Research Base for Mathworks Curriculum Project  
“Guiding Principles”

The design for the Mathworks curriculum project is based on specific guiding principles, supported by research about how students best learn mathematics. The goal is to engage all students in doing mathematics at a high level, and to ensure that the needs of all students are addressed. These guiding principles address a collection of factors including curriculum design, teacher training, classroom environment, administrative support, and parental involvement. The bibliography that follows provides links to the underlying research. Research has shown that student success depends on an integrated approach that supports learning in each of these domains.

1. **Doing mathematics** is about making sense of and thinking deeply about fundamental concepts. Students need to:
   - Make connections using mathematics
   - Investigate challenging, well-sequenced problems
   - Build on prior knowledge
   - Explore problems to make sense of mathematical ideas for themselves
   - Focus on the math problems, not the answers
   - Reflect on what they have learned

2. Teachers need to establish a **classroom culture** where students are not afraid of failure. The keys to establishing this culture are to:
   - Encourage students to take risks without fear of failure
   - Value curiosity; make the problems fun, interesting, and relevant
   - Promote productive struggle
   - Allow sufficient time for learning ideas deeply
   - Consider all attempts seriously

3. **Psychological factors and student beliefs** need to be addressed, nurtured, and developed. Students need to:
   - Develop a “growth mindset”
   - Take ownership of their own learning
   - Understand and believe that ability can be developed with hard work
   - Develop the persistence and confidence needed to solve challenging problems

4. **Communication** between students and teachers is critical for learning. To facilitate this, teachers should:
   - Expect students to present work and defend reasoning using precise mathematical language
   - Take student ideas seriously, and examine both right and wrong approaches
   - Expect students to articulate the big ideas (justify reasoning)
   - Balance individual and group work; both can be appropriate depending on the problem.
     Group work needs careful management

5. **Dispositions** and external factors are powerful and need to be taken into account and dealt with. To do this, the teacher must:
   - Identify and deal with extraneous issues that can affect learning
   - Inspire desire to build a nurturing classroom environment where students take charge of their own learning
   - Obtain buy-in from teachers, administrators, and parents
What Makes the Mathworks Curriculum Project Unique?

The Mathworks curriculum project is an integrated approach that supports student learning in multiple ways that address the needs of all students. The unique part of the program is its insistence on careful, rigorous attention to each of the areas below:

Curriculum
- The curriculum weaves in algebraic concepts throughout.
- Math is transparent in all activities, with a focus on the big ideas.
- The curriculum addresses Texas and national standards in a coherent way.

Teachers
- Teacher training addresses both content and other factors that impact student learning, allowing teachers to practice what they see in summer camps.
- Teachers themselves develop as active learners as part of a professional learning community, including common planning times, that supports collaboration.

Administrative Support and School Environment
- The program has administrative support at all levels, including the school board, superintendent, principal, curriculum specialist, math coach (if present), and teachers, ensuring that there is a consistent program for the students.
- The administration and teachers are all committed to providing an environment that supports student learning, both during the day and after or before school as needed.

Parents
- Parents are an integral part of the program, participating in family math nights, as well as encouraging their own children at home to take an active part in their own learning.
References for the Guiding Principles
Mathworks Curriculum Project

1. Doing mathematics is about making sense of and thinking deeply about fundamental concepts.


2. Teachers need to establish a classroom culture where students are not afraid of failure.


Stein, M. K., & Lane, S. (1996). Instructional tasks and the development of student


3. **Psychological factors and student beliefs** need to be addressed, nurtured and developed.


Psychology, 86, 193-203.

4. Communication between students and teachers is critical for learning.

the Proceedings of the twenty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Snowbird, UT.


5. **Dispositions** and external factors are powerful and need to be taken into account and dealt with.


