MANEUVERING THE MIDDLE

researched best practices

In 2014, the National Council of Teachers of Mathematics published the book, *Principles to Actions: Ensuring Mathematical Success for All*. In Principles to Actions, NCTM sets forth a set of **"strongly recommended, research-informed actions for all teachers, coaches, and specialists in mathematics; all school and district administrators; and all educational leaders and policymakers."**

In 2022, the Texas Education Agency produced a training outlining the Essential Best Practices in Mathematics Instruction. In the training, they outlined five practices that should be present in curricular materials for mathematics.

As teachers and administrators seek out new materials, the question of whether or not materials are research-based is frequently asked. **Maneuvering the Middle Curriculum places a high priority on the principles outlined below as we design curricular resources: attainable for students, standards-based, rich in real-world application, and flexible in implementation.**

Though Maneuvering the Middle has not conducted a formal study, we design our materials to support both the NCTM Principles to Actions and the TEA Researched Based Instructional Strategies. In the pages that follow, please review the NCTM Principles to Actions and TEA RBIS with the accompanying evidence of each principle as it is included or supported in our curriculum.

National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematical success for all. Reston, VA: Author.

Texas Education Agency. (2022). Math research based topics! In *tea.texas.gov*. Strong foundations framework grant learning opportunity, United States of America. https://tea.texas.gov/academics/instructional-materials/strong-foundations-framework-math-rbis.pdf

learning goals and alignment

"**Establish mathematics goals to focus learning.** Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions." (National Council of Teachers of Mathematics (NCTM, 2014, p. 10).

"**Connect concepts within and across grades** along a strategic progression of learning so that new understandings are built on previous foundations. Mathematics tells a continuous, connected story." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum is aligned with the grade-level standards and utilizes the standards as the learning goal for the student. Concepts are divided into units that are composed of lessons. The lessons are scaffolded to build toward the ultimate learning goal or standard.

Maneuvering the Middle Curriculum provides a coherent learning experience for students as they build on learning from previous days, units and grade levels. The consistent approach within each grade level connects the mathematical concepts in a meaningful way for students. Furthermore, within each unit, a variety of activities are provided to support students at different levels so that teachers have the resources readily available to make the best instructional decisions for their classes. The supplemental activities allow students an opportunity to connect their learning goals to real-world situations as well as monitor their own understanding of the concepts through application and analysis.

mathematical reasoning and rigor

"**Implement tasks that promote reasoning and problem solving.** Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies." (NCTM, 2014, p.10).

"**Focus on math content that aligns to and meets the rigor of the TEKS** for each grade level, while concentrating time and effort on going deep on the most important topics for the grade level." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum utilizes a variety of higher-level thinking questions and tasks to promote a student's ability to think critically and deeply about a math concept as it relates to the real world. Students are encouraged to apply their thinking and problem-solving skills to solve application questions in both the student handouts and independent practice. Through collaborative activities and performance tasks, students analyze mathematical errors. Real world projects allow students an opportunity to research, problem solve and complete tasks as they connect their learning to relevant and meaningful situations.

Throughout the materials, teachers and students alike are encouraged to use problem solving models and graphic organizers that incorporate a restate, represent, reflect process. This method of problem solving allows for multiple entry points, multiple representations and models, and most importantly highlights a student's ability to make meaning of the math concepts. The materials also incorporate scaffolded practice with intentional opportunities for students to engage in rigorous questions requiring higher-level thinking skills and application of understanding appropriate for the grade level.

balance of procedural and conceptual understanding

"Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving." (NCTM, 2014, p.10).

"Pursue rigor by balancing conceptual understanding, procedural skill and fluency. Apply this balanced understanding to mathematical application as required by the standards in the TEKS." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum promotes the use of standards-based, grade-level appropriate manipulatives, models, and representations. Students are exposed to a variety of supports and instructional methods for various concepts. Materials follow the concrete, representational, abstract framework where students are given opportunities to make meaningful connections between all three representations. New concepts are introduced using modeling and hands-on learning to allow students to connect conceptual understanding of the mathematical concept to its procedural application.

For example, ratio tables are utilized in the materials as students are introduced to the concept of a ratio. Further in the materials, students are also encouraged to use a ratio table to solve percent application problems. Many activities encourage students to create multiple representations of the same concept to help build connections.

"Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems." (NCTM, 2014, p.10).

"Pursue rigor by balancing conceptual understanding, procedural skill and fluency. Apply this balanced understanding to mathematical application as required by the standards in the TEKS." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum incorporates a standards-based, grade-level appropriate introduction to concepts that focus on conceptual understanding. As students interact with the concepts, they progress to a procedural understanding. Throughout the materials and instructional videos, efficiency with numbers is encouraged. The resources prompt both teachers and students to utilize math strategies to develop a clear understanding of mathematical concepts, rather than tricks or shortcuts.

Teachers can utilize the materials to allow students to discuss and explain their thinking, as well as connect their understanding to other methods and strategies.

promote critical thinking

"**Support productive struggle in learning mathematics.** Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships." (NCTM, 2014, p.10).

"**Students engage in productive problem solving, engaging in multiple opportunities for practice, discussion, representations, and writing** that requires them to explain and revise their thinking." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum incorporates higher-order thinking skills and questioning throughout the materials, including the student handouts, independent practice, and classroom activities. These materials give teachers the opportunity to allow students to struggle productively in their learning and understanding of the math concepts. While lessons are intentionally scaffolded to best support the goals and standards, specific questions are also scaffolded to provide structure and help students break down the question. Teachers are able to facilitate these discussions and struggles by providing wait time, posing clarifying questions, and encouraging perseverance in student thinking.

"**Elicit and use evidence of student thinking.** Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning." (NCTM, 2014, p.10).

Maneuvering the Middle curriculum incorporates a variety of summative assessment tools including customizable unit quizzes, customizable unit tests, performance tasks, and real-world projects. Teachers are able to adapt these assessment tools to meet the needs of their students.

Our lesson materials include problem solving graphic organizers which prompt students to consider what they know, develop a plan to solve the problem and reflect on their solutions. As students work through lesson materials and collaborative activities, they are encouraged to provide written and verbal justifications of their mathematical understanding. Our training encourages teachers to check for understanding throughout lessons, including the use of an exit question.

mathematical discourse

"Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships." (NCTM, 2014, p.10).

"Students engage in productive problem solving, engaging in multiple opportunities for practice, discussion, representations, and writing that requires them to explain and revise their thinking." (Texas Education Agency, 2022).

Maneuvering the Middle Curriculum provides support for the teacher to serve as a facilitator, furthering student learning by asking leading questions and allowing students to take ownership in their learning as they are encouraged to discuss and apply in small groups with their peers. Activities often ask for a justification or proof of student thinking.

Our training program encourages teachers to pause for wait time, ask probing questions, and encourage students to share justification and reasoning.

"Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments." (NCTM, 2014, p.10).

Maneuvering the Middle Curriculum facilitates both types of questions in the student handouts and designated activities that provide opportunities for students to analyze a mathematical problem, dialogue with others regarding solution strategies, and share reasoning and justification for their response. Teachers are encouraged to incorporate these activities throughout their pacing to facilitate the mathematical discourse and allow students to ask clarifying questions, explain their thinking and defend their reasoning.

Multiple ways to solve problems have been incorporated into our video library to support a student's understanding and facilitate multiple approaches to problem solving.

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