AIMS Ghana

HTMC

HELPING TEACHERS TEACH MATHEMATICS CONFERENCE

University of Ghana

13th – 16th of May 2025

AIMS | African Institute for Mathematical Sciences GHANA

UNIVERSITY OF WATERLOO

The CENTRE for EDUCATION in MATHEMATICS and COMPUTING
cemc.uwaterloo.ca

ABOUT AIMS GHANA

AIMS (African Institute for Mathematical Sciences) is a non-profit pan-African network dedicated to delivering exceptional teaching, research, and education in the Mathematical Sciences. Established in 2003, it stands as Africa's pioneering network of Centers of Excellence, aiming to empower Africa's brightest minds to become independent thinkers, problem solvers, and innovators, crucial for Africa's scientific, industrial, educational, and economic advancement.

With a presence across Africa, including South Africa, Senegal, Ghana, Cameroon, and Rwanda, AIMS has been a transformative force for over two decades, with its Ghanaian branch making significant strides since its inception in 2012. Led by the late Professor Francis K. A. Allotey, AIMS Ghana attained the prestigious status of a UNESCO Category II Centre of Excellence in 2018, solidifying its commitment to excellence.

AIMS Ghana boasts a diverse alumni base, having graduated over 500 students from 27 African nations, with a notable 33% being female. The center offers a Regular Master's in Mathematical Sciences program, spanning 10 months, and a Master's in Mathematical Sciences for Teachers (MMST) Program initiated in 2020, supported by the Government of Ghana. The MMST program, designed for mathematics educators, utilizes a hybrid learning approach to equip teachers with modern mathematical skills, enhancing both content and teaching methodologies in secondary-level education.

One of the key strengths of AIMS Ghana lies in its curriculum, which not only imparts theoretical knowledge but also emphasizes practical applications. AIMS students are trained to apply mathematical principles to solve real-world challenges across various sectors such as finance, healthcare, technology, agriculture, climate forecasting, and natural resource management. The impact of this training is evident, with approximately 70% of AIMS graduates furthering their studies in esteemed global universities, while others have ventured into industry, making remarkable contributions.

ABOUT THE HTTMC

A major objective of AIMS Ghana as a UNESCO Category II Centre of Excellence is to provide training and professional development in the Mathematical Sciences for high school teachers across Africa.

In line with this, AIMS Ghana in collaboration with the Centre for Education in Mathematics and Computing (CEMC) at the University of Waterloo, Canada have partnered to organize an annual conference on helping teachers teach Mathematics and Computing, dubbed the Helping Teachers Teach Mathematics Conference (HTTMC).

The goal of the conference is to provide current teachers in Africa with the opportunity to expand their knowledge on how to teach mathematics based on the foundations of the core high school curricula. It also aims to expose them to new ways of teaching and applying modern mathematics. Most talks and presentations which would during the conference include tasks that will be directly applicable to daily classroom teaching. The conference will also challenge the teachers to brainstorm creative and dynamic ways of transmitting their knowledge to students.

This blended (online/in-person) conference for Mathematics teachers is an opportunity to connect and share ideas.

With the first edition successfully organized in 2023, this year's Helping Teachers Teach Mathematics Conference (HTTMC) seeks to bring educators together to share their knowledge and expertise, help build new connections and tap into a renewed enthusiasm for mathematics and computing.

Agenda

DAY 1	14th May, 2025
7:00 - 9:00	Arrival and Registration
9:00 - 9:30	Ice Breaker
9:30 - 10:00	Opening Remarks
10:00 - 11:30	Plenary Session: Emmanuel Essel (in person)
11:30 - 12:00	**Coffee Break**
12:00 - 13:30	Parallel Session Speaker 1 - Salomey Addo (in person) Speaker 2 - Gloria Armah (in person)
13:30 - 14:30	**Lunch**
14:30 - 15:30	Practice Session/ Tutorials
15:30 - 17:00	Parallel session Speaker 1 - Judith Ann Koeller (online) Speaker 2 - David Stern (online)
17:00 - 18:00	Plenary session: Rich Dlin (online)

DAY 2	15th May, 2025
8:30 - 10:00	Plenary Session: John Afrim (in person)
10:00 - 11:30	Parallel session: Speaker 1 - Chisara N.P. Ogbogbo (in person) Speaker 2 - Peter Akayuure (in person)
11:30 -12:00	**Coffee Break**
12:00 -13:30	Parallel session: Speaker 1 - Carly Ziniuk (online) Speaker 2 - Jen Nelson (online)
13:30 -14:30	**Lunch**
14:30 -15:30	Practice Session/ Tutorials
15:30 -17:00	Plenary Session: Ian VanderBurgh (online)
17:00 -18:00	Plenary session: Rhoda Hawkins (in person)

DAY 3	16th May, 2025
8:30 -10:00	Plenary Session: Angela Tabiri (in person)
10:00 -11:30	Panel discussion
11:30 -12:00	**Coffee Break**
12:00 -13:30	Pitch by participants on creative ways of teaching maths
13:30 -14:30	**Lunch**
14:30 -15:30	Closing Ceremony and Departure

Speakers

Emmanuel Essel

University of Cape Coast

Salomey Addo

University of Cambridge

Gloria Armah

University of Education Winneba

Judith Ann Koeller

University of Waterloo

David Stern

Innovations in Development, Education and the Mathematical Sciences (IDEMS) International

Rich Dlin

University of Waterloo

John Afrim

International Baccalaureate Specialization

Ian VanderBurgh

University of Waterloo

Chisara N.P. Ogbogbo

University of Ghana

Peter Akayuure

University of Education

Carly Ziniuk

NASA Space Apps Collective

Jen Nelson

Centre for Education in Mathematics in Computing

Rhoda Hawkins

AIMS Ghana

Angela Tabiri

AIMS Ghana

Abstracts

Day 1

Emmanuel Essel

Ideas for teaching in content areas and best practices in the classroom

Salomey Addo

PRIMM – an approach to teaching programming in schools

PRIMM is a structured approach to teaching programming in schools. The acronym stands for Predict, Run, Investigate, Modify, Make, and it is grounded in research on programming education. This framework supports teachers in delivering programming lessons in a collaborative and learner-centred way. By using PRIMM, teachers can scaffold learning and design targeted tasks that help students grasp key programming concepts. Studies have shown that teachers who implement PRIMM often see improved understanding among students who previously found programming challenging. In my talk, I will demonstrate how PRIMM can be effectively used in the classroom to enhance the teaching and learning of programming.

Gloria Armah

Beyond the Bars

This study explored the ability of first-year pre-service mathematics teachers to interpret graphical representation, with an emphasis on histograms. The descriptive survey design was employed as the methodological framework for the investigation. The study was carried out at the Department of Mathematics Education, University of Education, Winneba, Ghana, during the 2022/2023 academic year. The purposive and convenient sampling techniques were used to sample 342 first-year pre-service mathematics teachers. This sample included 31.3% (107) trained teachers who have taught mathematics at the basic school level. Females also formed 15.5% (53) of the sample. The test used as the instrument for collecting data was adapted from previous studies and classified into two skill types: statistical literacy (SL) and statistical reasoning (SR). Data was analysed by computing the success rates for the items as well as assessing participants' valid justifications for their responses. This gave insight into the challenges participants encountered. Under statistical literacy items, findings revealed that for items which covered tasks like reading frequencies and identifying axes, success rates ranged from 45.6% (156) to 63.7% (218), whereas those which required identification of the median of a categorical dataset in a bar chart and comparing modes of two histograms presented a more complex situation with success rates around 26.0% (89). Under the statistical literacy items, only 12.1% (11) could provide valid justifications for their correct response on the item on identifying the median of a categorical dataset in a bar chart, and 28.1% (25) for the item on comparing modes

of two histograms. On statistical reasoning items, moderate success rates were recorded for items requiring interpretation of information from histograms with success rates ranging from 33.0% (113) to 56.1% (192).

Challenges were encountered with matching a given description to an appropriate histogram and comparing and contrasting distribution characteristics, with success rates of 24.0% (82) and 0.6% (2), respectively. Under these statistical reasoning items, participants' lack of conceptual understanding was evident, as either zero conceptually sound justifications were recorded or an abysmally low one (5.3% (9) or 6.2% (7)), even for correct responses, with just a repetition of the choice of answer from the options. Participants demonstrated moderate proficiency in basic statistical tasks; however, significant challenges were encountered with more complex tasks which required inferential reasoning. It was recommended that teachers integrate creative pedagogical approaches and interactive technologies that emphasise statistical reasoning into their teaching.

Judith Ann Koeller

A Window from your Math Classroom to the World

Try your hand at some mathematical problems with real-world applications, including planning more efficient routes, transmitting photos from space, saving lives through organ donations, and predicting future population numbers. We will see how these connect to high school curriculum topics, including polynomials, factorials and probability.

David Stern

Might the digital textbooks of the future be openly co-developed by African teachers?

This presentation will start by presenting experiences with Educators in Kenya, Ghana and Ethiopia which have inspired me to recognise the need for a different approach to developing educational resources globally. It will then tell elements of the School Mathematics Project(SMP) story, which was largely teacher driven and created a highly successful mathematics textbook series back in the 1960's. It will then switch into an interactive component exposing participants to open digital textbook initiatives from partners across the continent which have the potential to not only support teaching and learning but also enable teachers to participate in developing future looking interactive resources.

Rich Dlin

Engaging Students in Mathematics Requires Only Active Minds

In 2024, Rich had the pleasure of travelling to many different schools in Ghana over the course of three weeks, to work with students and meet and discuss math education with teachers and administrators. It was truly informative and gave him a deep appreciation for the work that Ghanaian educators do. In this talk, Rich will present some of his ideas for teaching mathematics in a way that can engage and challenge students at all ability levels using the resources available. The talk will include

problem solving strategies as well as different approaches to the curriculum that can bring deeper appreciation of mathematics to your students.

Day 2

John Afrim

Incorporating technology in your teaching.

In the evolving landscape of education, technology has become an indispensable tool for enhancing teaching and learning experiences. This presentation, "Incorporating Technology in Your Teaching," explores practical strategies for integrating digital tools into mathematics instruction to foster engagement, differentiation, and conceptual understanding. The session begins by examining the pivotal role of technology in modern mathematics education, setting the stage for intentional and effective integration. Participants will learn how to design dynamic lessons using presentation tools such as Google Slides and PowerPoint to create visually appealing and structured content. The workshop will also highlight how adaptive learning platforms like Khan Academy, IXL, and DeltaMath can support differentiated instruction, catering to diverse student needs and learning paces. Additionally, attendees will explore the use of interactive visualization tools such as GeoGebra and Desmos to make abstract mathematical concepts more tangible and accessible. Finally, the session will provide practical guidance on preparing for online teaching using platforms like Zoom and Google Meet, ensuring that educators are equipped to deliver engaging lessons in both virtual and hybrid environments. By the end of the workshop, participants will have actionable insights and resources to seamlessly incorporate technology into their daily teaching practice.

Ian VanderBurgh

Providing challenges to strong students

Having strong students in our classrooms can be a real blessing, but also presents a challenge to us as educators. How can we best engage these students to allow them to progress and excel, recognizing that our attention is always divided between various groups of students? This session will discuss this challenge from both philosophical and practical angles.

Chisara Peace Ogbogbo

Creativity and Innovation in Delivery of Mathematics content: a Panacea to student Aversion

Student aversion to Mathematics in Africa is a reality. This seems to create a communication barrier between the learner and the teacher. Some level of creativity in the delivery method would arouse the curiosity and interest required for the student to connect. Innovation with flexibility would work better in the teaching of mathematics, than the regular teaching methods. In my talk, I will present series of illustrations, that will awaken the teachers, to device more creative and innovative approach, for the delivery of the subject. It is expected that this will minimize aversion.

Peter Akayuure

Unlocking Students' Mathematical Potentials through Games and Puzzles

In many classrooms in Ghana, the teaching of mathematics is often characterised by abstract expositions and rigid routine procedures. This approach often leads students to view mathematics as socially irrelevant and disconnected from their lived experiences. Games and puzzles have the potential to bridge this pedagogical gap. As socially meaningful dilemmas, games and puzzles do not only resonate with students' everyday experiences but also promote pattern recognition and logical thinking. Although, these pedagogical tools are being referenced in the Ghanaian mathematics curriculum, many Ghanaian mathematics teachers are yet to fully experience and explore their potentials in mathematics classroom. This session introduces mathematics teachers to indigenous and digital games and puzzles as creative, low-cost pedagogical tools for developing mathematical thinking of students in the senior high schools. Underpinned by the constructivist views, the session will explore how problem-based activities, ranging from games and logic puzzles to pattern and strategy-based tasks could foster interest, creativity, critical thinking, collaborative learning and perseverance. Using hands-on demonstrations and reflective discussions, participants will examine how these playful tools deepen students' conceptual understanding and learning engagement, in line with Ghana's Senior High School mathematics curriculum. The session aims to empower teachers to unlock the mathematical potentials of every student in an active, inclusive, joyful, and intellectually stimulating environment.

Carly Ziniuk

Boole Bezier and Beauty

Approximating curves by using lines and line segments is fundamental to the understanding of Calculus, yet all students in high school math courses can explore this concept through both historical contexts and modern applications. You can explore the historical connections with the creativity of these beautiful and geometrical creations while developing your own perspectives while you build your algebraic skills. We will demonstrate connections to Mary Everest Boole's Curve Stitching, coding with Scratch and Desmos, and Bézier curves from architecture and computer graphics. How do these curves describe both the Ba-ila settlements of southern Zambia and the coronal loops, the plasma arcs from the sun?

Jen Nelson

Let's solve some problems!

At its best, math is all about the art of problem-solving. A good problem offers the opportunity to think carefully and systematically, as well as the chance to exercise creativity in discovering a path to the solution. In this session, we will experience these things for ourselves as we work through several interesting problems that could be used for discussion and enrichment in your classroom. Along the way, we will discuss problem-solving tips to share with your students and other resources where you can find more problems to try out in your schools and classrooms.

Rhoda Hawkins

Supporting struggling students

As we all know, lots of students struggle with maths. For many students, an engaging class teacher, encouragement and lots of hard work is what they need. However, some students have particular needs that can mean they do not respond well to usual classroom teaching methods. In this talk we will consider a variety of specific needs and how to support students with these needs. We will consider physical disabilities and learning/behavioural difficulties. Physical disabilities, such as visual and hearing difficulties, can significantly affect a student's ability to learn. Specific learning difficulties such as dyslexia or dyscalculia can cause serious problems but traditionally have often been left undiagnosed. Conditions that affect behaviour, such as ADHD (Attention Deficit Hyperactivity Disorder) and autism, can be disruptive for the teacher and other students as well as the individual with the condition. We will discuss ideas for how to support students with such conditions. With appropriate support these students can achieve the highest levels of attainment in mathematics.

Day 3

Angela Tabiri

Mathematics of Quantum Mechanics for High School Students

The year 2025 has been declared by UNESCO as the International Year of Quantum Science and Technology in commemoration of 100 years since the discovery of quantum mechanics. In this talk, we will discuss the mathematical foundations of quantum mechanics and how this can be introduced in high schools.

Organisers

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AIMS Ghana

Ian VanderBurgh

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Angela Tabiri

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2024 Highlights