

## **Professional Workshops**

### **About The Math Studio and The Algebra Game**

#### *Playing The Algebra Game for Better Mathematics Education*

An out-of-the-box thinker from the start, Catheryne Draper first developed The Algebra Game as part of The Math Studio's student assessment services in the mid-1980's. During the 1990's Draper expanded the tool's uses so that the decks could be an integral part of classroom instruction. She used the decks with students in her own classrooms, and field-tested them in other teachers' high school classrooms, teacher education programs in college settings, and in on-site professional development programs inside and outside of Massachusetts. The responses inspired Draper to further develop the program into a game-like format (decks of cards) to entice students to "play" with the symbols of algebra they perceived as daunting.

The Algebra Game, launched nationally in 2000 by Salem, MA-based The Math Studio, Inc., is like the stone that creates the ripples in the pond – with its effects radiating out from Draper's long-standing belief in providing a way for students to take control of their learning. To accomplish this control, students must be engaged at their developmentally appropriate level. Game play engages students, and engaged learners succeed. While this innovative program is called "The Algebra Game," it has learning pedagogy implications far broader than "just a game."

In 2009, the Alabama Mathematics Science and Technology Initiative (AMSTI) purchased the Linear Graphs, Quadratic Equations, Conic Sections, and Trig Functions Topic Sets of The Algebra Game as part of its statewide mathematics education improvement program. AMSTI teachers are using the decks in professional development programs to prepare for incorporating the decks into their classroom curriculum. One goal of the AMSTI initiative is to "identify high quality programs that support the AMSTI philosophy of instruction." (See [www.amsti.org](http://www.amsti.org) for more information.)

Having The Algebra Game selected to be part of Alabama's education improvement initiative is part of a greater success that has seen The Math Studio's products' sales increase consistently over the past 10 years. The Math Studio, Inc.'s products are primarily sold through school supply catalog distributors to national and international markets for use in middle school, high school, technical school, and college classrooms. Schools may also purchase the products directly from The Math Studio, Inc., and make arrangements for on-site professional development training for teachers. The Algebra Game has been listed on the website of the Eisenhower National Clearinghouse ([www.goENC.org](http://www.goENC.org)) since 1998.

### **About The Algebra Game**

There are 60 cards per deck, with each deck containing 12 unique graph examples to be matched to their related components. The decks cover four topics: Linear Graphs, Quadratic Equations, Conic Sections, and Trig Functions. A teacher's manual offers guidelines for use, and student activity sheets have multiple uses.

These four topics within the Algebra Game program are appropriate for any algebra classroom where these topics are part of the curriculum. "The decks make any textbook material interactive with hands-on manipulatives for students, because the material in the decks is the same information that is in the texts," says Draper.

Schools buy the deck games to enhance their current mathematics courses (especially for lengthened block scheduling of classes). Teacher education classes use the decks to give elementary and secondary teachers experiences with hands-on manipulatives involving abstract algebraic concepts.

### **Why The Algebra Game Works**

What makes The Algebra Game so effective? Testimonials from educators and students reveal recurring themes of:

- ✔ making connections,
- ✔ involvement, and
- ✔ visual relationships.

With the cards, students are able to make connections between concepts and grasp the bigger picture. They see how what they are studying fits together, gaining an understanding of the how and why of mathematical relationships. Using the decks is participatory, prompts animated discussions among students, and triggers insights from the students. Teachers using The Algebra Game have observed that struggling students have finally made the connections between things like linear equations and their graphs. Students looking for a challenge have found that mastering the game meets that need.

**The Algebra Game decks allow all students to use their preferred learning style**, whether it be visual or tactile. Howard Gardner's theory of multiple learning intelligences (described in his book *Frames of Mind*) is also supported by the decks:

- ✔ The cooperative group discussion allows the intra-personal learners to thrive.

- ✔ The discussion questions after the activities allow the literacy or linguistic learners to excel.
- ✔ Because students recognize the connections and relationships among the symbolic forms, more students have their mathematical intelligence enhanced.
- ✔ The visual learners have more success because the graph “pictures” are directly keyed to match the equations and other symbolic data.

With The Algebra Game, all of the parts make sense to all learners because everything fits together into an organized system that usually eludes the typical algebra classroom learner.

Some of the visual difficulties that can complicate (if not downright obfuscate) mathematical learning are addressed in the teacher manuals *and* in the card layout. Kinesthetic and tactile learners use tracing paper to trace graphs and overlay the tracings with other graphs within all of the topics, allowing students to make visual comparisons that correspond to the related algebraic expressions. Teachers can use these decks as starting points for lessons to make the textbook come alive or to review all of the lessons in a particular concept.

**The Algebra Game makes the connections obvious across all levels of topics** – it’s why Draper developed all 22 decks in the Algebra Game program. From her teaching experience, she realized that students didn’t know what they didn’t know, so they needed a tool that could indicate what was missing. Otherwise, students try unsuccessfully to memorize unrelated symbols – essentially trying to make sense of nonsense. “That is what kids tend to do out of a need to survive the algebra class,” says Draper. “Most psychologists will tell you that when the mind attempts to make sense out of nonsense, the seeds of neuroses have been planted! It hit me that part of the problem may be how the student sees the *organization of the information*, not just the math presentation itself.”

**When they’re playing The Algebra Game, students literally take possession of their own learning** by holding the cards and classifying the cards by placing them on category mats. This active possession is a subtle but high-impact strategy to avoid the passive stance of uninterested students. When students sort and classify the cards based on the teacher’s directions, they must compare, contrast, analyze, and interpret the information on the cards. Following this sorting, the students discuss questions that require synthesis and understanding. The students thus employ critical thinking and the essential components of problem-solving skills. The cards are designed to be used within cooperative learning groups so that students learn how to work together toward a common goal. The “answers” come out of argument or reasoning “proof,” not from the back of a book.

**Classification triggers critical thinking skills.** When critical thinking is absent from learning, the student becomes passive, uninterested, and not surprisingly, unsuccessful. (Does this sound like math phobia or math anxiety?) Psychologists and educators have spent careers attempting to define critical thinking in a manner that classroom teachers can use in their classrooms.

Some specify classification and sorting as critical thinking components, others specify broader-based processes such as analysis, comprehending or understanding, applying what you understand, analyzing the information, and synthesizing. Draper's focus is on classifying as an essential ingredient from which the other components can be generated.

**In the process of using The Algebra Game, students learn how to *think*.**

Teachers and students have recognized that there is a predictability to the patterns and relationships among the cards in the decks. Further, these relationships can be generalized across mathematical topics that many students have not known existed. Too often students memorize symbol manipulations in algebra classes and hope for the best. With The Algebra Game decks, there are so many different components, each one on a different card to discourage memorization and encourage relational thinking. Success depends on making connections, seeing relationships, and recognizing patterns among the cards and within the system.

At a national math program Draper recently attended, a nationally recognized presenter emphasized that teachers cannot motivate students -- motivation is an inside job. The Algebra Game helps teachers provide a direction and give students just enough information so that students can make conjectures in mathematics, thus contributing to the body of information. This fits into Draper's notion that teaching is more about facilitating than it is about providing information. A needlework sampler in Draper's office sums up the best kind of teaching: "A good teacher teaches their students to teach themselves." The Algebra Game helps teachers do just that. To learn more about the decks, click here [LINK to <http://www.mathstudio.com/product.html>].

**About Catheryne Draper**

Catheryne Draper founded The Math Studio, Inc. in 1982, after 10 years of teaching and supervisory experiences in public schools, and six years as a consultant and editor for publishers of math educational materials. She has been involved with math education at K-12 levels in public and private schools, at the college level, and in the development of regular and special ed instructional materials. She conducts teacher training workshops, coaches adults and school-age students, and develops math instructional tools. Draper has a B.S. in Mathematics and an M.Ed in Mathematics and Supervision from the University of Georgia. As president of The Math Studio, Inc., she regularly presents professional development programs at state, regional, and national math conferences.