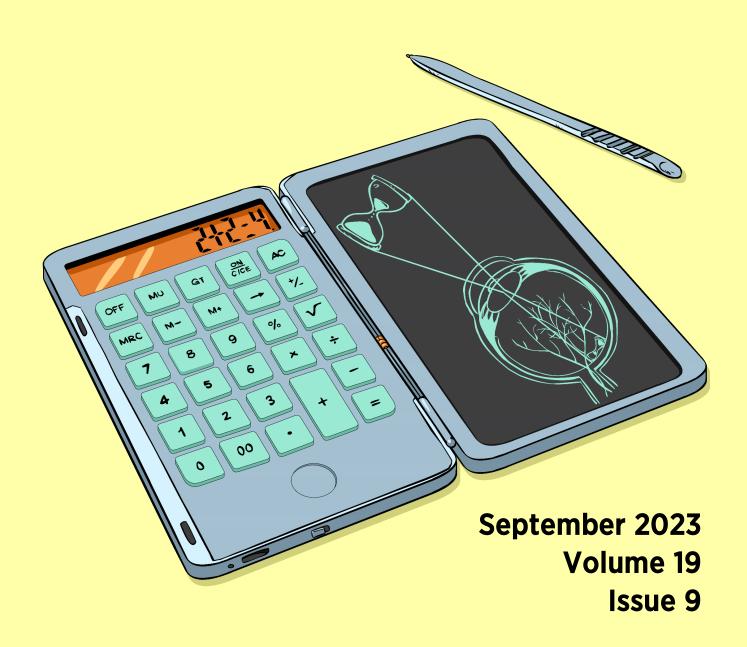
ISSN: 1305-8223

EURASIA JOURNAL OF MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION



Published by: Modestum

Publication Office: Modestum LTD, 29 Gildredge Road, Eastbourne, East Sussex, BN21 4RU,

United Kingdom

Serbia Office: Modestum DOO, Bulevar Mihajla Pupina 10i, 3. Sprat, Stan 133, Belgrade,

SERBIA

Phone: +381 61 6600107

Email: publications@modestum.co.uk

Publisher: https://modestum.co.uk

Journal Web: https://www.ejmste.com

Twitter: https://twitter.com/ejmste

Facebook: https://www.facebook.com/ejmste

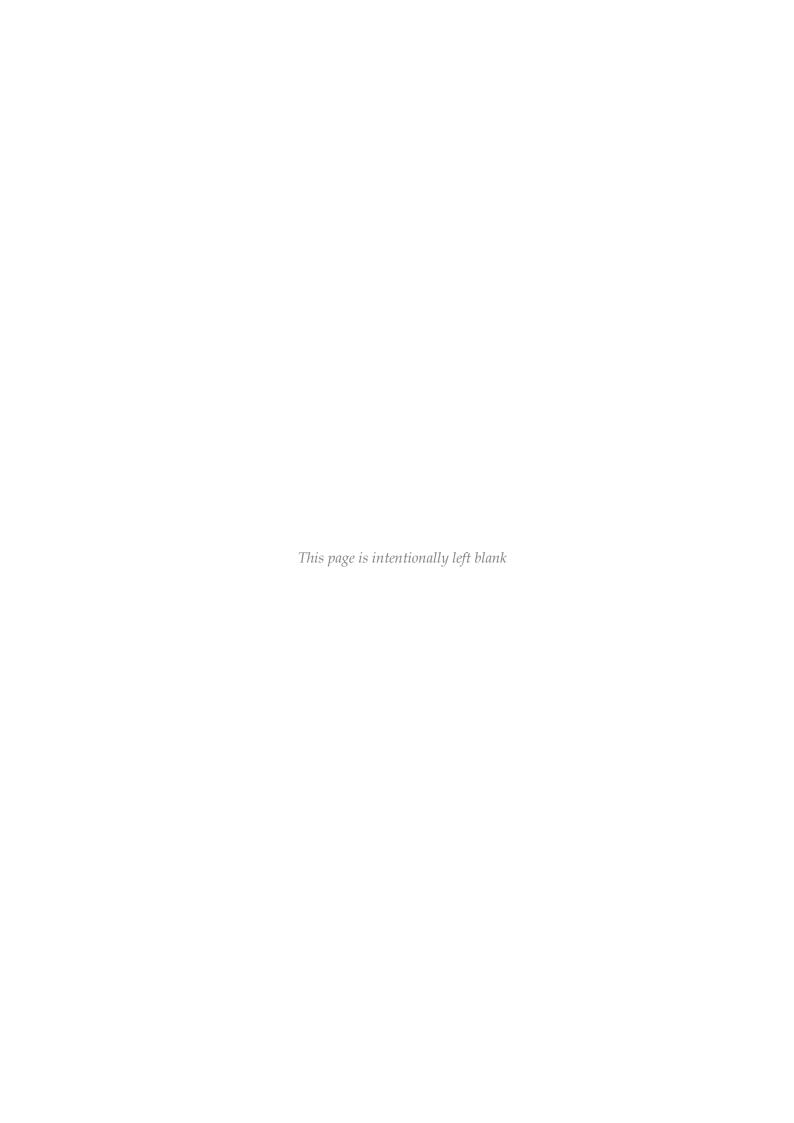
© 2005-2023. All rights reserved by Modestum. Copyright for Open Access Content is Retained by Authors. Also, authors continue to hold the copyrights of their own papers by acknowledging that their papers are originally published in the Eurasia Journal of Mathematics, Science and Technology Education. Hence, articles published are licensed under a "Creative Commons Attribution 4.0 International License."

ISSN: 1305-8223 (Online)

EURASIA JOURNAL OF MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION

September 2023 Volume 19 Issue 9





EURASIA JOURNAL OF MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION

The Eurasia Journal of Mathematics, Science and Technology Education (Abbrev. EURASIA J. Math., Sci Tech. Ed. or EJMSTE) is an English Open Access peer-reviewed journal publishing articles on all aspects of Mathematics, Science and Technology Education with ISSN: 1305-8223 (online). The journal is published 12 times in a year, and strictly adheres to the principles of the peer review process.

EURASIA Journal of Mathematics, Science and Technology Education encourages submissions from all authors throughout the world. Manuscripts are judged by two experts solely on the basis of their contribution of original data, ideas and their presentation. All manuscripts must comply with Manuscript Preparation Guidelines. Submitted manuscripts must not have been published, accepted for publication or be under consideration elsewhere.

Submissions: EJMSTE has a fully online review system. This system offers authors the convenience of submitting their manuscripts via **EditorialPark**. Please send your manuscripts an MS Word attachment to the editors via the following address: https://www.editorialpark.com/ejmste/

Eurasia Journal of Mathematics, Science and Technology Education (EJMSTE) is a monthly journal published online 12 times annually in January, February, March, April, May, June, July, August, September, October, November, and December.

EJMSTE is indexed and/or abstracted in

- EBSCO
- ERIH PLUS
- Google Scholar
- Genamics JournalSeek
- PsycINFO
- PSYNDEX
- ROAD
- SafetyLit
- SCOPUS
- Scimago

All articles are archived by:

- The British Library
- Portico

Publication of any material submitted by authors does not necessarily mean that the journal, publisher, editors, or any of the editorial board members endorse or suggest the content. Publishing decisions are based and given only on scholarly evaluations. Apart from that, decisions and responsibility for adopting or using partly or in whole any of the methods, ideas or the like presented in EJMSTE pages solely depends on the readers' own judgment.

EDITORIAL BOARD

Editors-in-Chiefs

Chun-Yen CHANG, National Taiwan Normal University (NTNU), TAIWAN

Lianghuo FAN, University of Southampton, UNITED KINGDOM & East China Normal University, CHINA

Editors

Engineering Education

Teen-Hang MEEN, National Formosa University, TAIWAN

Xiangyun DU, Qatar University, QATAR & UNESCO PBL Center for Engineering and Science Education, Aalborg University, DENMARK

Mathematics Education

Chunxia QI, Beijing Normal University, CHINA

Der-Ching YANG, National Chiayi University, TAIWAN

Joohi LEE, University of Texas at Arlington, USA

Lianghuo FAN, University of Southampton, UNITED KINGDOM & East China Normal University, CHINA

Kwok Cheung CHEUNG, University of Macau, MACAU

Mei-Shiu CHIU, National Chengchi University, TAIWAN

Oh Nam KWON, Seoul National University, SOUTH KOREA

Sandra NITE, Texas A&M University, USA

Science Education

Hayat HOKAYEM, Texas Christian University, USA

Jan Alexis NIELSEN, University of Copenhagen, DENMARK

Jana FANCOVICOVA, University of Trnava, SLOVAKIA

Jing LIN, Beijing Normal University, CHINA

Mariusz PANCZYK, Medical University of Warsaw, POLAND

Milan KUBIATKO, Jan Evangelista Purkyně University, CZECH REPUBLIC

Onofrio Rosario BATTAGLIA, University of Palermo, ITALY

Ozcan GULACAR, University of California, Davis, USA

Sarantos PSYCHARIS, School of Pedagogical and Technological Education, GREECE

Silvija MARKIC, University of Education Ludwigsburg, GERMANY

Vanda JANSTOVA, Charles University, Prague, CZECH REPUBLIC

STEM Education

Eila JERONEN, University of Oulu, FINLAND

Federica VALLONE, University of Naples Federico II, Naples, ITALY

Technology Education

M. Shane TUTWITER, University of Rhode Island, USA

Tzu-Hua WANG, National Tsing Hua University, TAIWAN

Yi-Shun WANG, National Changhua University of Education, TAIWAN

Zacharia ZACHARIAS, University of Cyprus, CYPRUS

Editorial Board Members

Agustin ADÚRIZ-BRAVO, Universidad de Buenos Aires, ARGENTINA

Alipasa AYAS, Bilkent University, TURKEY

Anjum HALAI, Aga Khan University, PAKISTAN

Anna Maria GRUGNETTI, University of Pavia, ITALY

Carlos HERVÁS-GÓMEZ, University of Seville, SPAIN

Charis VOUTSINA, University of Southampton, UNITED KINGDOM

Chin-Chung TSAI, National Chiao Tung University, TAIWAN

Colleen T. DOWNS, University of KwaZulu-Natal, SOUTH AFRICA

Do-Yong PARK, Illinois State University, USA

Fouad ABD-EL-KHALICK, University of Illinois at Urbana-Champaign, USA

Gert KADUNZ, University of Klagenfurt, AUSTRIA

Gregory J. KELLY, The Pennsylvania State University, USA

Gurol IRZIK, Sabanci University, TURKEY

Ingo EILKS, University of Bremen, GERMANY

Jan H. VAN DRIEL, University of Melbourne, AUSTRALIA

Jari LAVONEN, University of Helsinki, FINLAND

Kamisah OSMAN, Universiti Kebangsaan Malaysia, MALAYSIA

Kenneth TOBIN, The Graduate Center of CUNY, USA

Kyriacos ATHANASIOU, National and Kapodistrian University of Athens, GREECE

Eurasia Journal of Mathematics, Science and Technology Education

Lung Hsiang WONG, Nanyang Technological University, SINGAPORE

Lyn ENGLISH, Queensland University of Technology, AUSTRALIA

Lynn A. BRYAN, Purdue University, USA

Mailizar MAILIZAR, Syiah Kuala University, INDONESIA

Marika KAPANADZE, Ilia State University, GEORGIA

Martin RUSEK, Charles University, CZECH REPUBLIC

Michael ALLEN, Kingston University, UK

Monika Szczygieł, Pedagogical University of Krakow, POLAND

Nélio BIZZO, Universidade de São Paulo, BRAZIL

Pavol PROKOP, Trnava University, SLOVAKIA

Paul PACE, University of Malta, MALTA

Pernilla NILSSON, Halmstad University, SWEDEN

Peter C. CORMAS, California University of Pennsylvania, USA

Rachel MAMLOK-NAAMAN, Weizmann Institute of Science, ISRAEL

Rohaida Mohd. SAAT, University of Malaya, MALAYSIA

Rolf V. OLSEN, University of Oslo, NORWAY

Sarantos PSYCHARIS, School of Pedagogical and Technological Education - ASPETE, GREECE

Sarika KEWALRAMANI, Monash University, AUSTRALIA

Sonya N. MARTIN, Seoul National University, REPUBLIC OF KOREA

Uwe GELLERT, Freie Berlin University, GERMANY

Vanessa KIND, Durham University, UK

Vincentas LAMANAUSKAS, University of Siauliai, LITHUANIA

CONTENTS

The effect of the 5E instructional model on students' cognitive processes and their attitudes towards chemistry as a subject	em2317
Ivana Sotáková, Mária Ganajová	
https://doi.org/10.29333/ejmste/13469	
Pre-service teachers develop their mathematical knowledge for teaching using manipulative materials in mathematics	em2318
Alberto Arnal-Bailera, Mónica Arnal-Palacián	
https://doi.org/10.29333/ejmste/13470	
The geographic inquiry process skills scale: A validation study	em2319
Bagila Sadykova, Ulzhalgas Yesnazarova, Aigul Tokbergenova	
https://doi.org/10.29333/ejmste/13471	
Cluster sampling MUSA methodology for user satisfaction analysis of an educational distance-learning platform	em2320
Nikolaos Manikaros, Evgenios Avgerinos	
https://doi.org/10.29333/ejmste/13472	
Adaptation of the sources of the mathematics self-efficacy scale for Oman: A validation study	em2321
Khalid Saif Salim Al Umairi, Umi Kalsum Mohd Salleh, Hutkemri Zulnaidi	
https://doi.org/10.29333/ejmste/13481	
Mathematics teacher argumentation in a didactic perspective	em2322
Walter F. Castro, Jorge A. Toro	
https://doi.org/10.29333/ejmste/13498	
Self-concept, learning anxiety, and performance in mathematics learning: The moderating effect of teacher cognitive activation	em2323
Yuanhua Wang	
https://doi.org/10.29333/ejmste/13499	
Improving the learning of geometric proportionality using van Hiele's model, mathematical visualization, and GeoGebra	em2324
Jhor Fredy Restrepo-Ochoa, Elgar Gualdrón-Pinto, Luis Fernando Ávila-Ascanio	
https://doi.org/10.29333/ejmste/13500	
Optimizing the surface of orthohedra with virtual reality in primary school	em2325
Isabel Romero, José A. Rodríguez-Martínez, José L. Rodríguez	
https://doi.org/10.29333/ejmste/13508	
Mismatching ideas among the experts-Producing science edu- communication media for the citizen	em2326
Leon Yufeng Wu	
https://doi.org/10.29333/ejmste/13509	

Construct map development for the propagation of sound in the air João Paulo Costa, Mónica Baptista, Teresa Conceição, Paulo Maurício https://doi.org/10.29333/ejmste/13510	em2327
Evaluating students' ability in constructing scientific explanations on chemical phenomena	em2328
Lukman Abdul Rauf Laliyo, Rahmat Utina, Rustam Husain, Masri Kudrat Umar, Muhammad Rifai Katili, Citra Panigoro https://doi.org/10.29333/ejmste/13524	
Analysis of supervisor's written feedback addressing pre-service science teachers' pedagogical content knowledge during teaching practice Nathaniel Ayodeji Omilani, Stella Nneka Ogbonna https://doi.org/10.29333/ejmste/13525	em2329
https://doi.org/10.25555/cjiliste/15525	
Bibliometric review of articles related to context-based learning in science education	em2330