

# Scarsdale Schools Education Foundation Report

## October 2014

### **Project: Elementary MakerSpaces**

**Funding:** \$35,000 for five elementary schools

**Goal:** Provide support to further develop the successful Center for Innovation MakerSpace pilot at Fox Meadow. Establish MakerSpaces at the four other elementary schools.

### **Setting the Context: The Maker Movement and the Scarsdale Schools**

*by Scarsdale Maker pioneer Christine Boyer*

The term “MakerSpace” is often associated with fields such as engineering (designing, prototyping, building, etc.). It is essentially a collaborative space for creative endeavors.

MakerSpaces allow students to take control of their own learning by designing projects and creating them using tools and materials. Through making, students gain confidence in their own abilities and become engaged at deeper levels than if there were no hands-on component.

In a MakerSpace, children are learning and honing problem-solving skills. While these skills could be taught in a traditional classroom setting, they are best learned through practice and coaching. Some projects are designed to teach a specific skill, such as using a hammer or a soldering iron. Other projects use acquired skills for an undefined end goal – students can design their own outcomes, which is an incredibly powerful learning experience.

Rachel Wolfe (SHS Class of 2014) created a documentary that explores the role of high school as a resume builder for college and its impact on authentic learning. She spent a few days with elementary students last June, and was in awe of the work they were doing.

<http://rachelbwolfe.wordpress.com/2014/06/26/losing-ourselves/>

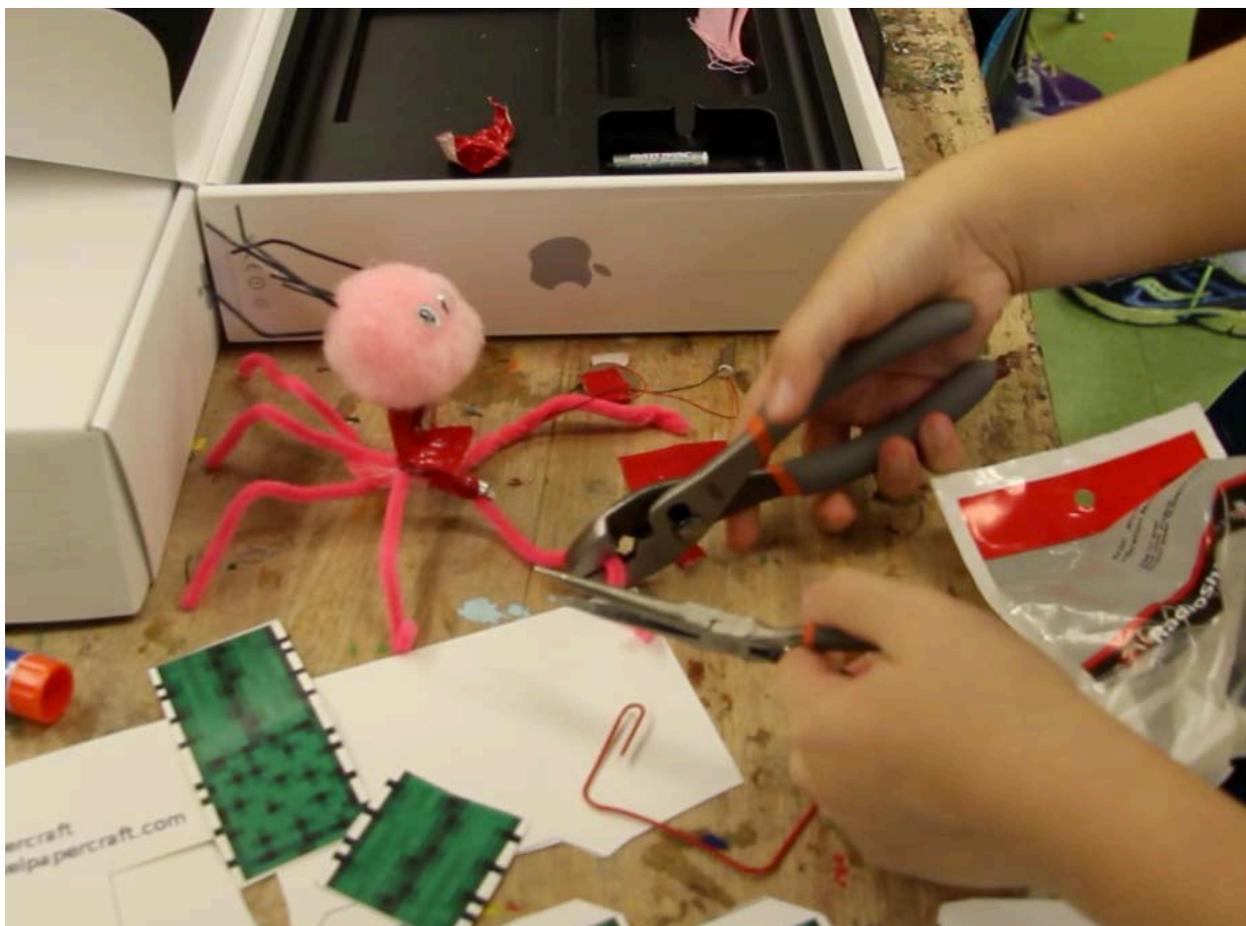


In a recent presentation to the Scarsdale community, Andy Jassy, Vice President of Amazon Web Services, said, “We need to build more builders.” As Rachel highlights in her film, the builders already exist. We must cultivate and challenge the builders we already have.

In a MakerSpace, the instructional focus shifts from transferring knowledge to allowing students to create their own solutions to problems. Gary Stager, a leader in the Maker movement, uses the acronym **TMI** to highlight the process of **Think, Make, Improve**. This is the core of design thinking and the attitude that is adopted in MakerSpace work. Learning to fail is part of the process, as well as learning *what to do* when failure happens. We see the establishment of MakerSpaces as an important step in helping our students to understand the design process and have hands-on experiences that promote critical and creative thinking.

**Impact:**

Four of the five elementary schools have established MakerSpaces or have implemented Maker programs, and the fifth school, (Greenacres) is launching its MakerSpace initiative this year. In addition, Scarsdale teachers have received local and national recognition for their MakerSpace projects.



## **Edgewood: Building a Community of Makers**

Edgewood faculty members began their work on a school MakerSpace by crafting a vision statement. They determined that the focus of their efforts would be on student-centered learning in a constructivist environment. Part of their vision describes student project work:

*“Projects will give students time to experiment, make mistakes, and work through those mistakes in a supportive, collaborative environment. Projects we create should be student-centered, in that creations and vision comes from student interests, not assignments or tasks given them.”*

Although the school does not have a dedicated place to host a MakerSpace, the faculty identified a location for the storage of design materials that would support their initiative. The school community believes that this is consistent with its vision that MakerSpace projects can be taught by anyone and take place in all “spaces” within the school.

In the spring, materials were purchased and projects began. Some projects took place during lunch, via coding clubs and Maker clubs in the art room, as well as after school in a club setting.

The planning team hosted a lunch meeting that was attended by 23 teachers who were interested in learning how to design opportunities for integrating the MakerSpace concept into current grade-level content. A variety of ideas emerged, including the creation of a professional support group that would be tied to an upcoming STI lesson study course, and the possible creation of a MakerSpace support course that would take place during the second semester.

The group created an implementation plan, with several project proposals for this year that would directly impact the science curriculum. These include:

- Rethinking the fifth grade science “models and designs” unit to create variations on the traditional outcomes generated by the existing curriculum.
- Transforming the fourth grade ecosystems unit by providing students the materials to create their own design for the school vivaria (indoor nature study areas) after explaining guiding principles of design.
- Enhancing the Energy/Electricity/Circuits unit in third grade by allowing students to create Rube Goldberg models to show energy transfer, and providing opportunities for students to use squishy circuits and conductive paint.

Art teacher Matt Fitzpatrick has been leading the school’s MakerSpace project; and he recently presented his work at this year’s NY Tech Forum. The Edgewood team is excited to move forward with these projects that will impact virtually all students in the upper grades and beyond.

## Budget Summary

Allocation:	\$7,500
Expenditures:	\$5,680
Current Balance	\$1,820

## **Fox Meadow: Enhancing Success and Sharing Expertise**

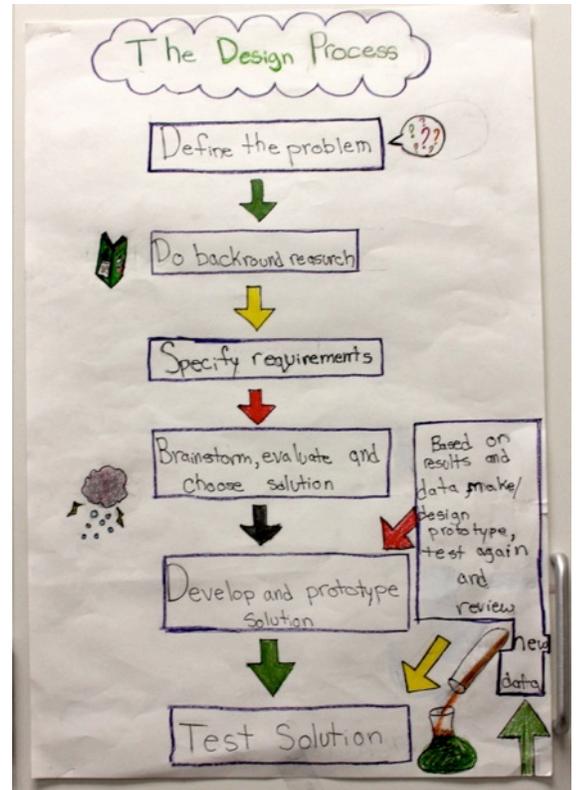
The MakerSpace project at Fox Meadow continued to grow by increasing collaboration among the school teams, increasing curriculum integration, and reaching out to national institutions working on design thinking and the Maker movement. Highlights include:

### **School Teams**

- A Makerspace STI course was given at Fox Meadow that was attended by K-12 teachers from across the District.
- Members of the Fox Meadow team participated in the design thinking STI class to increase their own understanding of the design process.
- School teams increased collaboration across the elementary schools and with the Middle and High School.
- Within Fox Meadow, the originating team reached out to others on grade level to try a challenge-based STEAM project.

### **Regional and National Impact**

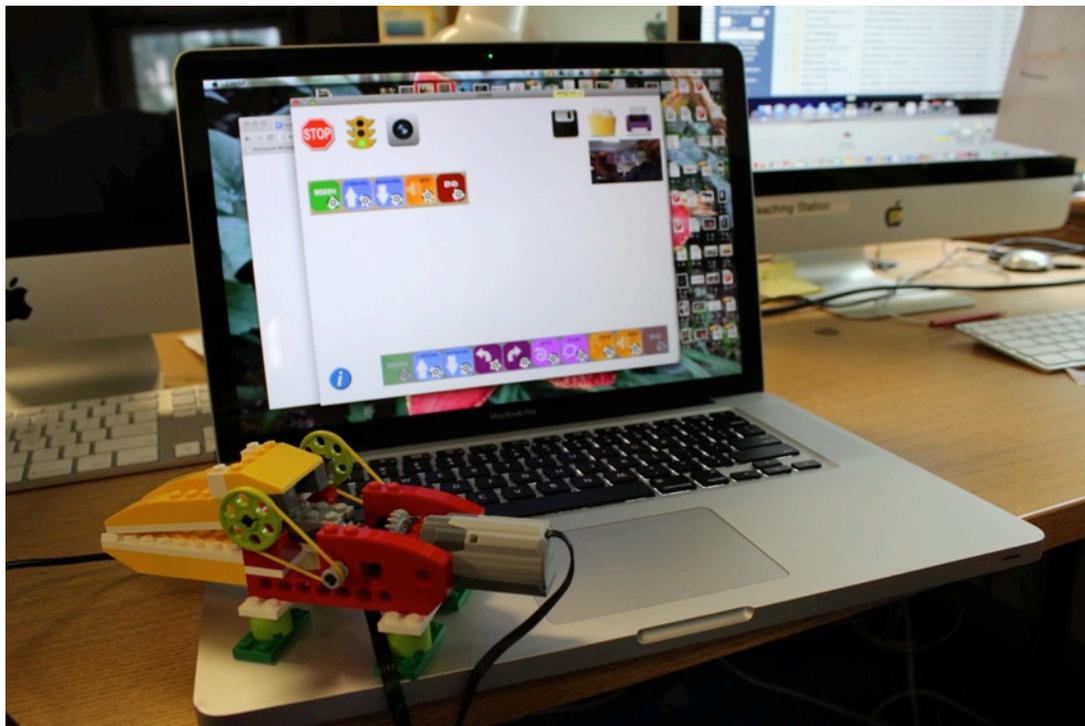
- Librarian Jan Schorr and computer teacher Peter McKenna presented at a Northeast regional webinar on MakerSpaces in schools and libraries, sponsored by the American Library Association.
- The Google Plus community "School Makerspaces" was created, and now has 65 regional and national members:  
<https://plus.google.com/u/0/communities/108934196060301716128>
- Peter McKenna presented on a panel with District Director of Technology Jerry Crisci at the NY Tech Forum last October. A video of the presentation can be viewed at:  
<http://www.techlearning.com/techforum/newyork13>
- Fox Meadow hosted several visitors interested in seeing the MakerSpace and how they might accomplish creating and planning for a MakerSpace in their schools.
- Fox Meadow librarian Jan Schorr and computer teacher Peter McKenna presented at a poster session for BOCES, sharing their knowledge with librarians throughout the region.



- Fox Meadow principal Duncan Wilson and Peter McKenna presented at the Global Learning Alliance conference at Columbia University in April, making a connection with the Project Zero group from Harvard University.
- Harvard Project Zero members visited Fox Meadow and other schools to interview staff.

### Curriculum Integration

- Fifth grade teachers redesigned the rocket launch science unit to incorporate more design and STEAM challenges.
- Second graders integrated circuits into their community model.
- Third grade teachers used Kidwind: ( <http://www.kidwind.org> ) windmills to create and measure energy and workload, and to design and create blades that increased power and speed.
- Third grade teachers had teams of students create and test bridges made from Popsicle sticks in teams. Their challenge: create a bridge to hold maximum weight given limited resources (25 sticks and hot glue): design, test and rework.
- Teams within Fox Meadow purchased materials to integrate STEAM in the curriculum.



## Plans for 2014-15

- Peter McKenna and Duncan Wilson will attend the launch of a national maker/design-educator Learning Community (for practitioners) that the Agency *by Design* team at Harvard's Project Zero is helping to organize at Harvard on November 14th.
- Over 30 BOCES administrators visited Fox Meadow in October to see the space and what we have done and have learned.
- The Fox Meadow PTA now sponsors a full suite of Maker clubs - from coding to 3D printing to robotics.
- Teachers are planning to implement greater curriculum integration throughout the grades in collaboration with science helping teacher Jen Kiley and others.

Parent-run lunch clubs have been totally reworked to feature challenge-based design and making. Many students and parents will participate in this throughout the late fall and winter. Projects include:

- Maze building for the Beebots (younger grades) - two weeks
- Snap Circuits (younger grades) - two weeks
- Marshmallow Challenge with Structures blocks (all grades) - one week
- Helioscopes (all grades, but potentially a more involved project for older grades); one to two weeks depending on whether or not the students do their own cartooning
- Littlebits (multi-week projects involving increasingly complex challenges and culminating in a bigger project working in teams) one to two weeks
- LEGO WeDo (12 kits) - motors and robotics
- Air rockets
- Needle arts and knitting
- Solar lanterns and the creation of a solar oven

## Budget Summary

Allocation:	\$5,000
Expenditures:	\$3,404
Current Balance	\$1,596

## **Greenacres: New Construction, New Opportunities**

The Greenacres MakerSpace committee consists of eight teachers who will continue meeting to develop a vision for the school's MakerSpace. Although this team is just getting started (the staff has been waiting for construction to be completed this summer), they have been making progress by defining their MakerSpace as a place that allows students to solve problems using a design process.

The MakerSpace will be located in the school's former main office. Though material will be housed in that space, the school is committed to the idea of *classrooms* as MakerSpaces.

The Greenacres team's vision is that project ideas may be generated from learning in classrooms, and that materials could be brought from the MakerSpace to classrooms, or students could go to the MakerSpace to use the materials and equipment in that location while engaging in problem-solving through a design process. Lunch Clubs and After School programs may also provide opportunities for students to engage in similar problem-solving.

The MakerSpace team expects that the K-5 science curriculum will play an integral role in generating contexts for problem-solving, while also allowing students to use their skills in technology, mathematics and the arts to engineer solutions. The school team expects to integrate technology in a multifaceted way, including the development of coding skills. Students and teachers will come to see the MakerSpace as an opportunity to integrate, create, investigate, experiment and design. The MakerSpace will play an integral role in cultivating a growth mindset, as students learn the importance of effort and perseverance in achieving success, while collaborating through experimentation.

Members of the MakerSpace team will attend an STI course – *Learning by Design: Creative Problem Solving for the 21<sup>st</sup> Century*. They are hopeful that this course will help refine their philosophical and conceptual understandings so that the faculty can be purposeful in defining its vision as well as the range of possibilities for its utilization. This will influence the kinds of material and equipment that will be purchased, as well as influence the design and layout for the physical space with the goal of maximum utilization. Items to be purchased include: soldering and glue guns, wire, circuit board holder, vinyl cutter and 3D printer. They are planning to visit the other elementary schools in the District to research how the spaces have been used, and to explore which materials have been most effective in support of the vision. The team is also planning to ask parents to donate tools and materials that could be safely utilized, and to explore opportunities for parents to be collaborators

The MakerSpace will enhance the opportunity to reach all learners – including students who struggle in traditional classroom settings and present opportunities to challenge students who maintain success at higher achievement levels. While the MakerSpace exists in school, the hope is that students will make connections with their world and see themselves as problem solvers.

#### Budget Summary

Allocation:	\$7,500
Expenditures:	\$3,217
Current Balance	\$4,283

## **Heathcote: Passionate and Pioneering**

Christine Boyer, a fifth grade classroom teacher, leads the MakerSpace project at Heathcote. Her interest in the maker movement began a few years ago. She researched school-based maker programs, and connected with like-minded individuals across the country on Twitter, as well as within our District. She collected articles, images and books; arranged for a visit to Marymount School in NYC (known for its innovative MakerSpace) and attended lectures including the one by Gary Stager given at the High School last year.

With Heathcote principal Maria Stile's support, conversations began, with hopes of obtaining funds for a Makerspace. The awarding of funding by the Scarsdale Schools Education Foundation was a transformative moment in the school's MakerSpace initiative.

The MakerSpace at Heathcote is housed in a space that served as a storage area and staff office in the school library. Several colleagues volunteered to clean out the space, and Christine Boyer painted the room to "brighten up" the area. Supplies were ordered: a Makerbot 3D printer; Makey-Makey sets, Squishy Circuits, Littlebits, Snap Circuits, Makedo Brushbots, and an assortment of high-tech and low-tech materials.

The MakerSpace was up and running by late February 2014. Initially the first students were fifth graders who went to work on projects during lunchtime. Later on, small group work was introduced, allowing children to work on curriculum-related activities. Simultaneously, the fifth graders were perfecting their coding skills using Scratch, using their Chromebooks or working in the computer lab. They also started teaching second grade buddy class partners and kindergarteners how to code with Scratch as well.

Fifth graders signed up to teach younger students how to make Brushbots during lunchtime. In the short time the Makerspace has been operational, approximately 75 children have had an opportunity to work on a project that originated in the room. Several projects were started in the Makerspace and incorporated into classroom instruction. For example, a design and building project was incorporated into the fifth grade *models and designs* unit.

This September there are two After School Clubs that allow students to embrace their inner Maker. Kathy Leary and Christine Boyer are teaching Lego Robotics and Rob Kissner from the Westchester *Digital Arts Experience* is teaching Lego Stop Motion Animation.

## **Future Plans**

This year, the professional development of staff and education of parents will be a focus of the school's program.

A year of unique learning experiences is being planned to aid in greater understanding of the Maker Movement and the benefits of the school MakerSpace. For example: Rob Kissner of *The Digital Arts Experience* in White Plains has offered to work with the Heathcote staff on digital

tools; Deb Winsor from *Construction Kids* in Brooklyn has offered a free field trip where they will work with students on projects, provide tools, and complete lesson plans (planned with fifth grade staff aligned with our science curriculum); *The Technical Artisans Collective* is available for an assembly program that will showcase how math and science is integrated with the work of stagehands on Broadway and in Hollywood; and Andy Forest from *Maker Kids*, a developer of curriculum for MakerSpaces, will host professional development sessions via a videoconference with our staff.

In addition, there are lunch dates planned for staff open “discovery time” to explore the materials and activities associated with our MakerSpace. There is also a parent evening planned in early October, where parents will be able to see student work and explore the MakerSpace’s tools and materials. In addition, Christine Boyer regularly tweets articles and information regarding events related to making and MakerSpaces: <https://twitter.com/5Boyer> and did a presentation at the NY Tech Forum in October 2014.

It is important for the learning that occurs in the MakerSpace be transparent. The location of the MakerSpace does not make that easy. However with the help of our technology teacher Chris Casal, the lessons will be displayed on the two televisions that are in the Heathcote hallways.

Lunchtime offers a unique opportunity to have both staff and students in the space. Clubs will be offered for both cross-grade and single grade groups at this time.

Finally, a Heathcote **PTA STEAM Committee** was formed to bring parents and teachers together with the hope of creating an environment where the school’s MakerSpace and a Maker Philosophy will take root and thrive within the school.

#### Budget Summary

Allocation:	\$7,500
Expenditures:	\$7,500
Current Balance	\$0

#### **Quaker Ridge: A Technology Enriched Makerspace**

The Quaker Ridge MakerSpace is led by the efforts of John Calvert, Quaker Ridge computer teacher and former sculptor/graphic designer. The space, located in the lower level of Quaker Ridge, consists of a large table surrounded by computers. In addition, old laptops have been refurbished, and students have been helping to construct a laptop cart.

#### **Phase One: Research**

The school’s investigation into the Maker Movement began by creating a MakerSpace committee of classroom teachers and specialists who wanted to explore the maker philosophy and discuss how it would impact Quaker Ridge. The committee visited the Westport Library to talk with Bill Derry, the library’s Assistant Director for Innovation and User Experience.

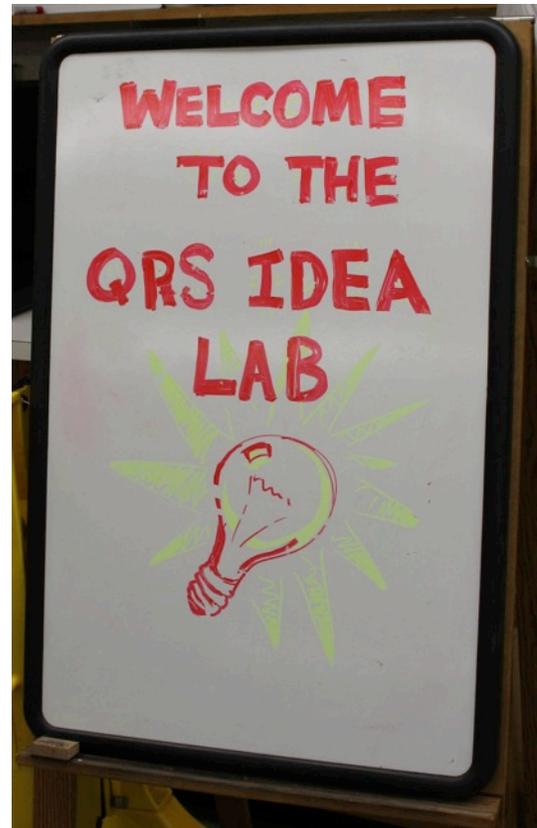
Committee members attended the Scarsdale Center for Innovation speaker series featuring Gary Stager. Several members continued on to read Stager's book *Invent to Learn*. Another book that was influential during this early stage was Adam Kemp's *The Makerspace Workbench*. A representative of the committee attended MakerSpace presentations at the Science Leadership Academy's EduCon 2.7. These experiences began to mold a perspective for the Quaker Ridge MakerSpace. We agreed that the physical space was secondary to a cultural ideal of creating hands-on experiences that encourage students to design, experiment, build and invent.

## Phase Two: Design

The Quaker Ridge team members wanted a space to serve as the epicenter of this idea and surveyed possible locations. They recognized that a MakerSpace needs to be flexible, a concept that continues to drive their thinking. They chose the school's second computer lab/music room. This location was selected for several reasons. The space contains a sink, has access to the outside, and includes storage. Most importantly, the room adjoins the art room and the music room, and is down the hall from the science space. The location makes it the perfect hub for a room dedicated to STEAMM (science, technology, art, engineering, mathematics, and *music*.)

The room originally had computers on tables surrounding a workbench. This design allows for the blending the digital and the physical space, while offering a place for students to meet and discuss their work. Upon reflection, however, they felt the space was restrictive and hard to maneuver.

During the summer, the QR technology teacher attended the STI course "*Design Thinking and More for Educators: Summer Institute*" and began to redesign the MakerSpace. Using the Stanford D.School book *Make Space: The Book*, as an inspiration, the room was reconfigured to promote a more flexible work and discussion area. The majority of the desktop computers in the room were removed and replaced with a laptop cart. This has cleared table space for student work. John Calvert also built a "T-Wall," a moveable structure with two intersecting 6' X 4' walls clad in dry-erase board. The T-Wall creates a way to divide the space for students to brainstorm in small groups.



### **Phase Three: Curriculum**

The space is still evolving, but so far Quaker Ridge has purchased tools and equipment with an eye on the following types of activities:

- Cardboard construction
- Prototyping
- Woodworking
- Electronics
- Robotics
- Digital fabrication

Integrating the Maker philosophy with the curriculum is important to the team. They have used resources from the space to support the 5th Grade Models and Designs unit, where students build arcade games out of cardboard. We have also used the space for a bridge building competition that was a part of the second grade communities unit. In this project, second grade students were given a budget and had an array of material that could be purchased for construction. Students needed to plan within their budget, build the bridge according to their plan, and then test their bridge.

Quaker Ridge has begun to use the space for faculty meetings to help acquaint teachers with the space. The T-Wall has been used in a staff meeting where teachers formed groups based on their learning styles. Faculty members discussed a problem, and then wrote or drew freely within their nooks. This collaborative space was also used with students to brainstorm ideas for the MakerSpace. Students naturally engaged in conversations about their ideas when confronted with the common surface of the “wall.” Then, they took a museum walk to read each other’s contributions.

### **Future Plans**

This year, the school team intends to expand the MakerSpace ideas into new curriculum areas. The team is looking forward to using the Maker Space during the fourth grade simple machines unit and the third grade electricity unit. In addition to being a curriculum space, the room hosts a club and provides a place for creative tinkering during the day. The school plans to open a lunch club where students will be able to sign into the space using a digital kiosk. Students will register for one of several designated areas, such as digital fabrication (laptops) Virtual World creation (Minecraft on desktops) Electronics Lab (squishy circuits, breadboards), Lego Engineering (Lego Mindstorms/Lego WeDo), un-making (taking apart electronics), and woodworking. There are plans to open this experience to third through fifth grade students. This opportunity will be free, and organized during the recess period in the colder months. Each area will have a cap of students who can register on any particular day. If one area is full, students will be encouraged to sign up for something new. The room will continue to be used for a young makers club that meets once a week after school. The club is planning to expand to two times a week next spring.

Several passion projects are also hosted in the MakerSpace. Students have built a wooden stand that will support a “Grow Bot.” The Grow Bot is a robot that will monitor and control soil, temperature, and light for an indoor garden. The garden will use the same seeds being used for the outdoor garden space. Students will be able to compare the robot garden with the outdoor garden. Students are also working on two arduino “Rhino Bots.” The Rhino Bot Chassis’ were printed on the 3-D printer and will use Arduino circuit boards (special electronics kits) to control servos and tank treads.

### Budget Summary

Allocation:	\$7,500
Expenditures:	\$6,657
Current Balance	\$843

### **Sharing our Success**

Scarsdale Maker teams are also informing the regional Maker movement. They will be presenting their work to forty Assistant Superintendents who will be visiting Scarsdale this fall. In addition, the Maker teams hosted many visitors from local school districts who were interested in learning about our initiative.

