

**Elementary Makerspaces:  
A Report to the  
Scarsdale Schools  
Education Foundation**



**The Scarsdale Center for Innovation  
Scarsdale Public Schools, New York**

In the 2013-14 school year, The Scarsdale Schools Education Foundation generously awarded funding to expand the Scarsdale elementary Makerspace program that began at the Fox Meadow School. Fox Meadow's Makerspace was created with funding from a Center for Innovation grant that was awarded in 2012. The grant, *Creating Prototype MakerSpace to Promote STEM Opportunities for Elementary Students*, provided funding to redesign and reconfigure a storage room in the Fox Meadow library and transform it into the District's first Makerspace. The rationale for the grant was clear, and was the result of a call for action to provide students with hands-on activities in science, technology, engineering, and mathematics, with an additional focus on design:

*Once, households across the nation had basements and garages where parents and children created, tinkered, and worked with tools and materials. Students need more time – and space – to solve real-life engineering tasks. The new and growing Maker movement aims to reinvent American ingenuity and manufacturing on a small, personal scale, encouraging experiential learning, collaboration, creativity, and authentic critical thinking. This team will develop a prototype Media lab/Maker space that will give elementary students the opportunity to engage in real engineering and design work, and promote experiential learning in STEM (Science-Technology-Engineering- Math). The lab will have a variety of computers, creative software, building and circuit kits, models, robotics kits and materials, 3D printers, and other emerging technology.*

The Fox Meadow Makerspace launched with additional support from the PTA, and the space was visited by educators from many schools in Westchester, as well as visitors from other states and countries, who were interested in replicating its success. In addition, the concepts behind the Makerspace were presented at a conference at Teachers College, as well as other local and national conferences. In 2013, the Scarsdale Schools Education Foundation generously provided a \$35,000 grant to strengthen Fox Meadow's Makerspace and fund equipment and materials to establish Maker programs at Edgewood, Greenacres, Heathcote and Quaker Ridge.

## **Makerspace Usage**

Although the District does not track specific usage of each school's Makerspace, schools report that many students are involved in many Maker activities, and schools have tracked the number of students involved in Maker activities. The increased interest in coding and robotics has been the greatest "outcome" of the school Makerspaces. As a result of the work that began in Makerspaces, coding and robotics are now being incorporated in virtually all K-5 classes as part of the District's new STEAM curriculum.

**It should be noted that many Maker activities have moved from the Makerspace to individual classrooms. This allows the Makerspaces to house dedicated equipment, like a 3D printer, as well as supplies that are used by classroom teachers. In many ways, this move from a room to individual classrooms has mirrored the use of technology in the elementary schools, where technology has been shifting from computer labs to mobile devices in classrooms.**

While there is a common vision for the importance of providing Maker experiences for students, and in many cases, a common core of equipment in each space, each school has approached the use of its Makerspace differently. For example, at Edgewood, the school does not have a dedicated physical Makerspace; however, equipment and materials for maker projects were purchased and students have been actively involved in Maker projects. Much of the making activities take place either in the art studio (STEAM Studio), the computer lab, or individual classrooms.

At Fox Meadow, the whole school has been impacted by the Makerspace in a number of ways. The entire staff has been inspired, and most have tried or continue to engage in makerspace activities as part of their teaching. There are also active STEM clubs that use the Makerspace after school.

At Greenacres, after school clubs use the space, in addition to use it receives during the day. This year there is increased interest in doing work in the Makerspace, especially after last year's very successful Tinker Night. A trainer/consultant was hired to work with classes on maker/STEAM activities, and his work focused on bringing maker activities to the classroom.

Heathcote reports that teachers often take activities from the Makerspace back to their classrooms. As the maker movement continues to spread across the school, more teachers are incorporating making into their curriculum. Several teachers have created "mini-makerspaces" in their classrooms to better integrate making and project-based

learning into their teaching.. There is also a Makerspace After-School Club that meets twice a week.

The Quaker Ridge Makerspace has spread into two areas: the library and the adjoining computer lab. All students use some aspect of the Makerspaces throughout the year and all teachers have welcomed some aspect of the Makerspace into their classrooms. After experiencing the success of the TinkerTown classroom makerspace grant, funded by the CFI, Quaker Ridge made an effort to create a more mobile and flexible makerspace. The school organized the space into theme-based carts that can be wheeled into a classroom for a prolonged period, thus creating a “pop-up” makerspace.

Here are some additional details, as reported by each school:

## **Edgewood**

### **Themes, Projects and Topics explored:**

Design Thinking, Sustainability, Architecture, Fashion, Simple Machines, Electricity, Engineering, 3D Modeling, Coding, Digital Storytelling.

### **Available equipment:**

3D printer, iMac computers, iPads, Chromebooks, MacBooks, Makey Makey, LittleBits, Hydroponics for indoor growing, electrical supplies (LED lights, conductive tape/paint), hand-held hardware tools.

### **Self-Reported Successes:**

- Students have opportunities to make numerous iterations of a design to better understand the process of making useful products.
- Teachers are more inclined to incorporate active learning in their classroom experiences.
- Teachers have more faith in the process of learning through risk-taking.
- Students are developing a collective mindset whereby they know creative solutions are always within reach.

### **Self-Reported Challenges:**

- “We’re still competing for time within a busy curriculum calendar.”
- “We’re still striving to build a professional learning community that exchanges ideas on making that directly supports curriculum knowledge.”

## **Number of Edgewood students impacted:**

While Edgewood did not have a room to create a formal Makerspace, the Art room served as a designated “STEAM Studio.” This is the space where Matt Fitzpatrick, Edgewood’s art teacher, has launched a number of curriculum-based activities. Here is a list of the activities, along with the number of student impacted by the experiences:

Kindergarten Kandinsky (60 students, 4 45 minute sessions)

- All kindergarten students engaged in the study of the artist Wassily Kandinsky using conductive paint, Makey Makey, and sounds programmed in Scratch.

Second Grade Rube Goldberg (40 students, two 60 minute sessions)

- Students experimented with Rube Goldberg contraptions to support of their Simple Machines unit.

Third Grade Circuits (80 students, three 60 minute sessions)

- Students created a simple circuit that lights up one chibi light over which students place an illustrated scene in which the light draws attention to a character, or students construct a chibi light circuit to create a decorative greeting card or bookmark.

Fourth Grade Design Challenge (new to 4th this year: 80 students)

- Students used Tinkercad to design a solution to a problem posed by the teacher. Earlier this year, teachers challenged 4th grade students to redesign the surface of their classroom tables to make it more comfortable and suitable to their class activities. Edgewood plans to bring this challenged-based activity to the whole 4th grade this year

Fifth Grade Guitars (60 students)

- 5th grade students make their own electric guitars using conductive tape, Makey Makey, Scratch, paint, and cardboard.

Coding & Robotics (all K-5 students)

- Paul Tomizawa leads instruction in all K-5 classrooms featuring coding resources such as Kodable, Tynker, Blockly, and Scratch, along with Bee Bot, Dot, and Dash robots.

Green Team (all K-5 students)

- All students were exposed to concepts of green energy, composting, and hydroponics. One year, 15 classrooms were growing vegetables and herbs with a makeshift hydroponics garden that involved nozzles printed with 3D printers.

Design Shop (ongoing weekly lunch club, varying numbers each week)

- First grade teacher Lorella Lamonaca runs what’s known to the entire school as the “Edgewood Design Shop.” It began with her first grade class, in which students designed and made ties, hand bags, purses, and scarves from a variety of scrap materials. Older students return the following years to help out 1st graders.

3D Design & Printing Lunch (60 students, three 2+ day lunch sessions)

- Students design and print holiday ornaments with Matt Fitzpatrick and Paul Tomizawa.

After school Clubs:

- Design Shop
- EV Lego Robotics
- Homemade Pinball Machines
- Rube Goldberg
- STEAM Studio (engineering challenges, art, robotics, etc)
- Coding with Little Bits

## **Fox Meadow**

**Themes, Projects and Topics explored:** 3d printing, robotics, coding, creating colonial implements, circuits, physical computing.

**Available equipment:** 3D printers, wood bench and tools, drill press, robotics, Lego, Wedo, art supplies, electrical-Littlebits/chibilights/copper tape/LEDs.

### **Self-Reported Successes:**

- Scarsdale was the first district in the region to even be talking about the idea of a Makerspace, and they are proud to be the District's pioneer. Many of these nearby districts visited or were inspired by Fox Meadow's initial work. There are different iterations of the Makerspace idea, but all center on the same themes, materials, and activities.
- The Makerspace serves as a materials center and an inspiration center, and its strength as such will ebb and flow as teachers have other demands placed on them.
- The school reports that having the tools and materials at hand is invaluable to inspiring and collaborating with teachers.
- Collaboration among the computer teacher, librarian, and art teacher, along with the classroom teacher, allows innovative projects to take place.

### **Self-Reported Challenges:**

- While the Makerspaces serve as centers of inspiration, their strength as such will ebb and flow as teachers have other demands placed on them.

## **Number of Fox Meadow students impacted:**

Fox Meadow clubs impact 200 students per year both in and around makerspace topics.

- Parent-run lunch maker classes (in our Makerspace) impact at least 200 students per year. These students are usually different from the students who enroll in clubs.
- All K-2 students do coding with robots as part of the “making program.” This impacts approximately 230 students per year.
- All third grade does chibi circuits—came out of Makerspace, approximately 80 students per year.
- Various classes and teachers at various times do maker projects either in the Makerspace or using materials housed in the Makerspace. This impacts 15-25 staff as well as 100+ students.

In addition, the Makerspace influenced other Westchester districts. It is believed that 15-30 districts were inspired by visits to the Fox Meadow Makerspace.

## **Greenacres**

**Themes, Projects and Topics explored:** In clubs last year students invented mechanical objects and built solutions for proposed challenges. There is also time for free exploration. One Third grade class experimented with a “golf ball challenge,” using a Simple Machine. First Grade extended their spring Chick study by using Bluebots and then programming the blue bot (chick) to travel from the egg through his first day of life. An informal lunch group created a thematic interactive bulletin board where students could fill out a speech bubble and add it to the board.

**Available equipment:** The room has two Makerbot Replicators and one other 3D printer, drill press, comprehensive tool chest, arts and crafts materials, collected found materials ( wheels, cardboard, plastics, styrofoam, ball bearings), Legos for primary, blocks, Keva planks, Magna tiles, Spheros, Dash and Dots, Blue Bots, Ozobots, LEDs, Playdoh, and button batteries. We have two new carts: one houses our robots, and the other is filled with circuit-making materials.

**Self-Reported Successes:**

- The redesign of the Makerspace has been very well received. The space was cleaned, organized, and stocked. Most of the materials are easily visible and accessible to all students. The space was brightened up with fresh paint, and new modular student-sized tables and chairs were purchased.
- A school-wide needs assessment was implemented last year in order to determine how to increase the use of the Makerspace. Results were gathered and analyzed and then an action plan was created.
- GA's Artist in Residence is a Maker/STEAM enthusiast and is meeting with teachers to meet their maker-awareness needs, and co-teaching a lesson to their students.
- Teachers are notably more interested about the space.
- Students are extremely excited to use materials in the Makerspace.

**Self-Reported Challenges:**

- Sharing with teachers about how to incorporate making into curriculum is an ongoing challenge.
- There are discussions about who is responsible for curating the Makerspace.
- It is a challenge to help teachers to be comfortable with "failure."
- We need to help others understand that you do not have to be in the "makerspace" to make.

**Number of Greenacres students impacted:**

- Approximately 180 students have done general building/making/ engineering in classroom at least once every two weeks (20 sessions total).
- Approximately 180 students participated in Maker afterschool clubs.
- 237 students participated in Greenacres Tinker Night..
- 164 students have used Blue Bots from the Makerspace.
- 267 students have used Dash and Dot robots from the Makerspace.
- 140 students have used Ozmobots
- 191 students have used Little Bits
- 195 students have created projects with TinkerCad/3D Printing

## **Heathcote**

### **Themes, Projects and Topics explored:**

There are many curriculum areas where teachers are incorporating making. These include, but are not limited to: Energy (circuitry & coding); Rocketry (3D design, explicit teaching of Design Thinking); Communities (constructing models); Weather; Models & Designs.

### **Topics explored:**

- Design Thinking: taking apart or unmaking using thinking routines, Extraordinaries
- Designing & Building: woodworking, sewing basics; 3D design, modeling with Legos and cardboard,
- Coding: Makey-Makey used with Scratch, Ozobots, Spheros.
- Circuitry: LEDs, Chibitronics, Makey-Makey
- Energy: circuitry
- Weather: building models
- Force & Motion: Rube Goldberg Machines

### **Available equipment:**

Keva Planks, Ozobots, Lego Robotics, paper circuits w/LEDs & Chibitronics, 3D designing & printing, Makey Makey, woodworking tools, Makedo, sewing machine, goggles, safety gloves, Littlebits, pvc pipe, variety of consumable materials including (but not limited to) various types of cardboard and paper, fabrics, ingredients, and equipment to make slime, play dough, etc.

### **Successes and Failures:**

#### **Self-Reported Successes:**

- Creating a Maker Culture within Heathcote School (see the infographic on the next page)
- A School-wide Design Challenge focused on the garden
- March Maker Madness
- The annual HExpo
- Buddy Bags
- Tinker Tubs, supported by a 2017 Center for Innovation grant

**Self-Reported Challenges:**

- Organization and inventory of consumable supplies has been a challenge because the space is smaller than a classroom.
- Storage of supplies and storage of projects in progress.
- Time to meet and plan across disciplines and grades.
- Documentation.
- Scheduling small groups to work within the makerspace.

**Number of Heathcote students impacted:**

- Approximately 180 students have used to the Makerspace during the school day.
- Twelve classroom teachers used materials from the Makerspace for "maker projects" in the classroom
- Lunch club will start in the spring, and approximately 30 students will participate
- Heathcote PTA 's Makerspace After School Club has approximately 40 students who participate each week during the year.

Here are some specific uses of the Makerspace materials by grade level:

- Kindergarten: Some materials, both consumable (e.g. cardboard, fabric, bottle caps, corks, etc.) and non-consumable (e.g. Keva Planks, Lego robotics kits) are borrowed from the Makerspace, but Kindergarten teachers typically do not bring their classes to the Makerspace. Some have their own "mini-Makerspace" in the classroom. Two of the 3 classes use Makerspace for materials.
- Grade 1: Materials are borrowed from the Makerspace for use in the classrooms and those classes are brought to the Makerspace in small groups (approximately 35-40 students)
- Grade 2: Materials are borrowed from the Makerspace for use in the classrooms. All classes that go to the Makerspace in small groups (it's too small to hold a class).

- Grade 3: Materials are borrowed from the Makerspace for use in all three of the classrooms. Two classes go to the Makerspace, and one class intends to go in the spring -- all small groups at a time, approximately 60 students.
- Grade 4: Materials are borrowed from the Makerspace for use in the classrooms in at least one classroom (Approximately 20 students).
- Grade 5: Materials are borrowed from the Makerspace for use in all three of the classrooms. All three classes go to the Makerspace, small groups at a time. (approximately 60 students)
- 40 students in grades 2 -5 use the Makerspace each week during after school clubs.

# Growing a Maker Culture

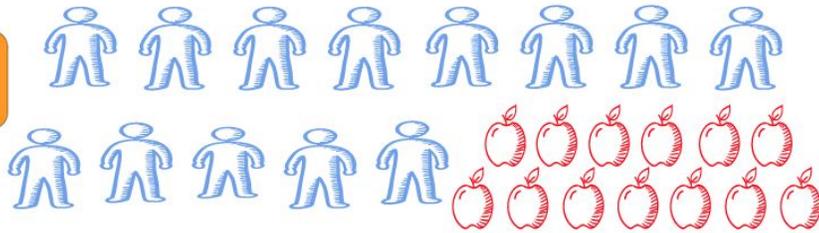
2014-2015



2015-2016



2016-2017



HExpo Participants  
Approximately  
20 Students



Teachers who integrate  
making:  
visit MakerSpace or  
have mini MakerSpace  
in their classroom

*This Infographic, created by Heathcote fifth grade teacher Christine Boyer, illustrates the growth of the Maker Culture at Heathcote.*

## Quaker Ridge

**Themes, Projects and Topics explored:** The types of projects are constantly evolving. Students often work with robotics, using Blue Bots in K-2 and Dash Robots K-5. Kindergarten students use a Dash robot to think about how to program a sequence. Fifth grade students design a pen harness for their dash and program the robot to draw on huge canvases. Other projects are connected to the curriculum more directly. For example, our third grade creates electronic Father's Day cards with Chibi lights and copper tape, in alignment with their science circuitry unit.

**Available equipment:** Robotics cart (Lego Evo Kits, Dash and Dot robots, Blue Bots, Ozobots, WeDo), Constructor Cart (Citiblocs, Magna Tiles, Crazy Forts), Unmaking Cart (Assorted tools, 4 toolkits), Circuitry Cart (Little Bits, Makey Makey, LEDs, Squishy Circuits, Chibitronics), Vinyl Cutter, two 3D printers, drill press, T-Walls, Hot Glue Guns, various media.

### **Self-Reported Successes:**

Moving the space to the library was a significant improvement. The space became much more visible. Teachers and students routinely ask about projects that they see and inquire about using the materials. The carts made access to materials even easier, allowing teachers to bring the space into their classrooms. Each year, the Makerspace becomes a more natural part of Quaker Ridge.

### **Self-Reported Challenges:**

The Quaker Ridge Makerspace has been reinvented several times. The first iteration conceptualized a functional space that allowed teachers to see what was possible. Its location was nestled between music and art rooms, a proximity that the teachers felt was advantageous. Unfortunately, it was also distant from classrooms. Because it was in a remote location, teachers found it cumbersome to use, preferring to limit transitions and stay close to the classroom. This resulted in the decision to move the Makerspace to its current location in the school library.

### **Number of Quaker Ridge students impacted:**

- 36 students participated in two Maker clubs and one robotics club last year.
- Robotics projects were used with every grade level and every class. Approximately 475 students took part in these projects.
- 60 students used the Lego cart, including special education classes

- 100 students attended the one of the two Quaker Ridge Maker Nights
- 170 students did a project involving circuitry using materials from a Maker cart
- Approximately 75 students participated in projects involving Little Bits using materials from a Maker cart
- Over 50 students participated in an “unmaking” project where electronic devices were deconstructed.
- PTA and the Center for Innovation also contributed funds for Maker supplies and materials through a CFI grant and PTA club funds.



*Quaker Ridge computer teacher, John Calvert, discusses the use of his school's Makerspace with visitors from other districts.*

## **In Closing: The Impact of Makerspaces on the Scarsdale Schools**

A major benefit of the creation of our Makerspaces has been the inspiration for many STEAM days and Tinker workshops at our schools. From the launch of the Heathcote HEXPO to the more recent Tinker night at Greenacres, to the District's next STEAM Day planned for this spring at the High School, the Scarsdale PTAs and parent community have embraced the Maker movement.

### **The Future**

The District is committed to providing \$1,000 a year to fund supplies for each of the Makerspaces, allowing schools to purchase items like batteries and bulbs, as well as other consumables. PTAs have also purchased maker materials to help sustain Maker clubs and other programs.

We are grateful to the Scarsdale Schools Education Foundation for providing us with the funding needed to launch the Makerspaces in our schools. The District now has a formal K-12 STEAM curriculum that was inspired by activities in the Makerspaces, and the creation of our Makerspaces has contributed to an interest in doing creative and innovative projects that enrich and enhance student learning in the Scarsdale schools.