and climate change-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas for effective teaching using relevant examples. Group representatives presented the new lesson plan frameworks and ideas. The workshop concluded with a brief discussion on continued engagement and collaboration with the TROP ICSU project.
Overall, the participants were keen on exploring ways to integrate climate science/climate change-related topics in their existing curriculum. They provided critical feedback on the existing teaching resources from the pedagogy perspective. Further, they actively participated in the discussion and creation of new lesson plan frameworks. Each group created a framework for one new lesson plan, and group representatives presented their ideas.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** 100% of the responses from the participants stated that the reviewed lesson plan was **very effective or moderately effective** in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** Approximately 92% of the responses from the participants indicated that the reviewed lesson plan was **very effective or moderately effective** in integrating the discipline topic(s) with climate science.

**Using the lesson plan in the classroom:** 100% of the responses from the participants indicated that they would **use the lesson plan in their classroom as is or with some modifications.**
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Detailed results for the lesson plan reviews are provided in *Appendix II: Review of Lesson Plans by Participants.*

**Summary of the feedback received on the teaching tools curated on the TROP ICSU website**

**Explaining the topic(s) in the discipline:** Approximately 89% of the respondents thought that the reviewed tool was *very effective or moderately effective* in explaining the topic(s) in the discipline.

**Describing the tool:** Approximately 92% of the responses stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

**Using the tool in the classroom:** 100% of the respondents indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in *Appendix III: Review of Teaching Tools by Participants.*

**Details of the Workshop**

**Agenda and Overall Organization**

The agenda of the one-day workshop was as follows:

- **Introductions of the participants:** Brief introductions including name, institution/organization affiliation, and disciplines/areas of specialization, expertise, teaching, and research

- **Welcome address and opening speech by the Indian Institute of Technology (IIT) Tirupati:** Welcome remarks by Prof. K. Satyanarayana, Director of IIT Tirupati; introduction to IIT Tirupati; objectives of the workshop
  
  Welcome remarks by Dr. Suresh Jain, Associate Professor, IIT Tirupati

- **Presentations by the TROP ICSU team:** Welcome remarks; introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline

- **Group-based activity by the participants (groups organized by discipline):** Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); providing feedback on teaching resources through online review forms
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**Group-based activity by the participants (groups organized by discipline):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

**Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

**Open discussion** on the review of teaching resources, overall feedback on the workshop, discussion on long-term engagement of participants with TROP ICSU

**Closing remarks**

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Group Activity at the Workshop for Teachers, IIT Tirupati, India
Presentations and Open Discussion at the Workshop for Teachers, IIT Tirupati, India

Participant Feedback and Suggestions on Existing Teaching Resources

- Add teaching resources for the Engineering disciplines
- Include teaching resources for Computer Science
- Organize and host webinars for dissemination of the project and its resources
Ideas for New Lesson Plans

Some of the new lesson plan ideas and frameworks created by the participants were on the following topics:

- Developing Language Skills through Climate-related Resources (English) (Identifying idioms and phrases, collocation, tags, connectives, etc.)
- Impact of Climate Change on Various Diseases in Humans: Study and Analysis using various Datasets and Tools (Computer Science and Engineering)
- Rise in CO$_2$ levels and Climate Change (Chemistry, Environmental Sciences, Earth Sciences)
- Renewable Sources of Energy: Solar Energy (Physics)
- Analysis and Interpretation of Climate Data by using Data Mining (Computer Science)
- Environmental Impacts of Combustion (Chemistry)
- Descriptive Statistics for Rainfall Data by using R-programming (Statistics)
- Particulate Matter and Climate (Civil Engineering)
- The Hydrological Cycle (Chemistry, Environmental Sciences, Earth Sciences, Water Resources)

Key Takeaways and Learnings from the Workshops

- From observations during the workshop, the key learnings for the teachers were: the idea of using teaching resources that integrate topics in climate science or climate change with topics in their discipline and the concept of creating new lesson plans that could be used across disciplines.
- Participants found the hands-on, interactive group sessions to be very useful and engaging.
- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.
- Participants sought contextually relevant examples (Tirupati, South India, India) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.
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- Teachers recommended the addition of new disciplines (such as Computer Science and various disciplines in Engineering).

- Some participants suggested holding a 2-day workshop instead of a 1-day event in order to explore the resources in more detail and to develop more complete lesson plans.

- Some feedback from participants:
  
  "Innovative and Modern Methods for teaching"
  
  "Please conduct Webinars"
  
  "Better to continue the duration to one more day for better results"
  
  "Computer Science Courses related specific tools like R-Tool, Orange, WEKA and etc. can be used"
  
  "It's great work and it is also better to add Engineering branches also"
  
  "Available resources are quite good"

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop

- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants

- Addition of region-specific (India) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

Big Data; Biomedical Instrumentation, Biomaterials and Artificial Organs, Biomedical Signal Processing, Mechanics of Biological Systems, Human Anatomy and Physiology, Medical Physics, Clinical Engineering; Building Materials and Construction; Chemistry; Computer Applications; Computer Organization; Computers; Data Analytics, Data Science, Deep Learning, Machine Learning; Data Mining; Design and Drawing of Reinforced Concrete Structures (DDRCS), Surveying, Concrete Technology, Pre-stressed Concrete; Digital Signal Processing; Economics; Electrical and Electronics Engineering; Engineering Chemistry; Engineering Mechanics, Heat Transfer, Manufacturing Technology, Thermal Engineering; Engineering Physics; English; Environmental Engineering, Environmental Impact Assessment and Mitigation; Environmental Science; Geology; Ground Water Quality; Hydraulics and Hydraulic Machinery (HHM), Water Resources Engineering; Human Resource Management; Management; Managerial Economics, Accountancy, and Finance; Mathematics; Mechanical Engineering; Neural Engineering; Signals and Systems; Software Engineering; Strength of Materials; Transportation Engineering; Water Resources Engineering
Appendix II: Review of Lesson Plans by Participants

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

26 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

26 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?
26 responses

8. Would you use this lesson plan in your classroom for your students?
26 responses
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

26 responses

- Very likely: 65.4%
- Likely: 34.6%
- Very unlikely: 0%
- Likely: 0%
- Not very likely: 0%
Appendix III: Review of Teaching Tools by Participants

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

37 responses

- Very effective: 51.4%
- Moderately effective: 37.8%
- Somewhat effective: 1.6%
- Not very effective: 2.7%
- Not sure: 3.7%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

36 responses

- Yes: 91.7%
- No: 8.3%
- Do not know: 0%
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

36 responses

- Yes: 91.7%
- No: 3.3%
- Do not know: 5%

6. Would you use this teaching tool in your classroom for your students?

36 responses

- Yes: 33.3%
- Yes, with modifications: 66.7%
**TROP ICSU: Transdisciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding**

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**Report on the TROP ICSU Workshops for Teachers at Kampala, Uganda, organized in collaboration with The African Union of Conservationists (AUC) (27-30 November 2018)**

**Workshop Title:** A Faculty Development Program cum Workshop on CLIMATE ACROSS THE CURRICULUM: RESOURCES FOR INTEGRATING CLIMATE TOPICS IN DISCIPLINE-SPECIFIC TEACHING

**Date:** November 27-28, 2018 (for University Lecturers)
November 29-30, 2018 (for High School Teachers)

**Venue:** Kampala Kolping Hotel, Kampala, Uganda

**Facilitators from the TROP ICSU Team:** Dr. Rahul Chopra, Ms. Anita Nagarajan, Ms. Aparna Joshi

**Facilitators from AUC:** Mr. Raymond Katebaka, Dr. Daniel Waiswa

**Team of Coordinators/Helpers from AUC:** Mr. Denis Lukato, Ms. Doreen Namawaza, Mr. Steven Swilliri, Mr. Richard Bavakure, Mr. Godfrey Tumuhairwe, Ms. Phionah Kansiime, Mr. Reuben Katwinomugisha

**Number of Participants:**
- Workshop for University Lecturers: 88
- Workshop for High School Teachers: 73

**Disciplines/Subjects Taught by Participants:**

**University Lecturers:** Biological Sciences, Environmental Sciences, Meteorology, Social Science, Agriculture, Social Administration, Geography, Mathematics, Computer and Telecom Engineering, Economics, Humanities

**High School Teachers:** Biological Sciences, Mathematics, History, Geography, Chemistry, Literature, Agriculture, Social Science, English, Physics, ICT, Environmental Education

A detailed listing of the disciplines is provided in Appendix I: Disciplines/Subjects Taught by the Participants.
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Summary of the Workshops

Two TROP ICSU workshops—a 2-day workshop for university lecturers and a 2-day workshop for high school teachers—were conducted in collaboration with the African Union of Conservationists (AUC) at Kampala, Uganda, from November 27 to November 30, 2018. The workshops included not only participants from different parts of Uganda, but also representatives from countries such as Tanzania, Kenya, Burundi, and Rwanda.

TROP ICSU recognizes the invaluable support and the dedicated efforts of the AUC and its coordination team in inviting participants from various countries and locations, in planning and organizing all the logistics and arrangements, and in personally visiting many schools to encourage teachers to participate in the workshops.

The objective of the workshops was to introduce the participants to digital teaching resources for teaching topics in the Sciences, Mathematics, Social Sciences, and Humanities using climate-related examples, case studies, and activities. In addition, participants would be invited to review the educational resources of the TROP ICSU project and to provide their feedback on the appropriateness and ease-of-use of the teaching tools and lesson plans.
The workshops began with an introduction to AUC and its work and an overview of the objectives of the faculty development program cum regional workshop. Then, participants attended a few plenary sessions for an overview of the TROP ICSU project and its teaching resources. Over the next one and a half days, the teachers/educators worked in groups to carry out hands-on, interactive activities by using various teaching tools and lesson plans from the TROP ICSU website. They provided review comments about the teaching resources (via an online review form) to help in further enhancing the quality and effectiveness of the content. Further, participants worked in discipline-based groups to develop new lesson plan ideas to teach topics in their discipline using climate-related examples. In these activities, participants engaged in peer-to-peer discussions and exchanged ideas. The workshop concluded with presentations on new lesson plan frameworks and ideas and an open discussion on continued engagement and collaboration with the TROP ICSU project.

The AUC had extended an invitation for participation to the National Curriculum Development Center (NCDC), Uganda, which was accepted. The representative from NCDC attended and actively participated in both the workshops. Workshop participants had the opportunity to interact with the representative from NCDC in a dedicated session focused on the exchange of ideas, questions and answers, and suggestions between teachers/educators and the central curriculum development authority. The discussions in these sessions triggered ideas for next steps in incorporating digital pedagogy and climate-change related teaching resources in classrooms across Uganda.

The AUC had also invited a member of the Uganda National Council for Science and Technology (UNCST) to participate in the workshop. His active participation and recognition of the importance of using the educational resources from the TROP ICSU project may play a key role in disseminating the learnings from the workshops across Uganda.
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Plenary Session at the Workshop for University Lecturers, Kampala, Uganda

Plenary Session at the Workshop for High School Teachers, Kampala, Uganda

Overall, the participants were keen on learning about the usage of digital teaching resources in the classroom and to integrate climate science/climate change-related topics in their existing curriculum. They also actively participated in the creation of new lesson plans and specifically, in the generation of ideas that are locally relevant to Africa as a continent or to one of the countries/regions in Africa. Each group created a framework for one new lesson plan for their discipline. Peer-to-peer discussions in groups enabled an exchange of several ideas, a debate on effective teaching practices in classrooms, and refinement and strengthening of lesson plan ideas.
Summary of the feedback received on the lesson plans from the TROP ICSU website

**Explaining the topic(s) in the discipline:** 100% of the responses from the university lecturers and 100% of the responses from the high school teachers stated that the reviewed lesson plan was very effective or moderately effective in explaining the topic in the discipline.

**Integrating the discipline topic(s) with climate science:** Approximately 93% of the responses from the university lecturers and approximately 92% of the responses from the high school teachers indicated that the reviewed lesson plan was very effective or moderately effective in integrating the discipline topic(s) with climate science.
Using the lesson plan in the classroom: 100% of the responses from the university lecturers and 100% of the responses from the high school teachers indicated that they would use the lesson plan in their classroom as is or with some modifications.

Detailed results for the lesson plan reviews are provided in Appendix II A: Review of Lesson Plans by Participants (University Lecturers) and Appendix II B: Review of Lesson Plans by Participants (High School Lecturers).

Summary of the feedback received on the teaching tools curated on the TROP ICSU website

Explaining the topic(s) in the discipline: Approximately 89% of the respondents among the university lecturers and 100% of the respondents among the high school teachers thought that the reviewed tool was very effective or moderately effective in explaining the topic(s) in the discipline.

Describing the tool: Approximately 89% of the responses from the university lecturers and approximately 94% of the responses from the high school teachers stated that the tool description adequately shows how the discipline topic can be taught using a climate-related example, activity, or case study.

Using the tool in the classroom: 100% of the respondents among the university lecturers and 100% of the respondents among the high school teachers indicated that they would use the reviewed tool in their classroom as is or with some modifications.

Detailed results for the teaching tool reviews are provided in Appendix III A: Review of Teaching Tools by Participants (University Lecturers) and Appendix III B: Review of Teaching Tools by Participants (High School Teachers).

Details of the Workshops

Agenda and Overall Organization

The agenda of each two-day workshop was as follows:

- **Day 1:**
  - Presentations by AUC: Welcome remarks, objectives of the workshop, introduction to AUC and its work
  - Presentations by the TROP ICSU team: Introduction to the TROP ICSU project, overview and demonstration of teaching resources (teaching tools and lesson plans) by using examples from each discipline

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TROP ICSU is funded by the [International Science Council (ISC)](https://www.isc.org)
Group-based activity by the participants (groups organized by disciplines): Review of discipline-specific teaching resources available on the TROP ICSU website (one lesson plan and one teaching tool per group); fill out the review form for teaching resources

Discussion on the review of teaching resources

Group Activity at the Workshop for University Lecturers, Kampala, Uganda

Day 2:

Introduction to the components of a lesson plan

Group Activity at the Workshop for High School Teachers, Kampala, Uganda
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**Group-based activity by the participants (groups organized by disciplines):** Creation of a new lesson plan based on an idea that integrates a climate topic with their regular teaching

**Presentation of new lesson plans by participants:** Brief summary of the lesson plan topic and tools/resources by each group

**Presentation by the representative from the National Curriculum Development Center (Uganda),** followed by a Q&A session with the participants

**Open discussions with participants:** Feedback on the workshop and discussions on long-term engagement of participants with TROP ICSU

**Closing remarks**

Feedback and Discussion at the Workshop for University Lecturers, Kampala, Uganda
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Participant Feedback and Suggestions on Existing Teaching Resources
- Include more examples and case studies that reflect the African context
- Include objectives in the lesson plan
- Reduce the number of activities in the lesson plan
- Narrow the scope of questions
- Provide offline versions because many classrooms lack an Internet connection
- Incorporate more local examples and data

Ideas for New Lesson Plans
- Climate Change and Biodiversity, example of East Africa’s mountain gorilla (Biological Sciences, Geography)
- Climate Change and Pollination (Biological Sciences)
- Impact of Climate Change on Crop Production, example of rice in Uganda (Geography, Agriculture, Environmental Sciences)
- Climate Change and Extreme Events, examples from Africa (Environmental Sciences)
- Climate Change, Droughts, and Food Production, examples from Uganda (Agriculture)
- International Trade and Climate Change (Economics)
- Climate Change and Poverty (Economics)
- Graphical Representation of Greenhouse Gas Emissions Data from Different Energy Sources (Statistics)
Key Takeaways and Learnings from the Workshops

- The use of digital pedagogy and computer-based tools was a novel idea to several participants (especially for the high school teachers); for these participants, the exploration and use of videos and online readings was relevant and effective as a first step.

- Overall, the university lecturers were comfortable with the use of computers and digital resources; however, the structure and usage of a lesson plan appeared to be a novel idea for them. From observations during the workshop, the key learnings for the university lecturers were: the use of digital pedagogy, the creation and usage of lesson plans, and the idea of integrating climate topics with topics in their discipline.

- Overall, the high school teachers were familiar with the creation and usage of lesson plans in the classroom; however, the use of computers and digital resources appeared to be a novel idea for them. From observations during the workshop, the key learnings for the high school teachers were: the use of digital pedagogy and the idea of integrating climate topics with topics in their discipline.

- Participants found the hands-on, interactive group sessions to be very useful and engaging.

- Peer discussions in groups helped in the exchange of ideas and enhanced participants’ learning.

- Participants sought local and region-specific examples (Uganda, East Africa, Africa) for their teaching; some of the lesson plan ideas generated during the workshop incorporated such examples.

- The offline (downloadable) version of the lesson plans was used by several participants; this version is convenient for use and access in the classroom.

- Some participants would have preferred to work in smaller groups.

- Participants requested references to resources that introduce the basics of climate science and climate change.

- Some feedback from participants:
  “It is a great pleasure to get this opportunity of workshop! The content covered during this period has sharpened my mind about our contributions as teachers (from different disciplines) in climate! I will recommend these digital tools to my fellow teachers (on my highest ability) and I have to make a climate advocacy within the community! Wish such workshops in next days(hope this is the first not the first and the last at once! Once again, thanks!”
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“I found the training is interesting, however we should have to focus on what is next to be done? how we can bring a wider impact at regional or African level by incorporating climate issues in curriculum at different levels.”

“It has really been so wonderful and we wait for any future interactions.”

“I appreciate how it was much inclusive; thank you for including us Rwandans.”

“Use pedagogy of integration to find smooth entry points of climate change and then develop supplementary materials or change the existing textbooks”

Next Steps

- Engagement by Team TROP ICSU with the participants to further enhance/refine the lesson plan ideas created during the workshop
- Modification of existing teaching resources (content and layout) based on analysis of feedback from participants
- Addition of region-specific (Uganda, East Africa, Africa) case studies, activities, and resources by using the ideas generated during the workshop
Appendix I: Disciplines/Subjects Taught by the Participants

University Lecturers:

Environmental Science; Wildlife Health and Management; Meteorology; GIS; Biodiversity Conservation; Social Science; Ecology; Agriculture; Ecology and Biodiversity Management; Forestry; Social Sector Planning and Management; Geography; Social Administration; Climate Change; Biology; Mathematics; Computer and Telecom Engineering; Beekeeping; Natural Resources Management; Economics; Gender; Computer Science; Humanities; Environment Management; Environment

High School Teachers:

Mathematics; Biology; History, Divinity and Education; Climate Change; Geography; History; Art and Design; Chemistry; Literature; Agriculture; Social Science; General Paper and English; Commerce; Entrepreneurship; Physics; ICT; Environmental Education
Appendix II A: Review of Lesson Plans by Participants (University Lecturers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

- Very effective: 53.3%
- Moderately effective: 46.7%

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

- Very effective: 53.3%
- Moderately effective: 40%
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7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

15 responses

86.7%

8. Would you use this lesson plan in your classroom for your students?

15 responses

66.7%

33.3%
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

15 responses

- Very likely: 66.7%
- Likely: 33.3%
Appendix II B: Review of Lesson Plans by Participants (High School Lecturers)

2. In your opinion, how effective is this lesson plan in explaining the topic(s) in the discipline?

13 responses

3. In your opinion, how effective is this lesson plan in integrating the discipline topic(s) with climate science?

13 responses
7. Do you think that your students will become more aware of climate change if you use this lesson plan in your classroom?

13 responses

8. Would you use this lesson plan in your classroom for your students?

13 responses
10. How likely are you to develop your own lesson plan that can enhance the understanding of a core topic in your discipline using a climate-related example, activity, or case study?

13 responses

- 46.2% Likely
- 53.8% Very likely
Appendix III A: Review of Teaching Tools by Participants (University Lecturers)

2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

- Somewhat effective: 11.1%
- Moderately effective: 33.3%
- Very effective: 55.6%

4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

- No: 11.1%
- Yes: 88.9%
5. Do you think that your students will become more aware of climate change if you use this teaching tool in your classroom?

- Yes: 88.2%
- No: 11.8%

6. Would you use this teaching tool in your classroom for your students?

- Yes: 27.8%
- Yes, with modifications: 72.2%
2. In your opinion, how effective is this teaching tool in explaining the topic(s) in the discipline?

- Very effective: 50%
- Moderately effective: 50%
4. Does the tool description adequately show how the discipline topic can be taught using a climate-related example, activity, or case study?

- No: 5.6%
- Yes: 94.4%

6. Would you use this teaching tool in your classroom for your students?

- Yes, with modifications: 50%
- Yes: 50%