KID MUSEUM

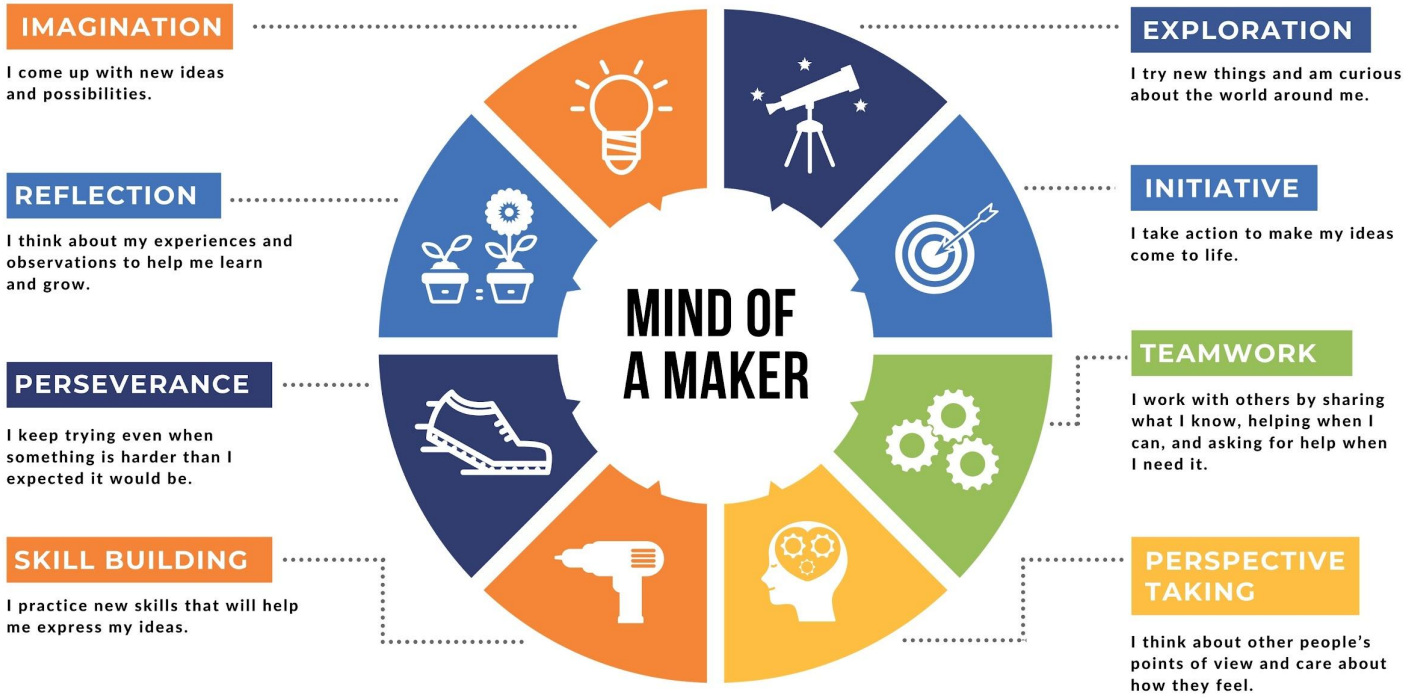
Maker Math

ABOUT KID MUSEUM

KID Museum is an equity-driven, educational nonprofit on a mission to equip youth of diverse backgrounds with the creative problem-solving and STEAM skills needed to thrive in the future.

Through deep and sustained maker-based learning experiences that deliver results, KID is an ***innovation partner***, offering inventive curriculum and programs for youth, teachers, and families.

Our Learning Philosophy



KID's hands-on, experiential learning programs unlock the ***creativity***, ***agency***, and ***empathy*** to support the next generation of innovators and changemakers. Our approach is grounded in "maker learning" — hands-on, project-based learning experiences that incorporate tech, engineering, and creative problem-solving skills.

MAKER MATH

Curriculum designed to accelerate math skills through hands-on maker learning.

Through our STEM-rich maker learning curriculum, students explore real-world applications of math and science content both directly and indirectly.

This curriculum engages students in hands-on invention and maker learning, where students explore new ideas, build skills in electronics, 3D modeling, and engineering design, while pursuing math concepts needed to build prototypes and inventions.

Program Goals

- Increase student engagement and ability in key mathematical concepts and skills
- Build students' confidence as learners, specifically in math
- Articulate the value of math as an important and applied life skill
- Increase creative problem solving and perseverance skills

"I am so impressed with how much [my student] has changed during this program. Her attitude is completely different."

- *Participating teacher*

MAKER MATH: Program Details

- The ***14 lesson, 21 hour curriculum*** is delivered by classroom teachers, Media Specialists, or STEM specialists
- Teachers participate in 4 hours of professional development, with coaching from KID Maker Educators throughout the program
- Program can be delivered during the school day, as an afterschool program, or a summer intensive.
- Maker Math is aligned to 6th and 7th grade Common Core Math Standards, and can be adapted for other grade levels
- Optional field trips may be included

Alignment of Math & Maker Learning

KID Museum's strategies for addressing math concepts through maker learning:

- Address math standards through ***problem-solving applications***, setting the stage for students to "figure out" the concepts needed to accomplish their goals
- Provide ***hands-on opportunities*** that help students make sense of math concepts that may be confusing or hard to grasp in the abstract
- Allow students time and space to ***build their understanding of math concepts organically*** and independently as they work towards individual design projects
- Present students with tasks with built-in feedback mechanisms, affording students opportunities to ***see the results of their assumptions and make adjustments*** to their work

MAKER MATH: Curricular Examples

Data, Probability, and Coding

Standards:

- 6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- 7.SP.C.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.

Maker Project: Coding Games with Micro:bit

Students use MakeCode for Microbit to design and program a game that they can play and share with their classmates. Students record win/loss data on a dot plot and determine the ratio of wins to losses. Students assess their data and use it to determine the win/loss rate that makes the best game. They then re-code their project and plot data from their new tests. They assess if their game was successful according to the "best game" criteria they set earlier in the lesson.

Ratios, Percentages, and Cardboard Carnivals

Standards:

- 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems
- 6.RP.A.3.b Solve unit rate problems including those involving unit pricing and constant speed.
- 6.RP.A.3.c Find a percent of a quantity as a rate per 100

Maker Project: Cardboard Carnival

Students learn techniques for building with chipboard, including making hinges, joints and flanges. Then they utilize these and other skills in creating a scale model of their carnival game. Students collaborate with their team to plan a budget for materials for building their large scale game. In the following session, students acquire materials according to the budget plans. During purchasing, students will experience a "flash sale" in which they have to recalculate their budgets to account for set percentage decreases in price.

Exploring Angles with Robotics

Standards:

- 4.MD.C.5-7 Understand concepts of angle and measure angles.

Maker Project: Robotic Inventions

Students learn to build with and program various robotic components, including servo motors. Servo motors are programmed to move between locations based on angles (0-180). Based on their individual projects, students program their servo motors two move between two precise angle locations.

Measurements and Circuits

Standards:

- 2.MD.A.1 Measure length using standard tools and measures.
- 2.MD.B.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

Maker Project: Circuit Boxes

Students design and build their own circuit boxes using various electronic components including switches, LEDs, motors, and buttons. After choosing the components and designing their boxes, students must determine to correct size hole for each component in their boxes. Students collect measurements for each component and use the information to choose the correct size tools (drill bits) for their individual projects.

IMPACT & RESULTS

Maker Math is being piloted in the Summer of 2023 as a 3-week program with rising 7th grade students in two Title I schools. Student evaluation data is still being collected, but interviews with teachers have revealed very positive results. Anecdotally, teachers observed a much higher level of engagement than past summer school experiences, and that students demonstrated increased interest in math and engineering. The use of authentic tools such as drills, a laser cutter, and scroll saws increased student desire to attend school and developed a strong sense of agency. The math teacher reported that students were more willing to challenge themselves with more complex concepts.

School Program Impact

KID Museum measures impact across programs using survey instruments, program observations, and interviews. Results from school programs with similar models as Maker Math have demonstrated strong student and teacher outcomes.

Elementary School Students

93% demonstrated perseverance at KID

95% experienced joy in learning STEM concepts

86% thought "people like me" can be scientists or engineers

Middle School Students

74% showed increase in critical thinking

77% Showed increased STEM engagement

76% are interested in pursuing a STEM job in the future

Teacher Feedback

"This program has re-inspired me as a teacher. I've been able to incorporate more hands-on learning into the classroom. Now we stress "mind of a maker" skills (perseverance, collaboration, creative problem-solving), no matter what we are teaching. These are skills they can apply anywhere."

"Students create unique projects using novel tools and materials that thoughtfully support literacy and math standards at their grade level. The curriculum development devoted to this program including dedication to prototyping and reflection make it stellar for students!"