

Penn State Berks  
Helping Hands Engineering Design Challenge  
March 11, 2014

Introduction:

The world of the physically disabled can be a daunting one. Things that non-disabled folks take for granted, such as picking up a dropped item, can be challenging for the physically disabled. There are many devices available today to assist them in retrieving dropped items. Some are quite good; others not so well designed or robust.

Your Challenge:

Design and build a device that lets you pick up different objects and drop them into a container. The objects will be located inside a 3 foot square. The container will be located on a table (at least 3 feet high) and placed two feet from the square... Items to be picked up may include small, medium, and large objects and are listed below. Some of the items will be heavy, others will be very light, and some items may be fragile. You should plan for these possibilities in your design.

Design Restrictions:

Students are given a budget and must “purchase” materials. Each material part has a cost associated with it. Students should try not going over budget. For high schools, the total budget may not exceed \$2.50. For middle schools, the total budget may not exceed \$3.50. All materials shall be supplied by your school or district.

Your device must have a line drawn 6” from the operator end of the device. You may not touch the device below this line when operating it.

Documentation Requirements:

You must bring a detailed sketch of your design with all parts indicated, listed, and priced with a final cost when your team comes to demonstrate your final design.

Materials are restricted to the list below. Suppliers are given as a reference only. You may purchase materials at any location, as long as they do not exceed the specifications shown at these links.

Your team may use wood glue, hot glue, a drill and other tools at no additional cost.

Jumbo Popsicle sticks, not to exceed 6” in length

Typical Source: [http://www.amazon.com/Chenille-Kraft-Natural-Sticks-3776-01/dp/B001GXD6BU/ref=sr\\_1\\_3?ie=UTF8&qid=1383828157&sr=8-3&keywords=large+popsicle+sticks](http://www.amazon.com/Chenille-Kraft-Natural-Sticks-3776-01/dp/B001GXD6BU/ref=sr_1_3?ie=UTF8&qid=1383828157&sr=8-3&keywords=large+popsicle+sticks)

Your Cost: \$0.05 each

Rubber bands, not to exceed 7 “ loop in length

Typical Source: [http://www.amazon.com/Alliance-Sterling-Ergonomically-Correct-25405/dp/B001HA8J1E/ref=sr\\_1\\_4?ie=UTF8&qid=1383828223&sr=8-4&keywords=rubber+bands](http://www.amazon.com/Alliance-Sterling-Ergonomically-Correct-25405/dp/B001HA8J1E/ref=sr_1_4?ie=UTF8&qid=1383828223&sr=8-4&keywords=rubber+bands)

Your Cost: \$0.05 each

String, total length allowed – 60 inches

Typical Source: [http://www.amazon.com/Quality-Park-Cotton-10-Ply-46171/dp/B0013L5DFC/ref=sr\\_1\\_1?ie=UTF8&qid=1383828300&sr=8-1&keywords=string](http://www.amazon.com/Quality-Park-Cotton-10-Ply-46171/dp/B0013L5DFC/ref=sr_1_1?ie=UTF8&qid=1383828300&sr=8-1&keywords=string)

Your Cost: \$0.01/inch

Brass Fasteners – 1” maximum length

Typical Source: [http://www.amazon.com/School-Smart-Brass-Plated-Fasteners/dp/B003U6TT7Q/ref=sr\\_1\\_4?ie=UTF8&qid=1383828376&sr=8-4&keywords=brass+fasteners](http://www.amazon.com/School-Smart-Brass-Plated-Fasteners/dp/B003U6TT7Q/ref=sr_1_4?ie=UTF8&qid=1383828376&sr=8-4&keywords=brass+fasteners)

Your Cost: \$0.10 each

Velcro sticky back strips – 7” total length allowed (Example: 1” of hook and loop attached is considered 1”; hook and loop are not measured individually)

Typical Source: [http://www.amazon.com/Velcro-Sticky-Strips-Inches-90161/dp/B002VKVD8A/ref=sr\\_1\\_4?ie=UTF8&qid=1383828568&sr=8-4&keywords=velcro+strips](http://www.amazon.com/Velcro-Sticky-Strips-Inches-90161/dp/B002VKVD8A/ref=sr_1_4?ie=UTF8&qid=1383828568&sr=8-4&keywords=velcro+strips)

Your Cost: \$0.25/inch

1/2” diameter Wooden Dowel (May not exceed 36” in length)

Typical Source: [http://www.amazon.com/Wood-Dowels-36-Pack-10/dp/B0044SGLV6/ref=pd\\_bxgy\\_hi\\_text\\_y](http://www.amazon.com/Wood-Dowels-36-Pack-10/dp/B0044SGLV6/ref=pd_bxgy_hi_text_y)

Your Cost: \$1.50 each

Tooth picks, as needed

Your Cost: None

Wooden Skewers – 6” long (Each skewer may not exceed 6” in length)

Typical Source: [http://www.amazon.com/Winco-Bamboo-Skewer-6-inch/dp/B0015YZ2R6/ref=sr\\_1\\_2?s=home-garden&ie=UTF8&qid=1383828958&sr=1-2&keywords=wooden+skewers+6+inch](http://www.amazon.com/Winco-Bamboo-Skewer-6-inch/dp/B0015YZ2R6/ref=sr_1_2?s=home-garden&ie=UTF8&qid=1383828958&sr=1-2&keywords=wooden+skewers+6+inch)

Your Cost: \$0.10 each

Suction cups, not to exceed 1.5” diameter

Typical Source: [http://www.amazon.com/Amico-Diameter-Transparent-Plastic-Suction/dp/B00ARASHHG/ref=sr\\_1\\_16?s=home-garden&ie=UTF8&qid=1383829027&sr=1-16&keywords=suction+cups](http://www.amazon.com/Amico-Diameter-Transparent-Plastic-Suction/dp/B00ARASHHG/ref=sr_1_16?s=home-garden&ie=UTF8&qid=1383829027&sr=1-16&keywords=suction+cups)

Your Cost: \$0.25 each

Magnets, not to exceed 1” diameter or 1” square, may have adhesive backing

Typical Source: [http://www.amazon.com/Package-Strong-Crafting-Creating-Embellishing-/dp/B00DI7MJ3I/ref=sr\\_1\\_14?s=arts-crafts&ie=UTF8&qid=1383829278&sr=1-14&keywords=small+craft+magnets](http://www.amazon.com/Package-Strong-Crafting-Creating-Embellishing-/dp/B00DI7MJ3I/ref=sr_1_14?s=arts-crafts&ie=UTF8&qid=1383829278&sr=1-14&keywords=small+craft+magnets)

Your Cost: \$0.25 each

#6 machine screws, flat washer, lock washer, and hex nut

Your Cost: \$0.10 for 1 set of screw, flat washer, lock washer, and hex nut

Duct tape, not to exceed 4” inches in length x 2” wide

Typical Source: [http://www.amazon.com/Duck-1265013-Colored-1-88-Inch-Single/dp/B002TOL40A/ref=sr\\_1\\_4?s=arts-crafts&ie=UTF8&qid=1383829494&sr=1-4&keywords=duct+tape](http://www.amazon.com/Duck-1265013-Colored-1-88-Inch-Single/dp/B002TOL40A/ref=sr_1_4?s=arts-crafts&ie=UTF8&qid=1383829494&sr=1-4&keywords=duct+tape)

Your Cost: \$0.25 per inch

Mouse trap, Victor

Typical Source: [http://www.amazon.com/Victor-Easy-Mouse-Trap-M038/dp/B000HJ79Y4/ref=sr\\_1\\_6?ie=UTF8&qid=1389368278&sr=8-6&keywords=mousetrap](http://www.amazon.com/Victor-Easy-Mouse-Trap-M038/dp/B000HJ79Y4/ref=sr_1_6?ie=UTF8&qid=1389368278&sr=8-6&keywords=mousetrap)

Performance and Demonstration:

Each school is allowed to send only one team of up to 5 students. You may bring your pickup items to the competition for practice however; the competition will supply the final pickup items. All teams will compete using the same pickup items.

Your Helping Hands device should be able to pick up any or all of the following items from the floor and move them to a bucket sitting on a table. The items will be placed in a 3 foot square marked out on the floor. The bucket will be located outside the square on a table at least 3 feet high. The device operator must sit in a chair next to the 3 foot square and may not stand up nor leave the chair to move the items.

Your Team must attempt to pick up items; they may not skip the Performance Phase of the contest.

There is a 10 minute time limit for your demonstration.

Only one individual may operate the Helping Hands device. A separate individual may present the design during the demonstration.

No individual may touch any of the items on the floor during the performance phase. Items will be placed at random in the 3 foot box by the Competition Committee or the judges.

Following are the items your Helping Hands Challenge may be expected to move as they are typical of the items a physically disabled person might need to pick up off the floor. The choice of what you decide to move is up to your Team. During the competition finals, all items will be supplied by the Competition Committee and/or judges. You may not bring use your own pickup materials during the competition phase.

Full 16.9 oz. Plastic Water Bottle standing upright on the floor

Empty Plastic Water Bottle lying on its side on the floor

A full sneaker string lying flat on the floor (must be out of the wrapper and stretched out)

8/12 x 11 piece of copy paper

A remote control

A quarter coin

A Kleenex tissue

A wooden pencil

A white sock

A battery (AAA size)

A battery (D size)

A tennis ball

A bracelet

A small cardboard box not to exceed 4" square – cannot be crushed.

A 14 oz. can of soup

An empty pill bottle

A cell phone

A large pair of scissors (Typical: [http://www.amazon.com/Fiskars-01-004253-Recycled-Everyday-Scissors/dp/B002M9EUO4/ref=sr\\_1\\_2?s=office-products&ie=UTF8&qid=1389367456&sr=1-2&keywords=scissors](http://www.amazon.com/Fiskars-01-004253-Recycled-Everyday-Scissors/dp/B002M9EUO4/ref=sr_1_2?s=office-products&ie=UTF8&qid=1389367456&sr=1-2&keywords=scissors))

Evaluation:

Your final evaluation will be based on a combination of the cost effectiveness of your design and how well it meets the performance objectives. The items to be retrieved will all be placed on the floor in a random order.

Scoring:

Your Team will receive 15 points for coming in on budget.

You will receive 1 additional point for every \$0.10 you are under budget; however, you will be penalized 1 point for every \$0.05 you are over budget.

You will receive 1 point for each of the items you successfully move.

A dropped item does not score, is penalized 1 point, and may not be reattempted.

If you use any item not on the supply list, you will lose 2 points for every instance of that illegal item.

You will be judged on your effort and the quality of your design by on-site judges at the final competition. You will be awarded between 0 and 20 points based on how well it is both thought out and implemented.

Scoring Matrix:

	Enter amounts:	Points Available:	Points Awarded/Deducted:
Enter Total Cost of Materials.		Add 15 points for coming in on budget, at or below \$2.50 →	
Enter amount under \$2.50.		Add 1 point for every \$.10 under \$2.50 →	
Enter amount over \$2.50		Deduct 1 point for every \$.05 over budget →	
Enter number of items <u>successfully moved</u> from floor to the bucket. <b>NOTE: IF AN ITEM IS DROPPED IT MAY NOT BE ATTEMPTED A SECOND TIME</b>		Add 1 point for every item successfully moved from the floor square in 10 minutes →	
Enter number of items dropped		Deduct 1 point for every item dropped →	
Enter number of items used that are not on the supply list		Deduct 2 points for every item not on the supply list →	
Judge's Score: Judges may award from 0 to 20 points based on well they believe your design is thought out and implemented.		Add Judge's Points →	
		Total Points:	