



**Task Group Co-Chairs**  
 - Peter Mahaffy (Canada)  
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# Systems Thinking in Chemistry Education (STICE) An IUPAC Project

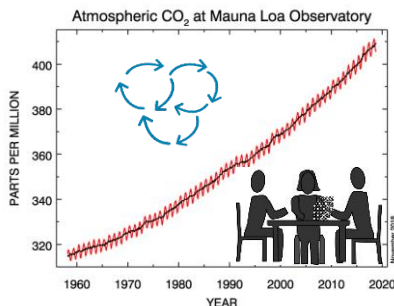
*How might systems thinking apply to Chem Ed, and how can that help the next generation address emerging global challenges?*

Features of learning processes applied to the unique challenges of learning chemistry

Theoretical frameworks of learning, learning progressions and the social contexts for learning

Chemistry teaching and learning

Learner systems



Earth and societal systems

Elements that orient chemistry education toward meeting societal and environmental needs

# Framework for Systems Thinking in Chemistry Education

Mahaffy, Matlin, Krief, Hopf, Meta, "Reorienting Chemistry Education through Systems Thinking"

**nature**  
REVIEWS CHEMISTRY

## *Journal of Chemical Education* Call for Papers—Special Issue on Reimagining Chemistry Education: Systems Thinking, and Green and Sustainable Chemistry

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**ABSTRACT:** The *Journal of Chemical Education* announces a call for papers for an upcoming special issue on Reimagining Chemistry Education: Systems Thinking, and Green and Sustainable Chemistry.

**KEYWORDS:** High School/Introductory Chemistry, First-Year Undergraduate/General, Upper-Division Undergraduate, Curriculum, Environmental Chemistry, Interdisciplinary/Multidisciplinary, Problem Solving/Decision Making, Green Chemistry, Learning Theories, Student-Centered Learning, Systems Thinking, Sustainability

- ~ 60 submissions – review in progress, some are published ASAP
- Expected Dec 2019 publication



# STICE Progress to Date

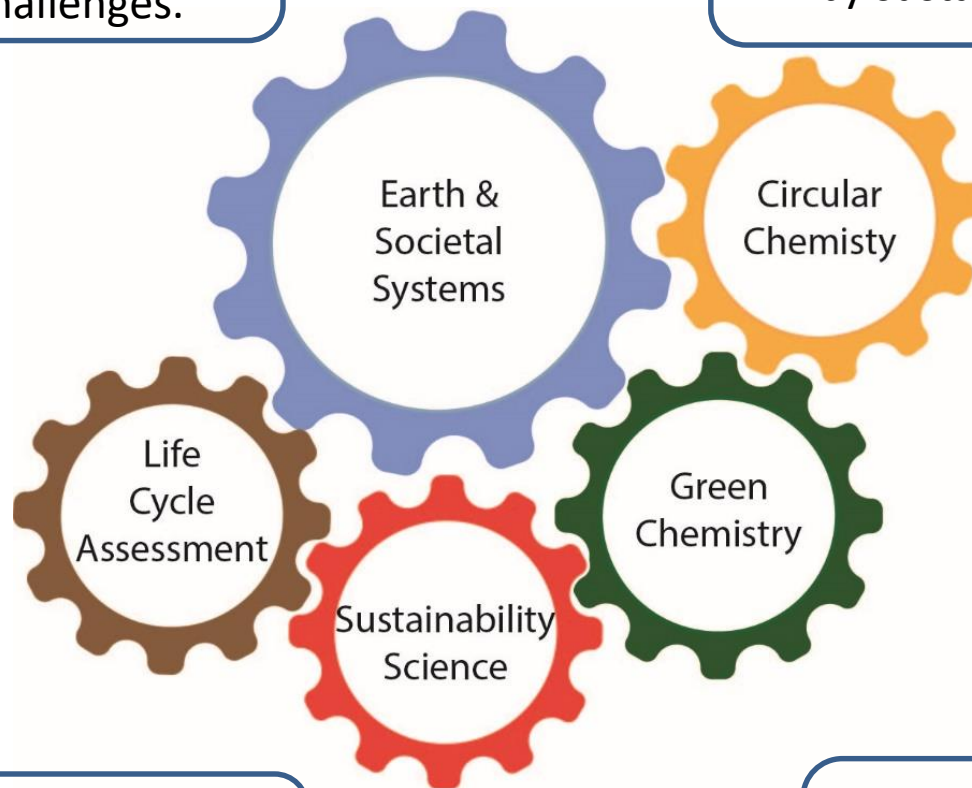
- Definition, purpose, and preliminary framework of STICE
- Review of ST in other STEM fields
- Challenges of dealing with complexity
- ST skills and competencies
- ST tools and visualizations
- ST to address global challenges – the molecular basis of sustainability
- Learning frameworks to guide use of STICE
- ST and educational standards related to chemistry

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**Recognize** the material basis of society as a core element in sustainability challenges.

**Shape** the practice of chemistry by sustainability science



**Educate** about the \*molecular basis of sustainability using systems thinking

**Reorient** chemistry education to address the sustainability of earth and societal systems

*\*The ways in which the material basis of our society and economy underlie considerations of how present and future generations can live within the limits of the natural world*

Mahaffy, Matlin, Holme, MacKellar, "Systems Thinking for Education about the Molecular Basis of Sustainability," (2019), 2, 362–370.

nature  
sustainability

# STICE Future Directions

- Resourcing chemistry educators and students
  - Learning theories perspective
  - Connection to curriculum and program standards
  - Define & explore STICE-related learning outcomes (LO)
  - Develop activities and assessments aligned with STICE LO
  - Develop, pilot, implement, and sustainably scale educator training opportunities.
  - Open access virtual user community
- Chemistry Education research related to STICE
  - Cognitive, affective aspects, assessment
- Examining who stands to benefit from a STICE approach

# Follow-on IUPAC STICE Project

- Review of STICE project at project meeting yesterday
- Consensus of project committee - we should propose to IUPAC from CCE a STICE V2.0
- IUPAC is the right framework to bring a global group of chemistry education thought leaders together.
- Other partners will be needed to resource the project (IOCD, UNESCO, European framework, etc.)
- Some members of the project group will provide continuity, new members from within and outside of IUPAC CCE will be sought.
- Please let us know if you have an interest in participating.  
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# Systems Thinking at World Chemistry Congress



14:00- 18:00 S-5.1 - Relation between education and society

Room 341

- Chairmen : J. APOTHEKER, R. BLONDER, I. EILKS, P. MAHAFFY

14:00 • **S-5.1 KN** • **Systems Thinking to Educate about the Molecular Basis of Sustainability** See abstract

> P. MAHAFFY

14:40 • **S-5.1 IL1** • **The importance of the nano-dimension when we teach chemistry in context** See abstract

> R. BLONDER

15:10 • **81** • **Using systems thinking and earth and societal systems to enhance student learning in General Chemistry** See abstract

> T. HOLME