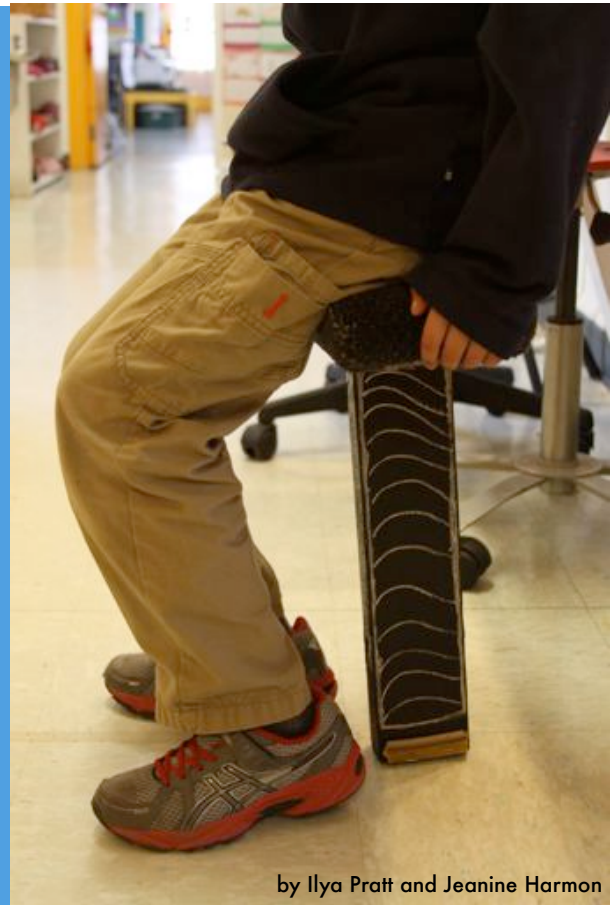


T-Stool

A STUDENT DESIGN + BUILD PROJECT

*Emphasizing student-community
engagement
Incorporating Agency by Design
themes and tools*



by Ilya Pratt and Jeanine Harmon

Fourth and Fifth Graders From North Oakland Community Charter School and Park Day School collaborate to build 60 T-stools for their school communities

Park Day School's 4th grade classes worked together to build 40 T-stools for the school and distributed them to several classrooms. As more students began to use the T-stools, both teachers and students discovered their learning benefits. This direct experience sparked an idea: What if our students could share this learning tool with other schools? We set about crafting a collaborative design and build process informed by learnings from Park Day's Community Outreach and Design+Make+Engage programs, and by our participation in the Project Zero, Agency by Design research project.

*"It helps
me focus."*

Occupational Therapists use T-stools with students to engage the key sensory systems and to build core strength. The stools have started to make their way into classrooms, as some students find they help them to calm and focus their bodies during seated learning. As students balance on the one-legged stools, their sensory systems and core muscles are actively engaged. This sensory "satiation" in turn helps the eyes to focus on the task at hand. T-stools are one of the many OT tools that can be made available within a classroom for students to self-select and utilize.

We used Project Zero's Teaching for Understanding principles to guide the planning and design of the T-stool Project. Our Throughline represents our overarching goal for the project. The Understanding Goals represent the overarching questions that guided us throughout the project. Our Understanding Performances are the specific student learning outcomes from the T-stool Project.

Throughline:

Maker Empowerment: A sensitivity to the designed dimension of objects and systems, along with the inclination and capacity to shape one's world through building, tinkering, re-designing or hacking.

Understanding Goals:

- How can we work together to improve our school environments?
- If you could design and build a T-stool for your classroom, how would you do it?
- How are T-stools helpful to learning?

Understanding Performances:

- Utilizes Quality Assurance rubric during build sessions
- Creates T-Stool Plan Book: Parts and Purposes Identification
 - Accurate identification of T-stool parts and purposes
 - Articulates 1-3 building/engineering tips
- Uses the resources provided to follow the build sequence
- Demonstrates Workshop Safety Rules
- Completes T-stool

T-stool Design+Build Collaboration Sessions

1. Student emissaries share stools and propose partnership. T-stool testing at NOCCS.
2. Design Session using T-stool plan books.
3. First Build Session: meeting partners, tool safety, build stool frames
4. Base coat painting
5. Second Build Session: carpet, foot pad; Decoration.
6. Feedback, reflection.

"I never really thought about how furniture was made before. It was really fun figuring out how it was built."

Community Partnership



At Park Day School, we actively seek opportunities for our students to work collaboratively on projects with the community, and this project provided an excellent opportunity for us to share information and resources to build something tangible and useful for the classroom. PDS students learned about the advantages and benefits of using T-stools after actually using them rather than just learning *about* them. The act of building T-stools gave PDS students a sense of ownership and empowerment. We wanted to share this experience with more students both within and outside of our school community.

We brought a team of student representatives from Park Day to North Oakland Community Charter School (NOCCS), a local charter school in Oakland, to share the stools and our partnership proposal with Leslie Miyagawa's 4th/5th combination class. PDS students demonstrated how to use T-stools and described how many students could benefit from using a T-stool instead of a chair as a way to help them focus better in the classroom.

We proposed that if, after trying them out, the students thought they would be useful to their community, we would work together to build 30 T-stools for each of our schools. Our goals were to work and learn together how to build T-stools, improve the current design, and to contribute to our school communities.

T-stool Test Drive

We left six T-stools with Ms. Miyagawa's class to use over the course of a week. During this time, students tried them in various learning situations within the school. The community came to the conclusion that T-stools would be a welcomed addition to the classrooms. The students couldn't wait to get started!

Design Session



Quality Assurance Rubric:

- +Neat Work
- +Share tool and stool time
- +Careful measurement
- +Organized plan book

We began the design session with a review of our “Quality Assurance” rubric. This rubric allowed us to set the expectations for the quality of work and collaboration.

The formal design process began with an observation period. This was structured using a simplified version of the Agency by Design Elaboration Game. Student teams were given finished stools, asked to silently observe them for one minute, and then to share with each other two observations and an “I wonder” statement. This provided a simple structure that encouraged close looking and invited them to start thinking about how the stools were made. This format worked well, as reflected in the fact that the number of observations and questions the pairs generated went well-beyond the proscribed amount.

Students shared observations and wonders with the whole group. This discussion naturally led to an exploration of the key things we would have to consider in our design and during the building. Students also began making suggestions for improving upon the design. This was the greatest point of excitement for them – sharing their ideas on how the T-stools could be better.

T-stool Plan Book:

Parts, Purposes, Complexities in Action

We used the Agency by Design “Parts, Purposes, Complexities” framework to craft the T-stool plan book. We have found that this framework is particularly powerful in helping students – and adults – tune into the design of an object or system.

The T-stool Plan Book cover was handed out first. In asking them to write their name, we briefly touched upon the thinking dispositions of designers, builders and engineers, and the fact that students were taking on each of these perspectives during the project.

“Can we offer ideas on how to make them better?”

Students were then asked to make a drawing of the T-stool that showed as clearly as possible what they looked like. In this way, they had to carefully attend to the whole object (T-stool).

The parts pages were then provided as a stack at each group's table, with the direction that students use one "parts page" for each part they identified. By not being told how many parts pages they would need, they had to do the work of ensuring they identified them all. In addition, the "Picture and Measurements" box required students to carefully observe each part.

In asking students to state each part's purpose, it helped them to be aware of the relationship of the parts to the whole. Or, how it fit into the T-stool design. In addition, if a student was unable to figure out a name for a part, prompting them with "What's its purpose?" worked well to cue them to find an appropriate name. When a name was suggested that was a little off, such as "strut" for the leg, referring to the overall object purpose helped: "What is this object (holding up a T-stool)? What do you usually call that part on similar object (chair)?"

Asking students for an engineering/build tip served to tune them into the T-stool's parts-to-whole complexities. In the case of the leg, for example, there is complexity in the relationship between it and the seat. If the leg is not perpendicular and on center, the stool balance will be impacted. The main cueing question we used was, "What will be good to keep in mind when we are putting on that part?" The engineering/build tips that students came up with were largely a reflection of the earlier Elaboration Game discussion.

T-Stool Plan Book

Designer/Builder/Engineer: *Ryan*
Date: *2/26/13*

Part 1: leg

Purpose: to keep the stool up and have a leg

Picture and Measurements:
 $13 \frac{7}{8}$ - length
 $3 \frac{1}{2}$ by $1 \frac{1}{2}$ - width

Engineering/Build Tips:
 put in middle
 even measurements
 smooth wood

Material: *staples, Made of Wood & Painted*

Part 2: Supporters

Purpose: To keep the stool stable

Picture and Measurements:
 $3 \frac{1}{2}$ length
 2 width

Engineering/Build Tips:
 smooth wood
 strong
 big

Material: *wood & nails + paint*

Part 3: carpet

Purpose: .comfort

Picture and Measurements:
 12 inches
 5 1/2 inches

Engineering/Build Tips:
 -right measurement
 -make sure it doesn't overlap
 -should use hot glue gun and staple gun

Material: *carpet/rug*

Partner Build Session



"It was fun starting to build the T-stools with partners and having the chance to get to know them better."

The T-stool build sessions took place on Park Day's campus on two separate days. Our build session support team included the classroom teachers and six parent volunteers. During each two hour session, students worked with their partner to each build a T-stool. Half of the NOCCS students joined one of the PDS 4th grade classes at each session, forming a total of 16 build team partners.

The build partners used the first ten minutes of the session for introductions which included choosing a team name, then moved into a discussion about what they would build if they could build anything in the world, and finished with a review of their Plan Books.

We gave the students an update about the design improvements that came as a result of their design session work. We changed to a construction adhesive and a square profile brace to help overcome the cracking problem the students had identified. We were gratified by this authentic redesign experience; the students affected a positive change on the T-stool design.

Workshop Safety Rules:

- ★Tools not toys
- ★Eyes on the work
- ★Talk through the task first
- ★Calm bodies in the workshop

Next, we introduced the main tools that we would be using: saws, jigs, hammers, drills carpenter squares, templates, caulk gun and constructive adhesive, sanding block and paper, staple gun, matte knives safety glasses and our "Workshop Safety Rules" to establish the workshop ethos.

Throughout the building session, the build team partners worked together, going from station to station. We wanted the students to be as independent as possible. We developed a checklist form that outlined all of the build steps (see example). Each team had the checklist on a clipboard.

T-stool Build Station Steps

However, it quickly became apparent that it was impractical for the students to keep track of the clipboard, pencil and the T-stool parts. In addition, very few students were using the checklist to determine their next step. For the second session, we decided to abandon this checklist and instead created a visual reference guide that we posted. The steps of building T-stools is not a strict linear process and therefore some students found it a bit challenging to independently navigate through the stations.

After the build session was complete, we debriefed as a group, sharing overall impressions about the experience and learnings from the day. The students also initiated an impromptu basketball game!

A total of 60 T-stools were built, 30 for each school. PDS students painted the base coat on all of the T-stools in order to streamline the finish work process. The final finished work sessions occurred separately at each school. These sessions included cutting carpet segments for the seat pad, attaching the seat pad, cutting bike tire segments for the foot pad and attaching the foot pad. The students used Sharpie metallic paint markers to create the final decorative designs for each T-stool.

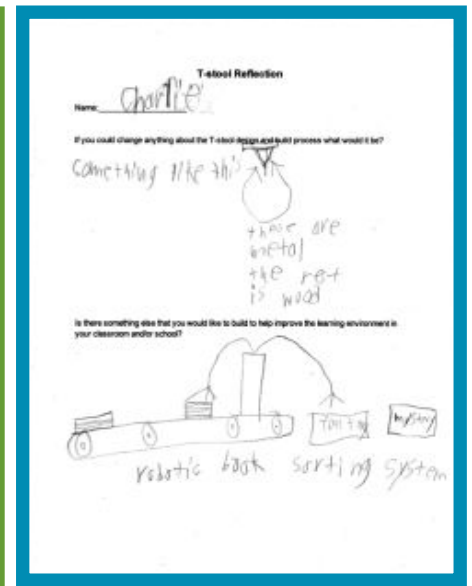
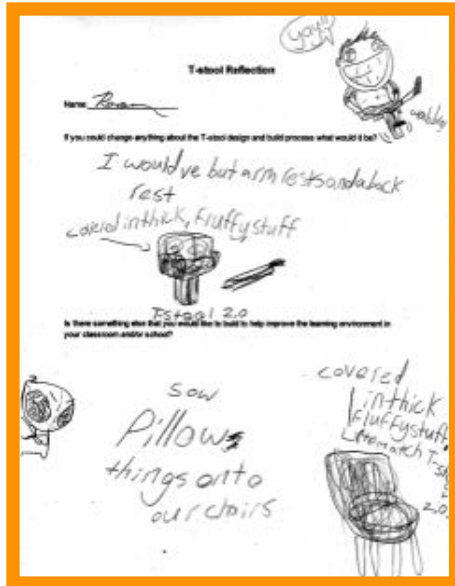
Checklist:

T stools Build Steps

BUILD TEAM: The blue marbles

Part	ACTION	Tools	COMPLETED
Seat	Sand 2x4 (light sanding ok)	Sandpaper, sanding block	✓
	Label with size (12 or 12 1/2)	Pencil	✓
	Mark Centerline, Mark screw holes	Ruler/measuring tape Hair template	✓
	Drill holes	Drill, drill bit Screwdriver to protect table	✓
Leg	Sand 2x4 (Sand to smooth finish)	Sandpaper, sanding block	✓
Braces: Make 2'	Measure 3 1/2' lengths	Pencil, measuring tape	✓
	Cut Pre-nail with two nails EYE PROTECTION!	Use, saw Hammer, 2" nails Protected table surface	✓
Seat Cover	Notch carpet	Template Sharpie Matte knife Protected table surface	
Frame ASSEMBLY			
Seat to Leg Assembly	Align seat and leg in 3/8" gap Screw together	Use 3/8" hole Drill 3/8" screws (2)	
Braces to seat Assembly	Glue and nail to seat EYE PROTECTION!	Hammer, nail "Liquid Nails"	
PAINT			
Paint	Paint only surfaces that will be seen	Paint Brush/roller Tarp rags	
Final ASSEMBLY			
Cover Seat	Check how carpet overlaps Staple	Electric staple gun T-150 staples 1/2"	
Attach Leg Pad	Check fit	Electric staple gun T-150 staples 1/2"	
Decorations		Paint markers	

Student Reflection Process



For our T-stool wrap-up session with the students, we used a prompt to kick off a general discussion about the T-stool Project, and then ended the session with a reflective writing exercise.

The class discussion centered around the prompt: *What was something that stood out to you from the T-stool design and build experience?* Student responses centered around several themes: the joy of building, excitement about using, the fun of working with another school and the feeling of empowerment.

After our discussion, each student wrote their responses to the following questions:

1. *If you could change anything about the T-stool design and build process what would it be?*
2. *Is there something else that you would like to build to help improve the learning environment in your classroom and/or school?*

Our first question was designed to give the students a broad enough category to consider in their reflection. It was important to us to move beyond how they felt about the project and into areas of specific feedback. Even though our question asked students to focus on the process, the majority of responses related to the T-Stool design and materials we used, particularly the seat covering.

We wanted the second question to inspire students to examine and consider the learning environment in their own classrooms. Some students were able to expand their vision to include their school community. This question was designed to push the students toward thinking like a builder. We wanted the question to tap into and capture their energy, enthusiasm and feelings of empowerment. Most of their responses were related to "making" rather than building something. Based on the number of these responses, we would revise the last question include the word "make."

"After I finished putting the wood together, I felt like we had done something awesome."

Building on Agency



T-stools are relatively simple in design, making them a good beginning design and build project for students. In addition to building a functional piece of furniture, students are creating an actual learning tool for the classroom. We were pleased with the overall results of this collaborative build project and believe we accomplished what we set out to achieve. This project was ambitious in scope and exciting to teach. In the end, all participants would still wholeheartedly agree that it was well worth the time and the effort.

Students at both schools are eager to continue to design and build. It became even more clear to us that we need to create and offer more building opportunities across the grade levels. It's important to note that depending upon the grade level, a project of this nature and scale may need a lot of adult assistance in order for it to be successful. Having access to tools and a workspace are also important, but the lack of these elements should not be seen as a deterrent. Partnering with another organization and/or volunteers to assess these resource can be a mutually satisfying exchange.

The T-stool Project continues to bring inspiration to the classroom teachers at both schools. At North Oakland Community Charter School, the middle school carpentry elective teacher is planning to incorporate T-stool building into his course next year. The 4th grade teachers at Park Day School went on to use the T-stools as their centerpiece for the school's Math, Science and Engineering Night. Students worked in teams to learn more about T-stools, from the parts and building materials prep process, to learning about T-stools as a system. Circling back after following the design and build process worked well for this age group. They experienced real-world applications of math topics such as measurement, fractions, budgets and cost analysis, in addition to science topics including the vestibular system, senses, and learning styles. The students also developed an appreciation for the amount of thinking and planning involved a project such as this.

At Park Day School, we've identified an additional empowerment opportunity: T-stool maintenance and classroom furniture repair. In the months ahead, our Design+Make+Engage program will be exploring how we can capitalize on student T-stool know-how to engage them in helping to maintain their classroom furniture.

Our next immediate step is to share our T-stool Project plans on the website [Instructables](#), a web-based documentation system for DIY projects. By making this project available to an even wider audience of students, teachers, builders and makers, we hope to inspire others to explore the idea of collaborating and combining resources to build T-stools for classrooms.

Ilya Pratt is the Director of the Design+Make+Engage Program at Park Day School in Oakland, CA. Jeanine Harmon is the Director of Community Outreach and Service Learning, also at Park Day School. Both are members of the Agency by Design research project and Oakland Learning Community.