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Developing Confidence in Pre-Service Mathematics Educators: Making Mathematics Meaningful for All



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Overview

This article highlights the need for the design of authentic assessment in the Mathematics Education Programme, showcasing how future educators utilize diverse models and technologies to enhance teaching and learning across mathematical strands. The initiative sought to develop greater confidence and competence in Pre-Service Mathematics Educators as they showcased their work to visiting teachers and students, and to promote a shift away from traditional rote learning toward the practical, real-world application of mathematical concepts.

The Challenge

Each year, pre-service teachers enter the teaching profession, many motivated by their enjoyment of and aptitude for Mathematics. They enter teacher training institutions with a passion to gain more knowledge in the subject area of Mathematics and in essence develop their skills and competences in delivering the concepts associated with the subject. However, as they begin their teacher preparation programmes, mathematics teacher educators often observe that many pre-service teachers lack confidence in their ability to effectively communicate concepts across the major strands of mathematics.

The challenge, therefore, was developing both mathematical confidence and mathematics teaching self-efficacy in Pre-Service Mathematics Educators.

These attributes significantly influence instructional effectiveness, teachers' willingness to engage students in meaningful mathematical inquiry, and their persistence in teaching challenging concepts. Research indicates that teachers with high mathematics teaching self-efficacy are more likely to adopt effective, student-centred instructional practices that enhance students' learning experiences and achievement (Tschannen-Moran & Woolfolk Hoy, 2001). Similarly, engaging pre-service teachers in rich problem-solving experiences strengthens their confidence by promoting productive struggle, persistence, and deep conceptual understanding rather than an overreliance on procedural fluency (Boaler, 2022).

Recognizing the importance of these competencies, the Bachelor of Education in Mathematics programme introduced the use of authentic assessment early in Year One in many courses. One such course is: 'Problem Solving and Mathematics Investigation'. This course provides pre-service teachers with opportunities to engage in authentic mathematical tasks that require investigation, reasoning, collaboration, reflection, and the application of multiple problem-solving strategies to real-world contexts. Through these experiences, students begin to develop the confidence, resilience, and pedagogical understanding necessary for effective mathematics teaching throughout the remainder of the programme and into their professional practice.

The Innovation

In the Problem Solving and Mathematics Investigation course, pre-service teachers participate in authentic assessment experiences that require them to apply mathematical knowledge and pedagogical skills to real-world contexts. Working from an assigned theme, they design and develop an innovative product, such as a mathematical model, educational game, mobile application, or other technology-based solution, that demonstrates meaningful connections between mathematics and everyday life. As part of the assessment, they create problem-solving tasks that integrate concepts from the major mathematics strands, including Number, Algebra, Geometry, Measurement, Statistics, and Probability.

The culminating assessment is presented at the institution's annual Mathematics Exposition, where pre-service mathematics teachers showcase their projects to an audience of teacher educators, peers, school students, and other invited stakeholders. They are evaluated on the creativity, mathematical accuracy, relevance, and practicality of their products, as well as their ability to communicate mathematical concepts effectively, justify their design decisions, and engage visitors in meaningful mathematical discussion. This authentic assessment fosters confidence, creativity, critical thinking, collaboration, and effective mathematical communication while preparing pre-service teachers to design engaging learning experiences for their future classrooms.

In addition, students in Grades 4 to 11 who attended the Mathematics Exposition were exposed to a variety of problem-solving strategies and mathematical investigations that enhanced their analytical and critical thinking skills. Through observing demonstrations and engaging with pre-service mathematics educators, they explored multiple approaches to solving mathematical problems and developed a deeper understanding of mathematical concepts across the curriculum. These experiences strengthened students' preparedness for national and regional examinations, including the Primary Exit Profile (PEP) and the Caribbean Secondary Education Certificate (CSEC) Mathematics examination. By showcasing the practical application of mathematical concepts, the exposition sought to increase students' interest, confidence, and positive attitudes towards mathematics.

A Taste of the Experience at the Mathematics Exposition

The Mathematics Exposition is an annual event held during Semester Two of each academic year (January–May). Each year, the exposition is organized around a theme aligned with the Ministry of Education, Skills, Youth and Information's national focus for Mathematics Week, ensuring that the authentic assessment activities in the Problem Solving and Mathematics Investigation course are directly connected to current national priorities in mathematics education.



This year's Mathematics Exposition was held on March 31, 2026, under the theme, "Mathematics for All: Building Communities, Confidence, Competence and Creativity." The event welcomed approximately 300 students and 30 teachers who were formally invited to participate. It provided pre-service mathematics educators with an authentic platform to showcase the assessment projects they had developed throughout the course while engaging with students, teachers, teacher educators, and other invited stakeholders. They used demonstrations, mathematical investigations, educational games, models, and technology to showcase their mathematical knowledge, creativity, teaching skills, and ability to integrate technology effectively into mathematics instruction. These authentic interactions contributed significantly to the development of their confidence, communication skills, and readiness for classroom practice. Furthermore, participants also receive a certificate of participation, acknowledging their involvement and encouraging continued interest and engagement in mathematics.

The highlights included the participation of keynote speaker Senator the Honourable Dr. Dana Morris Dixon, Jamaica's Minister of Education, Skills, Youth and Information. In her keynote address, Dr. Dana Morris Dixon emphasized that mathematics is everywhere -in banking, road design, public health, architecture, logistics, coding, construction, robotics, music, climate science, and artificial intelligence. Similarly, President of The Mico University College, Dr. Asburn Pinnock, noted that when mathematics begins to make sense to learners, it builds confidence, as students' struggles often stem not from a lack of ability but from a lack of connection to the subject. The Mathematics Exposition sought to strengthen that connection by demonstrating the relevance of mathematics through authentic, real-world applications while highlighting its interdisciplinary nature across the fields of Science, Technology, Engineering, the Arts, and Mathematics (STEAM).

I was also delighted to capture many of the event's highlights through the accompanying photographs. Viewing the mathematics exposition through the lens of a photographer - one of my favourite passions after teaching mathematics, gave me a unique perspective on the excitement, curiosity, and meaningful learning that unfolded throughout the day.



Dr. Asburn Pinnock, President of the Mico University College, Kingston, Jamaica



The Honourable Dana Morris Dixon, Minister of Education, Skills, Youth and Information



Pre-Service Teachers showcasing their work at Math Expo 2026

The Impact of the Mathematics Exposition

The Mathematics Exposition became a highly anticipated annual event for mathematics teachers, students, and pre-service mathematics educators. It consistently left a lasting impression on teachers, many of whom expressed a desire to replicate the innovative teaching resources and mathematical activities they experienced. They frequently inquired about how the materials were developed and how similar ideas could be incorporated into their own classrooms, with some even expressing a willingness to purchase the resources for use in their schools.

The impact of the exposition extended beyond practising teachers to the pre-service mathematics educators themselves. Many who participated during the first year of their teacher education journey described the experience as transformative, shaping their perspectives on effective mathematics instruction. As they transitioned into classroom teachers, many expressed a strong commitment to bringing their own students to future expositions so that they, too, could experience mathematics as an engaging, interactive, and meaningful subject. For me, this became one of the greatest indicators of the exposition's success—it influenced teaching practices well beyond the event itself and contributed to the preparation of future generations of mathematics educators.

For school students, the exposition provided opportunities to develop critical thinking, problem-solving, creativity, and mathematical reasoning through hands-on activities, mathematical games, and real-world applications. Students actively engaged with challenging tasks in a supportive and enjoyable environment, which helped them recognize that mathematics was both accessible and enjoyable. Participating in games and competitions also built their confidence and sense of accomplishment, particularly when they successfully solved problems or received recognition for their achievements.

Ultimately, the Mathematics Exposition became much more than an authentic assessment activity. It inspired practising teachers, empowered pre-service educators, and fostered confidence, curiosity, and deeper mathematical understanding among students. Its impact continued to strengthen mathematics education within schools and across the wider educational community.



Year One Pre-Service Mathematics Teachers with their Lecturers for the course: 'Problem Solving and Mathematics Investigation', Cheryl Lue-Simpson and Jessica Scarlett at the Mico University College, Kingston, Jamaica (March 2026)



Lessons Learnt

Continuous reflection and improvement remained essential responsibilities of mathematics teacher educators in ensuring that pre-service teachers were equipped to meet the evolving demands of contemporary classrooms. As curricula, learner needs, and educational priorities changed, teaching approaches, learning experiences, and assessment practices also needed to be regularly reviewed and refined to promote meaningful and effective mathematics learning. Such reflective practice enabled teacher educators to evaluate the impact of instructional strategies and make evidence-informed decisions that enhanced student learning and professional competence (Darling-Hammond et al., 2020).

Following each annual Mathematics Exposition, pre-service teachers and mathematics teacher educators engaged in reflective discussions to evaluate the strengths, challenges, and overall effectiveness of the event. These reflections informed improvements for future expositions while reinforcing successful practices. The discussions consistently revealed a strong sense of accomplishment among participants, who took pride in creating an engaging and meaningful learning experience. Feedback from visitors also indicated that the exposition left a lasting impression, with many continuing to speak about its impact long after the event. Such reflections reaffirmed the exposition's value as a transformative learning experience that inspired innovation, promoted collaboration, and strengthened the teaching and learning of mathematics.

Mathematics teacher education programmes should remain responsive to advances in technology and emerging pedagogical approaches that enrich the teaching and learning of mathematics. Integrating digital technologies, authentic problem-solving experiences, mathematical modelling, and inquiry-based learning helped pre-service teachers develop conceptual understanding, critical thinking, creativity, and confidence while demonstrating the relevance of mathematics to everyday life.

By designing courses that reflect contemporary educational practices and technological innovations, teacher education programmes better prepared future mathematics teachers to create engaging, student-centred learning environments and equip their own students with the knowledge, skills, and competencies needed to thrive in an increasingly complex and technology-driven world (National Council of Teachers of Mathematics, 2023; UNESCO, 2023).

Looking Ahead: Recommendations for Future Practice

Reflecting on this experience, I believe there are several practical steps that mathematics teacher education programmes can take to strengthen the use of authentic assessment and better prepare future teachers for today's classrooms.

- 1. Expand the use of authentic assessment.**
As technology continues to advance and learners become increasingly reliant on digital tools, teacher educators must adapt their assessment practices to better reflect the realities of contemporary classrooms. Greater emphasis should be placed on authentic assessment strategies that require pre-service teachers to apply their knowledge in meaningful, real-world contexts. Unlike traditional assessments that often emphasize procedural fluency and recall, authentic assessment provides a richer measure of learners' ability to apply mathematical knowledge, reasoning, communication, collaboration, creativity, and problem-solving to unfamiliar situations (Darling-Hammond et al., 2020; National Council of Teachers of Mathematics [NCTM], 2023).
- 2. Make authentic assessment an integral part of teacher preparation.**
Authentic assessment should not be viewed as a single activity at the end of a course but as an ongoing part of teaching and learning. The Mathematics Exposition demonstrated how meaningful assessment experiences can strengthen pre-service teachers' confidence, pedagogical competence, and ability to communicate mathematical ideas while bridging the gap between theory and classroom practice.
- 3. Continue embracing technology in mathematics education.**
Teacher education programmes should continue creating opportunities for pre-service teachers to integrate digital technologies into mathematics teaching and learning. The use of virtual manipulatives, interactive games, simulations, presentation technologies, and mathematical visualization tools enriched the learning experience and helped pre-service teachers communicate mathematical concepts more effectively. Technology-rich learning environments also strengthened learner engagement and conceptual understanding when integrated purposefully into instruction (UNESCO, 2023).
- 4. Create opportunities for authentic audiences.**
Providing opportunities for pre-service teachers to present their work to school students, teachers, and teacher educators encouraged ownership of learning, sustained engagement, and greater confidence. These authentic experiences reinforced the relevance of mathematics and helped pre-service teachers appreciate the importance of making learning meaningful and accessible.
- 5. Assess professional competence in multiple ways.**
Authentic assessment provided opportunities for pre-service teachers to demonstrate their understanding not only through the mathematical products they created but also through their ability to explain concepts, justify their reasoning, respond to questions, and facilitate mathematical discussions. These experiences offered a more comprehensive picture of the professional competencies expected of effective mathematics teachers than traditional written examinations alone.



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Cheryl Lue-Simpson is an experienced mathematics educator with over 20 years of teaching experience at the secondary and tertiary levels in Jamaica. She currently serves as a Lecturer in the Department of Mathematics at The Mico University College, where she is committed to preparing future mathematics educators through innovative, student-centred teaching and authentic assessment practices. Throughout her career, she has demonstrated a strong commitment to advancing mathematics education through effective teaching, curriculum development, and teacher preparation. Her work spans classroom instruction, mentoring pre-service teachers, and facilitating professional development initiatives aimed at strengthening mathematical understanding and pedagogical practice. Cheryl is particularly passionate about problem-solving, helping learners develop logical and critical thinking skills through real-life experiences. As a dedicated lecturer and educational practitioner, she continues to contribute to the improvement of mathematics teaching and learning in Jamaica by fostering engaging, relevant, and learner-centred approaches to mathematics education. 

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