

Math Fellows In International Schools

From algebraic relationships to geometric reasoning to inductive and deductive arguments, there are central ideas running through Middle and High School mathematics that must become the focus of secondary math instruction. By adding the Mathematical Practices to the Mathematics Standards, the game has changed in ways that challenge teachers to teach and assess differently. To meet this challenge, it is not sufficient to simply revise the list of mathematical content covered in the curriculum..

The emphasis the AERO Standards places on the Mathematical Practices requires students to be able to think mathematically, and apply the techniques they have learned to rich problems in diverse contexts. A focus on procedures, without attention to why they work, is no longer acceptable. The MFIS program for high school will focus on the impact of the mathematical practices on daily instruction, and To implement the Standards for Math Practice, it is necessary to experience the practice of mathematics. In each institute, teachers will do mathematics as mathematicians, and then reflect on their own work and their thinking processes. Teachers will then consider ways to implement similar tasks in their own classrooms in order to develop students' mathematical thinking. We will consider questions such as what conditions are necessary, how can obstacles be overcome, what are realistic goals, and how do we adapt tasks to fit into the curriculum?

Mathematics Fellows in International Schools (MFIS) is a 2 year certificate program designed for classroom teachers of mathematics, Grades 7-12. The program is a cohort sequence of 5 institutes designed to enhance teachers' understanding of the AERO Mathematics progressions and how to use the mathematical practices to bring order and logic to the content they teach.

Participants will acquire a deeper understanding of the impact of the mathematical practices on student learning and classroom instructional practice by:

- Examining the development of math concepts through the grades to “look back to move forward,” and link prior knowledge to the new concepts being developed;
- Using the progressions to identify sequences of instructional experiences which promote optimal student learning;
- Examine how learning progressions help in monitoring and addressing student progress towards targeted understandings

- Explore classroom-based formative assessment techniques and tools which can be used to plan, implement, and reflect on both teaching and student learning;
- Explore rich mathematical tasks and analyzing the mathematical practices involved
- Adapt and develop high cognitive demand tasks to gather evidence of student learning.
- Critically examine student work from participant classrooms for misconceptions to help in making informed instructional decisions about student learning.

Institute 1 Enhancing Understanding of Number Sense

Number Sense is included in the AERO Mathematics Standards; however classrooms are filled with students...who think of mathematics as rules and procedures to memorize without understanding the numerical relationships that provide the foundation for the rules. The goal of this institute is to examine the progression of the building of conceptual number sense from elementary to high school. A focus will be on Developing an understanding of the role of using multiple representations and contextual situations to support the building of number sense;

Institute 2: Proportional Reasoning

Researchers in mathematics education agree on the importance of developing strong proportional reasoning in the middle grades. Proportional reasoning is described as a pivotal concept, simultaneously the capstone of children's

elementary school arithmetic and the cornerstone of all that is to follow. Proportional reasoning is difficult to develop because it requires students to make significant shifts in thinking. Students must transition from using mostly additive strategies, which are emphasized throughout elementary school, to strategies that are multiplicative. The Institute will explore the Ratios and Proportional Relationships Domain of the AERO Mathematics Standards and will focus on thinking about proportional relationships through multiple representations, such as tape diagrams, double number lines, ratio tables, graphs, equations, and verbal descriptions.

Institute 3 Algebraic Reasoning

Algebraic reasoning permeates all of mathematics and is about describing patterns of relationships among quantities – as opposed to arithmetic, which is carrying out calculations with known quantities. "The Standards in mathematics are built on progressions which describe the progression of a topic across a number of grade levels, informed both by research on children's cognitive development and by the logical structure of mathematics." This Institute explores the Expressions and Equations Domain of the AERO Mathematics Standards and focuses on the development of algebraic reasoning using multiple representations such as words, tables, graphs, and equations to analyze and model mathematical relationships.

Institute 4 Functional Reasoning

Modeling bridges the gap between school mathematics and the mathematics in students' lives. Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. It is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Incorporating tasks that are situated in real-life contexts and involve modeling help students see the purpose of the mathematics. The institute will explore the progression of the Functional Conceptual category of the Standards with a focus on the various ways students can represent their mathematical understanding, including visual, symbolic, and physical representations. Connections to the Modeling Conceptual Category and the modeling cycle will be examined.

Institute 5 Geometric Reasoning

The process of articulating sound and precise reasoning is threaded throughout the Math Standards and requires reasoning and sense making to be a regular part of instruction. Integration of the Standards for Mathematical Practice is critical for student understanding of Geometry. Through "practicing" reasoning, students progress toward expressing grade-level appropriate geometric thinking by constructing viable arguments, critiquing the reasoning of others and attending to precision when making mathematical statements. This Institute will explore the Geometry Domain and Conceptual Category of the Standards for Mathematics in Grades 7-12, with a brief look-back to the standards from earlier grades to emphasize the overall K-12 coherence.

For more information on hosting a cohort or on the upcoming cohorts, contact Project AERO or contact Erma Anderson at globalmathteacher@gmail.com

The certificate is awarded by Project AERO, Office of Overseas Schools. Each institute is 16.5 hours over 2.5 days.

