

“Designing for Purpose”

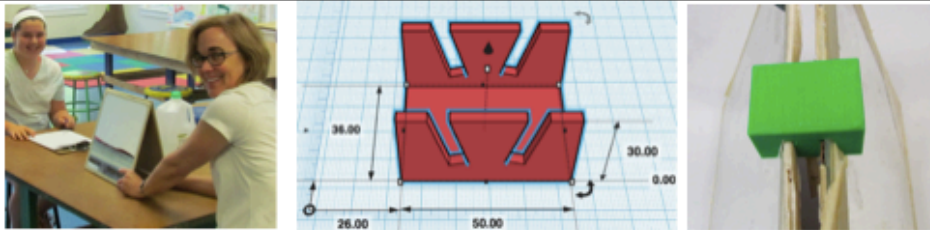
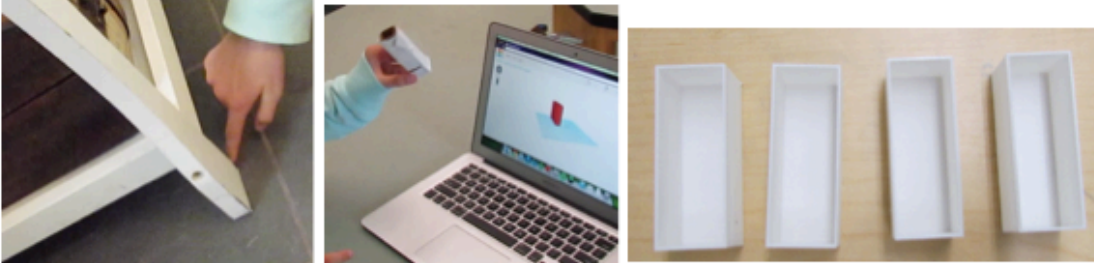
Rich Lehrer and Annie Johnson

For one week in May, students at Brookwood School in Manchester, MA immerse themselves in one of a variety of week-long experiential education courses in what Brookwood calls its “Steep Week”. This May, 2016, science teachers Rich Lehrer and Annie Johnson offered a “Designing For Purpose” course for girls (called “D-Zign Girlz”) that revealed the power of 3D printing to create solutions to real world problems. By allowing the girls the opportunities to design authentic and purposeful solutions immediate, local, and global problems, Lehrer and Johnson hope to inspire and empower their students to become change makers and problem solvers in their lives, their communities, and their world.

Over the course of the week students:

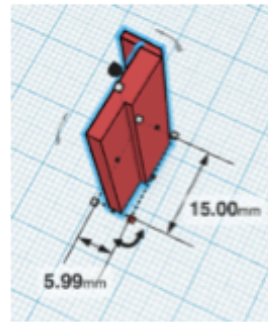
- designed solutions to problems posed by members of our school community
- designed tool adaptor devices for a student at our school who uses an Enable 3D printed prosthetic
- designed solutions for residents at a local seniors’ residence
- became immersed in the use of interviewing for empathy and authentic design to connect to their community and world

Day 1 – Brookwood – The morning was spent considering the power of young people to effect change in their lives and communities, learning the finer points of 3D designing and printing, and studying the role of empathy in effective interviewing and designing. The girls then put all this information into practice as they headed out to meet with teachers and other adults in our community who shared problems in need of a designed solution at our school. The remainder of the day was spent prototyping solutions to these problems using conventional materials, 3D designing solutions, refining their creations with repeated testing, redesigning, and reprinting, and finally sharing the solutions with the individuals who posted the problems.

Problem	Solution	Photos
The art department wanted a method for keeping 2 portrait mirrors at the proper angle	Gracie tried a number of different approaches and obtained success with 2 clips connected with a bridge.	
The maintenance department asked for small plastic boots to protect the legs of the table in the faculty bathroom in the event of an overflowing sink or toilet.	Addie prototyped a solution with cardboard, 3D designed a single boot with thin walls and then printed 4 after confirming her solution worked	

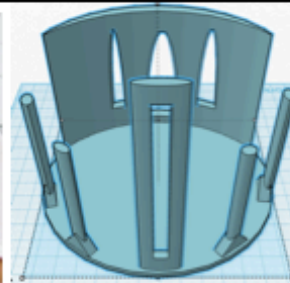
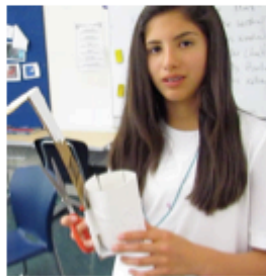
Mr. Woodruff requested a replication of a small plastic piece that allows the window on his boat to be firmly shut but that he can no longer order.

Sophia Facetimed with Mr. Woodruff to clarify the need, prototyped with clay, designed a first iteration, and continued to refine until finally ending up with a near perfect replica.



Ms. Buchan asked for a solution to the problem of her 5th grade students' water bottles continuously being knocked off their desks.

Abby spoke with the 5th graders in their classroom, prototyped, with cardboard and designed and refined her solution.



Mrs. Woodruff's daughter Addie lost a small black adornment piece off her dance shoes and asked for an improved replacement.

Brooke created a number of possible designs, shared them with Addie, and then printed off several versions of her favorite "A" style



The Lehrers acquired a used "Connect Four" game that was missing a number of pieces and asked the group to design replacements.

Ella prototyped with modeling clay, designed and gradually improved her iterations, and eventually printed off multiple copies of the final, very effective version.



Day 2 – Max – During Day 2, the focus was on designing activity specific clips for Max's 3D printed hand and the tool adaptor that he wears designed by Seattle Pacific University faculty and students. Students interviewed Max in the morning to learn more about his interests and challenges and then set about designing clips to allow him to more effectively swing a wiffle ball bat, ride a scooter, and ride his bike. In the afternoon, the students then had a great Skype session during which they shared their authentic designing with SPU engineering professor, Adam Arabian (inventor of the tool adaptor the girls were designing for in the morning), Enable Community Foundation founder, Jon Schull, and Jessica Huang from MIT's D-Lab. The day concluded with Max trying out some of the girls' inventions and giving them feedback for further refinement of their designs.

Problem

Max indicated that Wiffle Ball is an activity he enjoys and that a tool adaptor might help him hold the bat tighter

Solution

Brooke designed a bat clip that was bolted to the bat, giving Max a more stable swing

Photos



Max recently acquired a new scooter and without the ability to grip both handles, the scooter wobbled when he rode it

Ella designed a scooter adaptor that clipped over the narrow end of the handle and became tighter when pushed to the thicker end.

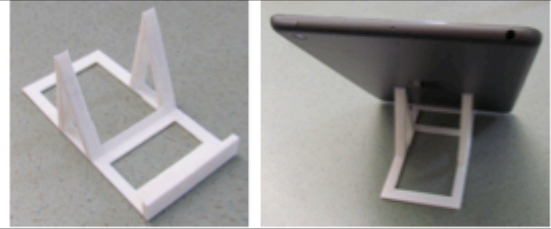
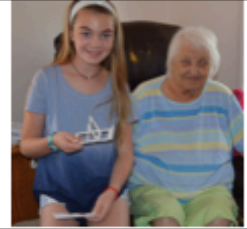

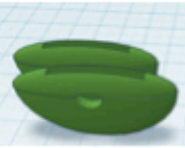
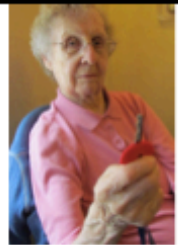




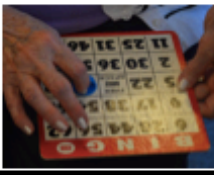
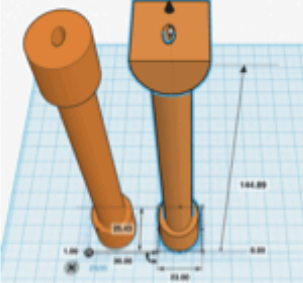
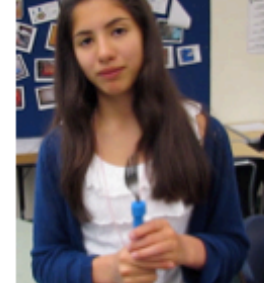




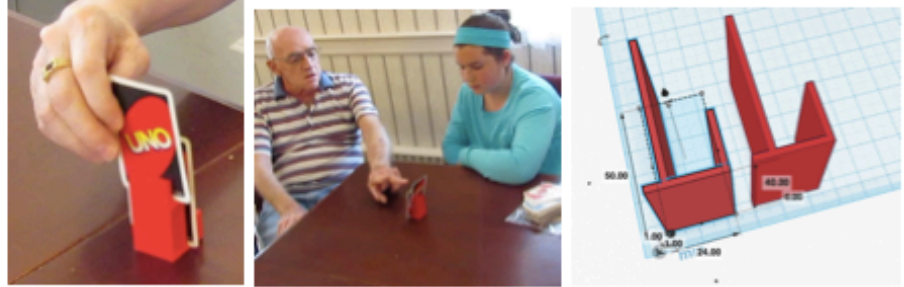

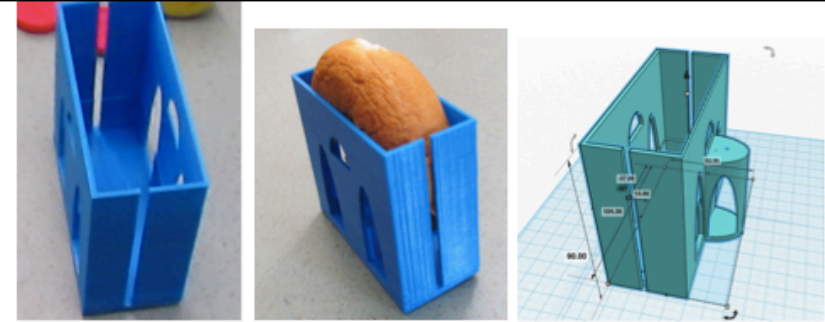
Although Max can ride his bike very well, he occasionally struggles when having to pull back on the handle bars (ex. climbing hills, starting to pedal, etc.)

Addie and Sophia designed bike handle clips that increased Max's ability to pull back on the handle bars.



Days 3-5 – Harborlight House Seniors’ Residence - During the final part of the project students designed solutions for authentic problems they identified through interviews and discussions with residents from Harborlight House in Beverly, MA. The concluding part of the authentic design project started with a visit to Harborlight House where the girls presented to a small group of residents about Brookwood, 3D printing, and authentic design. Students interviewed 5 different residents about their interests, their lives, and some of their challenges. They then headed back to Brookwood with a spectrum of great ideas for potentially helpful devices, and set about prototyping, designing, and printing 1st iterations. During the remaining two days, students revisited Harborlight House to share their first iterations with the residents and gathered feedback in order to refine their designs. The week concluded with the students presenting their devices to the residents celebrating an amazing week.

Problem	Solution	Photos
Joan indicated that she liked to Skype with her grandchildren but found it difficult to hold the tablet for long periods because of shoulder problems.	Brooke prototyped a potential solution with modeling clay, designed and gradually improved a stand that she then presented to a very appreciative Joan	 
A number of residents shared with the students that they found it difficult to turn their keys in the locks of their apartments.	With the help of a number of students, Addie designed a very effective “key sleeve” that very effectively provided more leverage and made it easier to turn the key	   
Students heard loud and clear that many residents had stopped playing Bingo due to the frustration of picking up the small plastic number markers	Ella designed several different Bingo markers with mini handles that she tested with the residents, eventually settling on a final design	   
A number of residents shared that arthritis was making it increasingly difficult to hold the silverware they used during meals for long periods of time.	Abby prototyped and designed a number of wider cutlery handles. We cut a fork in half, heated the plastic until it melted, and jammed the fork end in producing a very effective solution.	   

<p>Some residents had stopped playing card games (Uno, etc.) because they found it too difficult to hold the cards for long periods of time.</p>	<p>Gracie designed a thin card holder prototype section in order to get feedback on the effectiveness of the sizing and designed a very effective final holder</p>	
<p>The HLH staff shared with us that residents were helping themselves to Styrofoam cups of coffee in the reception but shaking was causing them to spill the coffee on the floor and burn their hands</p>	<p>Addie created several versions of a neck for coffee cups (called the "Noffee") and eventually produced a wide version that ended up being completely water (and coffee) tight.</p>	
<p>With their dining room under construction, residents have been increasingly eating in their rooms. Using sharp knives to cut bagels and English muffins has been causing safety issues.</p>	<p>Ella designed an initial solution that worked well, but successive iterations resulted in an attractive and increasingly safer design.</p>	
<p>Don shared that he could use a good coaster for his drinks. Students also noticed from the pictures on the all that Don is a huge N.E. Patriots fan.</p>	<p>Gracie and Brooke produced a simple but effective coaster design, made all the more appealing with the addition of the Patriots logo.</p>	