Preliminary Product Design Specifications: 9/21/2018
Design of a Spine Trainer

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Function: Minimally Invasive Spine Surgery is becoming more commonplace; however, there is minimal opportunity in spine surgery residency for neurosurgery and orthopedics training because the tools that are used for these procedures are significantly different from the standard procedures performed today. There is a need for a low-cost simulation environment to be developed to provide spine surgery trainees with the practice and training space to develop the fundamental scope-handling and manipulation skills necessary to perform minimally invasive endoscope based surgical treatments. Ideally, it will be made with simple materials to allow for its building and use globally.

Client Requirements:
- Low-tech design with simple materials available at any hardware store
- Mimic the targeting with the angled lens on endoscope, sweeping away tissue, and poking holes through membranes as tasks to train hand-eye coordination surgical skills
- Create a how to for creating the box and setting up the surgical spine training tasks
- Base on an air-environment
- Focus on tasks for surgical skills and not the anatomy
- No 3D printing allowed

Design Requirements:

1. Physical and Operational Characteristics
    a. *Performance Requirements:* Must be able to use the box for practice of each surgical task up to 50 times.
    b. *Safety*: Must prevent injuries to the user as the product undergoes wear and tear from the surgical tasks training.
    c. *Accuracy and Reliability*: Must never break during use.
    d. *Shelf Life:* Our goal is for the box to be used by one person for a year prior to needing to buy more materials in order to replace those used for training.

e. *Operating Environment:* The product must be able to be used with an endoscope for surgical practice or with a lens extension off of a cell phone if the product is updated.
f. *Ergonomics*: The product should be comfortable enough for the user to carry, place down, and use without causing any more stress to the body during training the surgical tasks than a typical spinal procedure would.
g. *Size*: The box must be 8in x 6in x 12in to allow for training use with multiple depths.
h. *Weight:* Must not exceed 5 lbs in weight
i. *Materials:* Materials must be simple and durable. The materials must be bought from a hardware store and allow for easy assemble of the box. The materials must also allow for training tasks at multiple depths.
j. *Aesthetics, Appearance, and Finish*: Aesthetics are not a main concern, but the product must still look professional.

2. Production Characteristics
    a. *Quantity*: Three boxes each with different insides that would help simulate different surgical environments. Each box would have a different surgical task inside.
    b. *Target Product Cost*: The product must be built under our $200 budget.
3. Miscellaneous
    a. *Standards and Specifications:For our project we don't expect to run into any problems with international or national standards. All of our resources we are using in our prototype are specifically chosen to be easy to use and make.*
    b. *Customer: Trying to reach out to Dr. Brooks currently so we can successfully fill this section out.*
    c. *Patient Related Concerns: Not applicable, the product just needs to be safe to the user training.*
    d. *Competition: There are high tech versions of spine simulators that already exist, one example is the SPINE MENTOR. This simulator has the appearance and feel that goes along with minimally invasive spine surgery. 3D printing was used to make the simulator appear realistic and virtual reality technology was used to show surgeons exactly what they were doing inside the simulator.*