ICCE2024 held in Royal Cliff Grand Hotel, Pattaya, Thailand.

## Chemistry Education

*by Supawan Tantayanon, Supakorn Boonyuen, and Taweetham Limpaparb*

In July 2017, Thailand faced a setback when South Africa won the bid to host the 26th IUPAC International Conference on Chemistry Education (ICCE) in 2020. However, we remained determined and successfully secured the bid in 2019 to host the 27th ICCE in 2022. Due to the COVID-19 pandemic, both the 26th and 27th ICCE were postponed to 2022 and 2024, respectively.

The 27th ICCE was held from July 15-19, 2024, at the Royal Cliff Grand Hotel in Pattaya, Thailand, a modern architectural marvel featuring sweeping sea-facing balconies and an impressive atrium lobby. The conference was organized by the Chemical Society of Thailand, in collaboration with Chulalongkorn University, Thammasat University, and Burapha University.

With the theme "**Power of Chemistry Education for Advancing SDGs,**" the conference emphasized the crucial role of education in addressing the environmental, social, and economic challenges of our time. Sustainable development requires a comprehensive approach that combines economic growth with social inclusion and environmental stewardship. The conference focused on the importance of educating societies about sustainable development principles and equipping learners—including teachers and lifelong learners—with the knowledge, skills, attitudes, and values necessary to build a more sustainable future for both people and the planet.

Policymakers, educators, practitioners, researchers, advocates, and other stakeholders were invited to explore innovative ways to integrate sustainable development into school curricula, pedagogy, assessments, and operations. The conference also showcased localized, practice-based sustainable development models from around the world. It was an opportune moment to learn from both the present and the past as we chart our course for the future.

Approximately 600 delegates from 56 countries attended ICCE 2024, representing a truly global gathering. The attendees included 50 delegates from North America, 46 from Europe, 44 from Africa, 17 from Australia and Oceania, 6 from South America, and 436 from Asia, with the majority hailing from Thailand (263 delegates). Notably, 38 % of the participants were schoolteachers, students, and young scientists. This high level of participation was made possible through scholarships that covered conference registration fees, accommodation for some, and partial travel support for a few. For nearly all these individuals, ICCE 2024 marked their first opportunity to attend a world conference.

### Conference Program

To address the diverse interests and needs of the participants, the conference featured eight comprehensive themes:

1. Chemistry Education in Informal Education and Lifelong Learning Contexts
2. Redesigning Chemistry Laboratory Teaching

3. Innovative Technology for Chemistry Education
4. Chemistry and Science Teacher Education and Continuous Professional Development
5. Chemistry and Chemical Science Education for Environmental and Social Sustainability
6. Policy, Reform, and Quality Assurance in Chemistry Education
7. Ethics, Diversity, Equity, and Inclusion in Chemistry Education
8. Emerging Educational Trends in Chemistry in the 21st Century

In addition to these thematic sessions, the conference provided a platform for several specialized symposia, including:

- Symposium A: The 12th International Symposium on Microscale Chemistry (12ISMC)
- Symposium B: Modeling-Based Instruction and Assessment for Chemistry Education
- Symposium C: Connecting Competency-Based Chemistry Education and the Challenge of Sustainable Development
- Symposium D: Advancing Chemical Safety and Security Education
- Symposium E: (Joint Education and Industry Symposium) Systems Thinking in Chemistry for Sustainability
- Symposium F: Green and Sustainable Chemistry in the Chemistry Curriculum: Advances and Models

## Opening Ceremony of ICCE2024

At the opening ceremony of ICCE 2024 on 15 July 2024, the event began with an introductory speech by Supawan Tantayanon, Chairperson of ICCE 2024. She reflected on the honor of hosting the ICCE conference 32 years after it was first held in Thailand, expressing deep gratitude to IUPAC and the Committee on Chemistry Education (CCE) for this opportunity. ICCE 2024 was organized to bring together educators, chemists, and scientists from around the world to engage with leaders in sustainable development. The conference aimed to explore the evolution of chemistry education, particularly in light of the lessons learned from the COVID-19 pandemic, with a focus on sustainability and resilience.

Following Tantayanon's address, Marietjie Potgieter, Chair of the IUPAC CCE, delivered a welcome speech. The ceremony then honored Mei-Hung Chiu with the Distinguished Contribution to Chemistry Education Lifetime Award from IUPAC CCE. Additionally, the Outstanding Early Career Researcher in Chemistry Education Awards were named to Amanda Bongers and Shelley Rap.


Mei-Hung Chiu (2nd from left) received 2024 Distinguished Contribution to Chemistry Education Lifetime Award from Peter Mahaffy and Supawan Tantayanon, both former awardees, and witnessed by Marietjie Potgieter, Chair of the IUPAC Committee on Chemistry Education (CCE).

## Distinguished Speakers

The conference provided an invaluable opportunity to gain insights into the latest advancements in sustainable chemistry education, featuring enlightening presentations from four plenary, ten keynote and thirty-eight invited speakers.

The first plenary lecture, "Chemistry Education Today for Our 2050 World," was delivered by Peter Mahaffy from The King's University, Canada. He highlighted that by 2050, today's chemistry students will be mid-career professionals tackling global challenges like climate change. Mahaffy emphasized the role of chemistry in these challenges and introduced systems thinking as a means to connect chemistry education with global issues and the UN Sustainable Development Goals.

The second plenary lecture, "Nurturing Multiple Intelligences: Challenges and Opportunities in Thai Education," was presented by Krissanapong Kirtikara, Chair of the Council of Kasetsart University, Thailand. Kirtikara discussed Thailand's focus on Logical-Mathematical Intelligence in science and math education, while noting less support for Musical and Bodily-Kinesthetic Intelligences. He called for better coordination and centralized data collection to align educational pathways with market needs and improve talent development.


Students proudly display their Gold Awards after receiving them from the Minister of Education of Thailand.

The third plenary lecture, "Chemical Sciences for SDGs: Gender, Diversity, Equity, and Inclusion Effects in the Least Developed Countries," was given by J. Catherine Ngila from the African Foundation for Women & Youth in Education & STI, Kenya. Ngila stressed the importance of chemistry in achieving the UN Sustainable Development Goals, particularly in food production, poverty reduction, and technology. She discussed the challenges of limited scientific infrastructure and gender disparities in the least developed countries.

Peter Hotchkiss, representing the OPCW (Organization for the Prohibition of Chemical Weapons), delivered the fourth plenary lecture titled "The OPCW: Ridding the World of Chemical Weapons." The OPCW was awarded the Nobel Peace Prize in 2013 for its efforts. Hotchkiss detailed the Chemical Weapons Convention's goal to eliminate chemical weapons and the OPCW's role in enforcing this, promoting peaceful chemistry use, and supporting UN SDGs related to health, sustainability, and peace. He also highlighted the OPCW's education and outreach initiatives.

Among ten distinguished keynote speakers, Ron Blonder, known for her pioneering work in integrating sustainability into chemistry curricula, and Khunying Sumonta Promboon, a pioneer in Thai chemistry education. Glenn A. Hurst shared his significant contributions to active learning in chemical education, while Jorge G. Ibanez focused on his expertise in green chemistry. Mary Garson emphasized the crucial role of chemical education in biodiversity conservation, and Vicente Talanquer provided deep insights into harnessing students' reasoning in chemistry to promote sustainable practices. Thomas Holme discussed innovative assessment strategies that support sustainability education in chemistry, and Mei-Hung Chiu highlighted the importance of chemistry education in fostering global environmental awareness. Amy S. Cannon, a leading advocate for green chemistry, presented compelling strategies for incorporating sustainability into chemical research and practice. Finally, Samia Khan's presentation on the use of technology and data in chemistry education demonstrated how digital tools can enhance sustainable teaching practices.

Alongside thirty-eight invited speakers, these distinguished individuals broadened our understanding of sustainable chemistry education and inspired innovative approaches and methodologies that will shape the future of the field. Their contributions highlighted the essential role chemistry education plays in advancing global sustainability goals.

## Science Projects in Schools Showcase

A side event of poster presentations was held July 16 and provided a platform for the high school students to present their research findings, experiments, and innovations to participants of ICCE2024. Through engaging poster presentations, students had the opportunity to discuss their projects, share discoveries, and engage in meaningful dialogues with attendees. This event not only fostered scientific inquiry, creativity, and communication skills but also deepened students' appreciation for the wonders of science. At the conclusion of the showcase, outstanding students were honored with the prestigious ICCE2024 Science Projects in Schools Awards (Gold, Silver, or Bronze), recognizing their achievements and inspiring further curiosity in STEM fields. A total of 23 Gold, 37 Silver, and 10 Bronze awards were presented. Student feedback was overwhelmingly positive, with many gaining valuable insights and constructive comments for project improvement. The audience was also impressed by the high level of research conducted by these high

school students, who represented the next generation of scientific leaders.

## Outstanding Poster Presentation Awards

There were 198 oral presentations and 187 posters. Among 187 posters, 5 IUPAC Best Poster Prizes, 5 CST Outstanding Poster Presentation Awards and 20 ICCE 2024 Special Awards for Poster Presentation were given to;

### IUPAC Best Poster Prizes

- Chayawin Chomngam, Thailand
- David-Samuel Di Fuccia, Germany
- Kong Ching Wong, Hong Kong SAR PRC
- Tri Minh Nguyen, Vietnam
- Witawas Handee, Thailand

### CST Outstanding Poster Presentation Awards

- Ari Syahidul Shidiq, Indonesia
- Ketsarporn Sompetch, Thailand
- Ludo B.F. Juurlink, Netherlands
- Magda Polec, United Kingdom
- Tojas Joshi, India

### ICCE 2024 Special Awards for Poster Presentation

- Erifon Ifiok Ukpe, Nigeria
- Carla Johanna Jänicke, Germany
- Claus Balte, Germany
- Darunee Sukchit, Thailand
- Elena Magrinya, Spain
- Juran Shin, Korea
- Khan Hung Nguyen, Vietnam
- Manasa Kongot, India
- Marina Birkenstock, Germany
- Maryam Asdagh Jahromi, Iran
- Mary-Ann Viduya Galo, Philippines
- Monrawat Rauytanapanit Lamthong, Thailand
- Norreddine Gherraf, Algeria
- Patipon Jandaeng, Thailand
- Pilailuk Sirisurawong, Thailand
- Robby Zidny, Indonesia
- Saranrom Yingsuk, Thailand
- Taweesak Poochai, Thailand
- Usa Jeenjenkit, Thailand
- Vitavas Jumpathong, Thailand

## Five Workshops and Chemistry Board Game

In addition to the oral presentations and posters, the conference offered five workshops. These workshops included:

- Microscale/Small Scale Chemistry (as one session of the 12th International Symposium on Microscale Chemistry, 12ISMC)
- Enhancing Chemical Safety and Security for the Chemical Weapons Convention
- Incorporating Systems Thinking into Your Classroom and Connecting to Sustainability
  - Part I: Education
  - Part II: Industry
- Green Chemistry and the U.N. Sustainable Development Goals: Harnessing Their Combined Power

Chemistry Board Game Event at ICCE 2024, organized by the Thailand Younger Chemists Network (TYCN) and the Chemical Society of Thailand (CST)

Traditional performances by schoolteachers from several countries.

- How to Publish in Chemistry Teacher International (CTI)

The Chemistry Board Game Event at ICCE 2024, organized by the Thailand Younger Chemists Network (TYCN) and the Chemical Society of Thailand (CST), in collaboration with the Department of Chemistry at Chulalongkorn University, Kasetsart University at Sri-Racha, and Silpakorn University, offered a unique blend of fun and learning for all participants. Featuring a variety of engaging and educational board games provided by Chemistry Board game and Boss Lab Boardgame, the event invited both chemistry enthusiasts and newcomers to delve into the fascinating world of atoms and molecules. This event not only provided an enjoyable and interactive way to learn new concepts and test knowledge but also served as an excellent networking opportunity. Participants left with positive feedback, appreciating the enjoyable experience and the valuable connections they made, which they can carry back to their home countries.

## Panel Discussion on "Power of Chemistry Education for Advancing SDGs"

The panel discussion on "Power of Chemistry Education for Advancing SDGs," held on July 18, 2024, celebrated the 10th anniversary of implementing the small scale chemistry teaching in Thailand under the project called "Dow Chemistry Classroom." Panelists included Mary Garson (IUPAC Vice President), Kessara Amornvuthivorn (SEAMEO STEM-ED), Poranee Kongamornpinyo (Dow Thailand), and Le Than Vinh (Lawrence S. Ting School, Vietnam), with Amy Cannon (Beyond Benign, USA) moderating.

The discussion focused on how chemistry education can advance the Sustainable Development Goals (SDGs) and the role of each organization in supporting this effort. The panelists emphasized that chemistry education is crucial in developing future chemists who can drive sustainable innovation. By equipping students with critical thinking and problem-solving skills, chemistry education plays a vital role in fostering sustainable solutions and contributing to global sustainability efforts.

## Social and Cultural Activities

The welcome reception took place on the evening of 15 July 2024, following the opening ceremony of ICCE2024. Guests enjoyed a selection of traditional Thai snacks, including Kanom Krok (Thai coconut pudding), Khao Griab Pak Moh (Steamed rice skin dumpling), and Foi Thong (Golden threads made by drizzling egg yolks) and Thong Yod (Golden egg-yolk drops) which were cooked and served at the event, alongside a general cocktail service. The event began with a warm welcome speech from the Mayor of Pattaya, followed by remarks from the Deans of the Faculty of Science at Chulalongkorn University, Thammasat University, and Burapha University. Mary Garson delivered an impressive speech, which was followed by a brief address

from the Manager of the Royal Cliff Grand Hotel, one of the event's sponsors. The evening continued with a captivating Baslop dance performed by students from Princess Chulabhorn Science High Schools.

Throughout the night, guests were treated to traditional performances from eight countries, performed by schoolteachers representing Vietnam, Nepal, Cambodia, Myanmar, Sri Lanka, Indonesia, the Philippines, and Thailand. The evening concluded with a Thai folk dance called "Ram Wong (Dance in a circle)," in which more than two hundreds of the participants danced together in a large circle, creating a memorable and joyful moment for all attendees.

The conference banquet was held on 18 July 2024, where participants enjoyed a series of traditional Thai classical performances during dinner. As the evening progressed, attendees joined the performers in a lively circle dance, adding a joyful and interactive touch before the banquet concluded.

Two complimentary sightseeing tours were offered to ICCE 2024 international participants, each showcasing different cultural landmarks. The first tour featured a visit to the Sanctuary of Truth, while the second tour included stops at Wat Yanasangvararam and Khao Chi Chan.

At the Sanctuary of Truth, visitors were captivated by the awe-inspiring wooden structure, crafted entirely in the traditional Thai carpenter style by Lek Viriyaphan. This massive sanctuary, adorned with intricate carvings depicting the philosophy of life, stands as a testament to human skill and vision. Participants were deeply impressed by its unique blend of art, philosophy, and spiritual symbolism.

The second tour highlighted Wat Yanasangvararam, a magnificent Buddhist monastery under the royal patronage of His Majesty King Bhumibol Adulyadej, known for its serene meditation center and stunning architecture. It also included a visit to Khao Chi Chan, where the world's largest Buddha image is intricately carved into a rock cliff, symbolizing the reign of King Rama IX. Both tours offered participants a profound cultural and spiritual experience, showcasing Thailand's rich heritage and artistry.

## Closing Ceremony

At the closing ceremony on July 19, 2024, participants enjoyed a video recap highlighting the key moments from the past five days of the conference. Following this, Mustafa Sözbilir introduced the 28th IUPAC International Conference on Chemistry Education, which will be held jointly with the 17th EuChemS European Conference of Research in Chemical Education. The joint event, ICCECRICE 2026, is scheduled to take place at Atatürk University in Erzurum, Türkiye, from 13-17 July 2026.

Vudhichai Parasuk, President of the Chemical Society of Thailand, extended his thanks to everyone for their participation and contributions to ICCE2024. Marietjie Potgieter, Chair of the IUPAC Committee on Chemistry Education, shared her reflections, noting that ICCE2024 was widely praised by participants for its overall excellence. Finally, Supawan Tantayanon expressed gratitude on behalf of the organizing committee before officially closing ICCE2024 at 1 p.m.

## Post Conference Reflections

At ICCE 2024, participants widely praised the conference's excellent organization and the valuable insights they gained on incorporating sustainable development into their research and teaching. Below are examples of this feedback, including an email from a student who received a conference scholarship and another from Marietjie Potgieter.

"Greetings from Nigeria!

I hope you're enjoying your time in Thailand after the conference. I want to express my gratitude for the opportunity to participate in the 27th IUPAC International Conference on Chemistry Education (ICCE2024) and share my research with the academic community. Thank you for allowing me to be a part of the conference and for the scholarship that covered my registration fee.

Your tireless efforts in organizing the conference did not go unnoticed, and I appreciate the hard work you put into making it a success. The conference was flawlessly executed, and I commend you on your exceptional organizational skills.

I'm particularly grateful for the platform you provided for me to showcase my research and receive valuable feedback from experts in the field. Participating in the conference helped me grow professionally and academically, and I'm grateful for the experience. The conference was a valuable learning experience that helped me refine my research and presentation skills.

Winning the poster presentation award motivated me to continue pursuing my research interests and strive for excellence. The award has encouraged me to take my research to the next level and explore new opportunities. Thank you for your dedication to academic excellence and your commitment to fostering a community of scholars. I appreciate your passion for promoting research and academic growth, and I'm grateful to have benefited from it."

"On behalf of IUPAC and the Committee on Chemistry Education (CCE), I would like to express my heartfelt thanks and deep appreciation for the very successful 27th International Conference on Chemistry Education held in Pattaya, Thailand last week. I congratulate Prof. Supawan Tantayanon and the Conference Organizing Committee for a memorable event that we all enjoyed very much. We were inspired to align our teaching with sustainability and implement new approaches in our practice when we returned home. It was an honour for IUPAC and the CCE to be associated with this conference.

I would like to acknowledge a few things which stood out:

- The conference organization reflected exceptional care and attention to detail in every aspect— the registration, welcoming ceremony, scientific program, excursions and conference dinner. We were hosted in a beautiful setting by a team of friendly and helpful chemistry staff and students who were eager to see to the needs of all visitors.
- The conference was attended by ca. 600 delegates from 56 countries of whom 200 were school teachers. Professor Supawan worked hard to raise funding for registration fee waivers for all of these teachers. Many of the delegates from the region and most of these teachers have never been able to attend an international chemistry education conference before and were most grateful for the opportunity. A special programme was offered for the teachers which included a whole-day workshop on microscale/small-scale chemistry.
- The organizing committee created a special event for Thai school teachers/students called "ICCE2024 Youth Scientists in Schools," to present their work in the poster session on 16 July. All participants were awarded certificates according to the merit of their work in three levels, Gold, Silver and Bronze, and these certificates and medals were presented to them by the Minister of Education of Thailand."

## Acknowledgement

As Chair of the 27th IUPAC International Conference on Chemistry Education (ICCE 2024), I would like to express my deepest gratitude to all the individuals and organizations that contributed to the success of this event:

1. **The International Advisory Board of ICCE 2024**: Your invaluable guidance was key to shaping this conference. I am particularly grateful to Marietjie Potgieter, Chair of the IUPAC Committee on Chemistry Education, for her crucial advice and support throughout the entire process, from the early stages of preparation to the execution of the conference.
2. **The Organizing Committee**: Your hard work and dedication were evident, especially during the five days of the conference. I would like to extend special thanks to Taweetham Limpanuparb, Supakorn Boonyuen, and Pumidech Puthongkham for their meticulous efforts in logistics and planning.
3. **The plenary, keynote, and invited speakers**, along with the **chairs, co-chairs, workshop leaders, and reviewers**: Your contributions were pivotal in making the scientific sessions both insightful and engaging.
4. **All the delegates**: Your active participation enriched the conference with outstanding presentations, posters, and workshops, making ICCE 2024 a truly collaborative and interactive event.
5. **The sponsors**: I am deeply thankful for your financial support, which made this conference possible. Special recognition goes to Bangkok Bank Public Company Limited, Dow Thailand, Boon Rawd Brewery Co. Ltd., Shimadzu, Bara Scientific Co., Ltd., the Royal Society of Chemistry (RSC), the American Chemical Society (ACS), International Union of Pure and Applied Chemistry (IUPAC), Organization for Prohibition of Chemical weapons (OPCW), Royal Cliff Hotels group, and many others for your generous contributions.

Your collective efforts and support have made ICCE 2024 a resounding success.

https://www.icce2024thailand.com/

## Building Chemical Bridges in Latin America: Reflections from the 36th Congreso Latinoamericano de Química

*by Javier García-Martínez*

Late September last year, I had the pleasure of attending the 36th Congreso Latinoamericano de Química (CLAQ, Latin American Chemistry Congress), held in Panama from 25 September to 9 October. This 2024 event was particularly significant as it coincided with the 50th anniversary of the Colegio Panameño de Químicos (Copaqui), marking an important milestone in the chemical sciences community in Panama. The congress theme, Construyendo Puentes Químicos en América Latina (Building Chemical Bridges in Latin America), emphasised the importance of regional