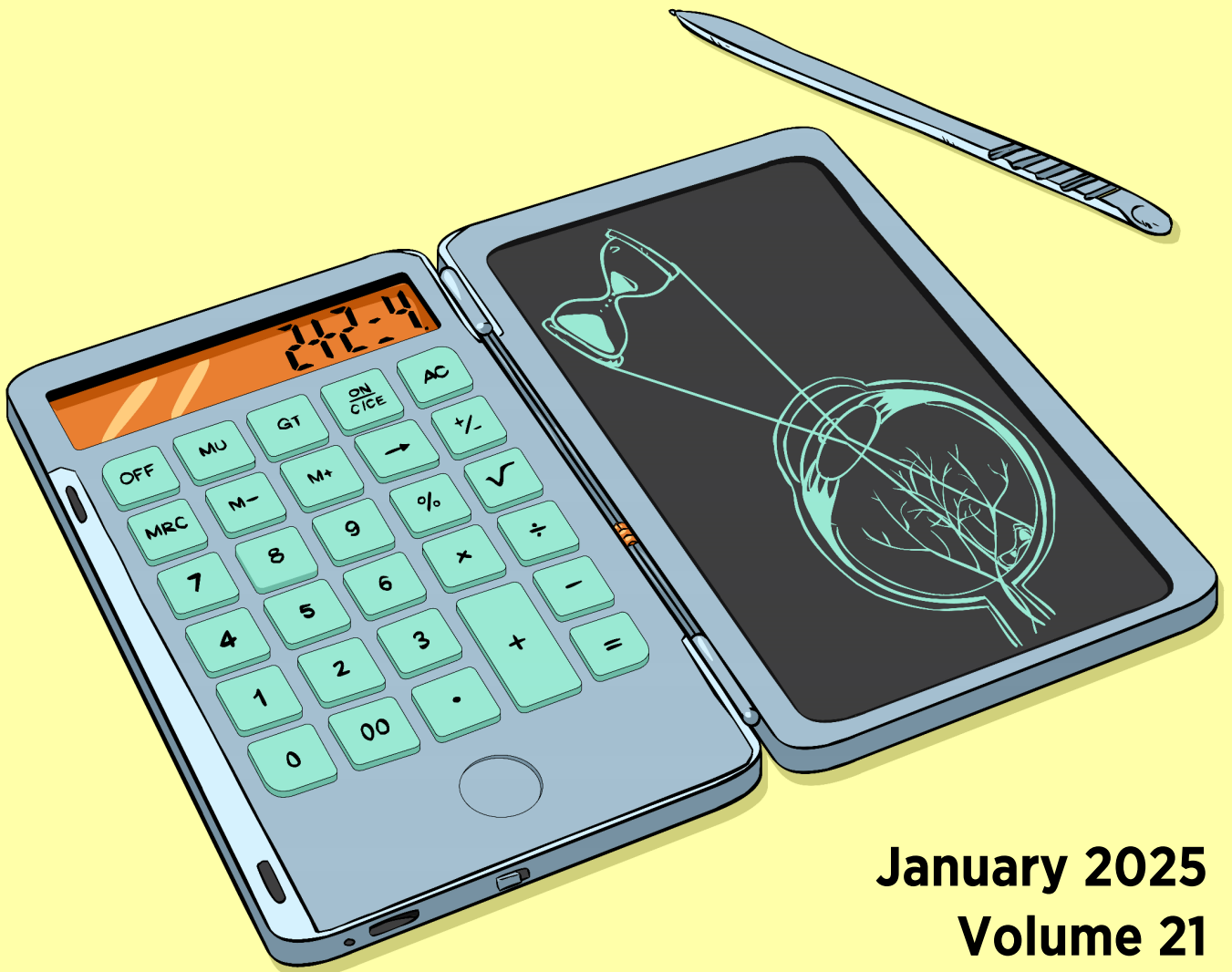


ISSN: 1305-8223

# EURASIA JOURNAL OF MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION



January 2025  
Volume 21  
Issue 1

Published by: **Modestum**

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

Serbia Office: Modestum DOO, Bulevar Zorana Đinđića 125D, sprat 1, stan 12C, 11070 Belgrade, SERBIA

Phone: +381 61 6600107

Email: [publications@modestum.co.uk](mailto: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>

© 2005-2025. 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**

January 2025  
Volume 21  
Issue 1



*This page is intentionally left blank*

## 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](#)
- [PSYINDEX](#)
- [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

**Philipp BITZENBAUER**, Universität Leipzig, GERMANY

### 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

Joohee 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 VOITSINA, 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

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, Comenius University Bratislava, 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
 

---

- 'This is not going to change in the short term'–Finnish and Spanish primary school student teachers' views on competencies for promoting sustainability education** em2556  
*Eija Yli-Panula, Isabel Banos-Gonzalez, Eila Jeronen, Maaria Tringham*  
<https://doi.org/10.29333/ejmste/15793>
- 
- Learning mathematics through peer assessment: "How can we assess something that we ourselves don't know how to solve?"** em2557  
*Yaniv Biton*  
<https://doi.org/10.29333/ejmste/15794>
- 
- A systematic review of empirical studies: Outcomes from programs informed by STEM reforms and policies** em2558  
*Evi Konstantinidou, Maria Evagorou*  
<https://doi.org/10.29333/ejmste/15795>
- 
- Enhancing student's interactivity and responses in learning geometry by using augmented reality** em2559  
*Dedi Rohendi, Muhammad Oka Ramadhan, Suzieleez Syrene Abdul Rahim, Hutkemri Zulnaidi*  
<https://doi.org/10.29333/ejmste/15796>
- 
- Enhancing student engagement through instructional STEAM learning activities and self-explanation effect** em2560  
*Mirjana Maričić, Branko Anđić, Filiz Mumcu, Mia Marić, Snežana Gordić, Marijana Gorjanac Ranitović, Stanko Cvjetičanin*  
<https://doi.org/10.29333/ejmste/15798>
- 
- The effect of technology integration on college of education students' achievement in quadratic equations: The perspective of photo math utilization** em2561  
*Prince Kusi, Francis Ohene Boateng, Emmanuel Teku*  
<https://doi.org/10.29333/ejmste/15799>
- 
- Integrating problem-based learning into the first-year physics laboratory course: A post-COVID-19 scenario at Walailak University, Thailand** em2562  
*Punsiri Dam-o Adamczyk, Thammarong Eadkhong, Chitnarong Sirisathitkul*  
<https://doi.org/10.29333/ejmste/15801>
- 
- The influence of multimodal learning strategies on prospective biology teachers' literacy-numeracy learning outcomes** em2563  
*Kasman Arifin, Muhammad Sirih, Asmawati Munir, Jahidin, Murni Sabilu*  
<https://doi.org/10.29333/ejmste/15802>

- Examining gendered patterns in mathematics and science anxiety levels among physical science pre-service teachers** em2564  
*Sakjiwaa Boateng, Brighton Mudadigwa, Sue Johnston-Wilder*  
<https://doi.org/10.29333/ejmste/15800>
- 
- Mathematics and science teachers: How their perceptions of their TPACK and use of technology interrelate** em2565  
*Ira Raveh, Irit Lavie, Iris Wagner-Gershgoren, Shirley Miedijensky, Ruti Segal, Anat Klemer*  
<https://doi.org/10.29333/ejmste/15803>
- 
- Modeling the understanding of the vector concept by a Bayesian multidimensional item response model** em2566  
*Viana Nallely García-Salmerón, Flor Monserrat Rodríguez-Vásquez, Francisco J. Ariza-Hernandez*  
<https://doi.org/10.29333/ejmste/15856>
- 
- Building students' research skills in environmental science courses with research team-based learning** em2567  
*Febblina Daryanes, Siti Zubaidah, Susriyati Mahanal, Sulisetijono*  
<https://doi.org/10.29333/ejmste/15893>
- 
- A systematic review of the implementation of STEAM education in schools** em2568  
*Aray K. Amanova, Laura A. Butabayeva, Galiya A. Abayeva, Akerke N. Umirbekova, Saltanat K. Abildina, Airegim A. Makhmetova*  
<https://doi.org/10.29333/ejmste/15894>
- 
- Prospective primary school teachers' mathematical knowledge of sampling** em2569  
*Alondra Stuardo-Aguayo, María Magdalena Gea, Nuria Begué, Carmen Batanero*  
<https://doi.org/10.29333/ejmste/15895>
- 
- Empowering STEM teachers with TPACK: Insights from the DECODE online professional development program** em2570  
*Bevo Wahono, Slamet Hariyadi, Agung Wijaya Subiantoro, Jose Arturo Molina Bravo, Marison Sudianto Manalu*  
<https://doi.org/10.29333/ejmste/15896>
- 
- The impact of computerized adaptive test termination rules on accuracy across different ability estimation methods** em2571  
*Lana Dwahdh, Nedat Alshraifin*  
<https://doi.org/10.29333/ejmste/15897>