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(2) 385-784 (2023)

FDITORIAL

392

Establishing a delicate balance in the relationship between artificial intelligence and authentic assessment in student learning

Gwendolyn Lawrie

REVIEW ARTICLES

394

Teaching crystal structures in undergraduate courses: a systematic review from a disciplinary literacy perspective

Veronica Caro, Brandon A. Carter, Joanna Millunchick* and Shalaunda Reeves

407

When a machine detects student reasoning: a review of machine learning-based formative assessment of mechanistic reasoning

Paul P. Martin and Nicole Graulich*

PAPERS

428

Pharmacy students' conceptions of theory-practice relation in the analytical chemistry laboratory – a phenomenographic study

Laura Teinholt Finne,* Bente Gammelgaard and Frederik Voetmann Christiansen

437

Analysis of students' diagrams of water molecules in snowflakes to reveal their conceptual understanding of hydrogen bonds

Henry Matovu,* Mihye Won, David Franklin Treagust, Mauro Mocerino, Dewi Ayu Kencana Ungu, Chin-Chung Tsai and Roy Tasker

453

Patterns of reasoning - exploring the interplay of students' work with a scaffold and their conceptual knowledge in organic chemistry

David Kranz, Michael Schween and Nicole Graulich*

478

Social support and continuing motivation in chemistry: the mediating roles of interest in chemistry and chemistry self-efficacy

Qian Huangfu,* Nana Wei, Ruli Zhang, Yuefan Tang and Guixu Luo

494

Examining the diversity of scientific methods in college entrance chemistry examinations in China

Yufeng Xu, Huinan Liu, Bo Chen,* Sihui Huang and Chongyu Zhong

509

Change in students' explanation of the shape of snowflakes after collaborative immersive virtual reality

Henry Matovu,* Mihye Won, David Franklin Treagust, Dewi Ayu Kencana Ungu, Mauro Mocerino, Chin-Chung Tsai and Roy Tasker

526

Course letter grades and rates of D, W, F grades can introduce variability to course comparisons

Nicole M. James

535

Evaluating the effects of the analogical learning approach on eighth graders' learning outcomes: the role of metacognition

Chia-Yu Wang

551

The efficacy of instruction in application of mole ratios and submicro- and macro-scopic equivalent forms of the mole within the unit factor method

Angela Elisabeth Stott

567

Tensions between depth and breadth: an exploratory investigation of chemistry assistant professors' perspectives on content coverage

Annika Kraft, Maia Popova, Robert M. Erdmann, Jordan Harshman and Marilyne Stains*

Analysis of post-secondary instructors' pedagogical content knowledge of organic acid-base chemistry using content representations

J. R. Boothe, E. K. Zotos and G. V. Shultz*

599

Scaffolding of experimental design skills

Luca Szalay,* Zoltán Tóth, Réka Borbás and István Füzesi

624

Revealing the development of interaction among components of pedagogical content knowledge in teaching chemical equilibrium

Elif Selcan Oztay,* Betul Ekiz-Kiran and Yezdan Boz

637

"What are they talking about?" A sociocultural linguistic approach to practical task effectiveness

Naomi Louise Hennah

659

A social semiotic lens to capture meaning-making of polymeric concepts during modelling in chemistry education

Lizette Widing,* Pernilla Nilsson and Pernilla Granklint Enochson

674

Navigating the interlanguage space: Chinese international students' perceptions of a virtual chemistry laboratory course

Eshani N. Lee,* Schetema Nealy and Laura Cruz

688

Students' interactive engagement, academic achievement and self concept in chemistry: an evaluation of cooperative learning pedagogy

Udu David Agwu* and John Nmadu

706

Evaluating electrophile and nucleophile understanding: a large-scale study of learners' explanations of reaction mechanisms

Stephanie J. H. Frost, Brandon J. Yik, Amber J. Dood, Daniel Cruz-Ramírez de Arellano, Kimberly B. Fields and Jeffrey R. Raker*

723

Characterizing and identifying influences on undergraduates' attitudes towards organic chemistry

Melissa A. Collini, Lauren A. Rocha, Jayda E. Ford, Rebecca Weber* and Molly B. Atkinson*

740

Development and implementation of innovative concepts for language-sensitive student laboratories

Sarah Kieferle* and Silvija Markic

754

Could competence-based chemistry teaching in secondary school harm students' performance in upper traditional exams?

Víctor López-Simó,* Carme Grimalt-Álvaro and Neus Sanmartí

768

Beliefs versus resources: a tale of two models of epistemology

Kimberly S. DeGlopper, Rosemary S. Russ, Prayas K. Sutar and Ryan L. Stowe*