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Editorial by Laela Sagita



Mathematics Teaching-Research Journal's Golden Fall issue is here.

With the return of The Problem Corner and 11 articles across various countries on mathematics education reveals diverse innovative approaches to developing both teacher and student competencies. These diverse approaches demonstrate that mathematics education is continuously evolving with innovative interventions and strategies aimed at enhancing students' understanding, motivation, and skills in various global contexts.

Taganap from the Philippines highlights an error analysis of pre-service mathematics teachers in solving verbal problems, emphasizing the importance of a deeper understanding of such problems. In Spain, **Muñoz-Escolano** explores the problem posing approach to train

prospective teachers in developing proportional reasoning, which is highly relevant for improving mathematical teaching competencies. Meanwhile, **Sie** in Ghana examines the harmony between pre-service teachers' knowledge of fractions and their classroom practices, stressing the need for alignment between theory and practice.

In Indonesia, two notable studies emerge. **Miftah** develops student worksheets through an interactive case-based learning model assisted by the Cublend app, aiming to enhance students' mathematical literacy skills, while **Nugroho** investigates how augmented reality can motivate students in the mathematics classroom. Additionally, **Syawahid**, also from Indonesia, highlights the functional thinking skills of mathematically gifted students in figural and non-figural linear patterns.

Research in other countries also offers significant insights. **Yazgan-Sağ** from Turkey discusses prospective teachers' thoughts on educating mathematically gifted students, which is increasingly relevant in the context of inclusive education. In Bhutan, **Gembo Tshering** conducted action research intervention in teaching algebra to Grade 7 students, emphasizing the importance of action-based approaches in the classroom. In the USA, **Yu** encourages undergraduate students to explore multiple proofs of the multinomial theorem, promoting critical thinking in advanced mathematics. **López** from Mexico explores how high school students understand and apply trigonometric ratios in motion vectors, aiming to shift from instrumental to relational understanding. Finally, in Greece, **Polydoros** examines math anxiety in the virtual classroom during the COVID-19 pandemic and its relationship to academic achievement, providing critical insights into the impact of online learning on students.

We extend our gratitude to the authors who entrusted us with their manuscripts, thereby establishing the Mathematics Teaching-Research Journal as an international authority in mathematics education research. **Enjoy!**

Error Analysis of Pre-Service Mathematics Teachers in Solving Verbal Problems

Author: *Frinz Adrian O. Valdez, Eduard C. Taganap* (p.6)

The paper focuses on analyzing the errors made by pre-service mathematics teachers when solving verbal math problems, using Newman's Error Analysis framework. It highlights the persistent issue of low mathematics proficiency among these teachers in the Philippines, partly due to challenges in understanding English, the medium of instruction. The study identifies various types of errors across different stages of problem-solving, including reading, comprehension, transformation, process skills, and encoding errors. Key findings suggest that while the teachers perform relatively well in reading the problems, they struggle more with comprehension and transformation, which are crucial for effective problem-solving. The research emphasizes the need for improved teaching strategies, critical thinking, and practical applications of mathematical concepts to enhance the mathematical abilities of future educators. Additionally, it suggests a refresher program for graduating pre-service teachers to address potential knowledge gaps, especially those exacerbated by online learning during the pandemic.

Problem Posing in Mathematics Teacher Training: Developing Proportional Reasoning

Author: *María Burgos, Jorhan Chaverri, José M. Muñoz-Escolano* (p.35)

The paper focuses on a study examining how prospective mathematics teachers create problems to develop proportional reasoning. It explores their beliefs about what constitutes a good problem and the challenges they face in problem posing. The study highlights the importance of problem posing in teacher training and identifies gaps in teachers' understanding of proportionality across various mathematical contexts, such as arithmetic, geometric, and probabilistic. Using the Onto-semiotic Approach, the research analyzes participants' responses to uncover discrepancies between their beliefs and practices in problem posing. The findings emphasize the need for improved training in proportional reasoning, particularly in geometric and probabilistic contexts, and suggest that a good problem should have a clear statement, motivating context, and promote reasoning. The study calls for further research and interventions to enhance the competencies of prospective teachers in creating effective mathematical problems.

Harmony in Teaching: Unraveling the Interplay between Pre-Service Teachers' Mathematical Knowledge Fractions and Classroom Practices

Author: *Charles Kwabena Sie, Douglas Darko Agyei* (p.59)

The paper explores the relationship between pre-service teachers' Mathematical Knowledge for Teaching Fractions (MKTF) and their teaching practices. It examines how different domains of

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MKTF influence various components of teaching effectiveness, particularly in the context of teaching fractions. The study involves 171 pre-service teachers from Ghana and uses regression analyses to assess the impact of MKTF on teaching practices. Key findings highlight the importance of specific MKTF domains, such as Knowledge of Content and Students (KCFS) and Content Knowledge for Teaching Fractions (CCKF), in improving teaching quality. The research emphasizes the need for enhanced teacher preparation and professional development to strengthen mathematical knowledge and teaching practices, ultimately aiming to improve instructional quality and student performance in mathematics. The study also notes the interdependence of MKTF domains and their collective influence on teaching practices.

Development of Prospective Teacher Student Worksheets Through Interactive Case-Based Learning Model Assisted by Cublend App to Improve Mathematical Literacy Skills

Author: *Ramdani Miftah, Lia Kurniawati, Kamal Fikri Musa* (p.76)

The paper presents details a study on enhancing mathematical literacy skills in prospective teacher students through the development of teaching materials based on the Inquiry-Based Collaborative Learning (ICBL) model, supported by the Cublend application. The study involves creating Learner Worksheets (LKPD) focused on arithmetic and geometric sequences, validated by experts and evaluated through student feedback. The findings indicate that these materials are valid, practical, and effective, significantly improving students' mathematical literacy skills, as evidenced by increased test scores. The research suggests that the ICBL-Cublend App model is a promising alternative for teacher professional development programs.

Figural and Non-Figural Linear Pattern: Case of Primary Mathematical Gifted Students' Functional Thinking

Author: *M. Syawahid, Nasrun, Rully Charitas Indra Prahmana* (p.94)

The authors explore the functional thinking abilities of mathematically gifted elementary students, focusing on their strategies for generalizing relationships in linear pattern tasks. The research highlights the students' use of various strategies, such as counting, multiplicative approaches, and contextual reasoning, to derive general forms and express relationships symbolically. The studies emphasize the advanced problem-solving skills of these students and suggest curriculum adjustments to better support their capabilities in functional thinking.

Thoughts of Prospective Mathematics Teachers on Educating Mathematically Gifted Students

Author: *Gönül Yazgan-Sağ* (p.116)

The article examines the perspectives of 40 prospective mathematics teachers on educating mathematically gifted students, highlighting their views on specialized education, differentiated curricula, and classroom practices. While many believe in the benefits of specialized schools for

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gifted students, concerns about socialization and isolation are noted. The teachers suggest strategies such as differentiated tasks and advanced materials to engage gifted students, but express challenges in implementing these in regular classrooms. The study underscores the need for enhanced teacher education programs to better equip teachers with the knowledge and skills necessary for effectively supporting gifted learners.

Teaching Algebra to a Grade 7 Student: Action Research Intervention

Author: *Gembo Tshering* (p.132)

The paper highlights the importance of responsive pedagogy, advocating for teacher professional development, metacognitive strategies, and culturally relevant teaching methods. It emphasizes creating supportive learning environments through personalized and differentiated instruction, ultimately aiming to foster a deeper conceptual understanding of algebra and encourage students to engage with mathematics as critical thinkers and lifelong learners.

Encouraging Undergraduate Students to Explore Multiple Proofs of the Multinomial Theorem

Author: *Christian Farkash, Michael Storm, Thomas Palmeri, Chunhui Yu* (p.154)

The paper explores various methods for proving the multinomial theorem, including combinatorial, induction, probability, and differential calculus approaches, and examines undergraduate students' attitudes toward these methods. A study conducted with math majors at Farmingdale State College revealed that while students appreciated multiple proof methods, they were most comfortable with combinatorial and induction proofs. The document emphasizes the educational benefits of exposing students to diverse proof techniques to enhance their understanding and problem-solving skills, and it also encourages further exploration of the binomial and multinomial theorems.

Trigonometric Ratios in High School Students: From Instrumental Understanding to Relational Understanding through their Application in Motion Vectors

Author: *Ivonne Alejandra Toledo-Nieto, José Antonio Juárez-López* (p.164)

The paper discusses various educational interventions and teaching strategies aimed at improving students' understanding of trigonometric concepts and vector addition. It includes a didactic sequence that integrates technology and collaborative learning, using tools like Google Maps and GeoGebra. The interventions focus on transitioning students from a superficial, procedural understanding to a deeper, relational comprehension of trigonometric ratios and their applications in motion vectors. The effectiveness of these strategies is evaluated through pretest-posttest assessments, with statistical analysis indicating significant improvements in students' understanding post-intervention.

The Problem Corner (p.183)

Ivan Retamoso

How to Motivate Students Using Augmented Reality in The Mathematics Classroom? An Experimental Study

Author: *Wanda Nugroho Yanuarto*¹, *Elfis Suanto*², *Ira Hapsari*¹, *Aulia Nisa Khusnia* (p.191)

The paper is a compilation of research articles and studies focused on the use of augmented reality (AR) in mathematics education. It explores the development, implementation, and effectiveness of AR-based learning tools aimed at enhancing students' critical thinking, motivation, and understanding of mathematical concepts. The studies cover various topics, including the challenges educators face, the impact of AR on students' learning experiences, and its practical applications in teaching geometry and other mathematical areas. The research indicates that AR can significantly improve student engagement, problem-solving skills, and overall learning outcomes compared to traditional teaching methods. However, it also highlights challenges such as high costs, technical issues, and the need for improvements in user interface and graphics. Overall, the findings suggest that while AR has the potential to enhance learning, effective teaching practices are crucial for maximizing its benefits.

Math Anxiety in the Virtual Classroom during COVID-19 Pandemic and its Relationship to Academic Achievement

Author: *Georgios Polydoros* (p.213)

The paper explores the relationship between mathematics anxiety (MA) and academic performance, particularly focusing on gender differences among sixth-grade students during the COVID-19 pandemic. It highlights that girls tend to experience higher levels of MA, which negatively impacts their math test scores compared to boys. The research underscores the importance of addressing math anxiety in educational settings, especially for female students, and suggests targeted interventions to mitigate its effects. The study also discusses the challenges posed by emergency online education during the pandemic and its psychological effects on children.