

# Chemistry Education Research and Practice

rsc.li/cerp

*A fully refereed electronic journal for teachers, researchers and other practitioners in chemistry education*

## IN THIS ISSUE

ISSN 1756-1108 CODEN CERPCE 24(3) 785–1100 (2023)

## EDITORIAL

791

### Engaging with engagement in learning chemistry: a guiding note about a multidimensional construct

Gwendolyn Lawrie

## REVIEW

793

### A systematic review of learning progressions for the concept of matter in science education

Guanxue Shi and Hualin Bi\*

## PAPERS

807

### Investigating the mangle of teaching oxidation–reduction with the VisChem approach: problematising symbolic traditions that undermine chemistry concept development

Meng-Yang M. Wu and Ellen J. Yeziarski\*

828

### Metacognitive regulation in organic chemistry students: how and why students use metacognitive strategies when predicting reactivity

Katherine A. Blackford, Julia C. Greenbaum, Nikita S. Redkar, Nelson T. Gaillard, Max R. Helix and Anne M. Baranger\*

852

### Characterizing students' peer–peer questions: frequency, nature, responses and learning

Grace Tiffany, Krystal Grieger, Kassidy Johnson and James Nyachwaya\*



## PAPERS

868

**"I am here because I wanted to shine": how poetry can be used to better understand undergraduate students' first-year chemistry or related course experiences**

Sam Illingworth\* and Mala L. Radhakrishnan\*

882

**Practices in instrument use and development in *chemistry education research and practice* 2010–2021**

Katherine Lazenby, Kristin Tenney, Tina A. Marcroft and Regis Komperda\*

896

**Learning to teach chemical bonding: a framework for preservice teacher educators**

Tim H. H. van Dulmen,\* Talitha C. Visser, Fer G. M. Coenders, Birgit Pepin and Susan McKenney

914

**Assessor in action: assessment literacy development in a biochemistry context**

Stephanie Feola, Paula P. Lemons, Jennifer A. Loertscher, Vicky Minderhout and Jennifer E. Lewis

938

**Effectiveness of particulate nature of matter (PNM)-based intervention studies in improving academic performance: a *meta-analysis* study**

Muammer Çalik,\* Neslihan Ültay, Hasan Bağ and Alipaşa Ayas



## PAPERS

956

**How chemists handle not-knowing in reasoning about a novel problem**

John Button, Diren Pamuk Turner\* and David Hammer

971

**Enhancing academic performance and student success through learning analytics-based personalised feedback emails in first-year chemistry**

Sara H. Kyne,\* Martin M. H. Lee and Charisse T. Reyes

984

**Patterns in undergraduate students' and educators' sense of the ontology of the atom and implications for addressing learning impediments**

Abayneh Lemma\* and Woldie Belachew

1003

**Using social influence models to characterize student interest in a general chemistry peer-led team learning setting**

Jacob D. McAlpin, Ushiri Kulatunga and Jennifer E. Lewis\*

1025

**Impacts of the flipped classroom on student performance and problem solving skills in secondary school chemistry courses**

Liang Yu,\* Yueru Li, Yu Lan and Huzhi Zheng



## PAPERS

1035

**Blooming student difficulties in dealing with organic reaction mechanisms – an attempt at systemization**

Gyde Asmussen,\* Marc Rodemer and Sascha Bernholt

1055

**Harnessing indigenous scientific discovery in medicinal chemistry to promote selected nature of science attributes among Chinese high school students: case of Artemisinin**

Dongsheng Wan and R. Subramaniam\*

1077

**Exploring social and cognitive engagement in small groups through a community of learners (CoL) lens**

Hannah T. Nennig, Nicole E. States, Michael Macrie-Shuck, Shaghayegh Fateh, Zubeyde Demet Kirbulut Gunes, Renee Cole,\* Gregory T. Rushton, Lisa Shah and Vicente Talanquer

