Product Design Specification

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Project title: Bed-mounted modular procedural training surface

Group members:

- Nathan Knight – Team Leader and BSAC (nknight3@wisc.edu)
- Evan Koelemay – Communicator (ekoelemay@wisc.edu)
- Tess Fitzgerald – BWIG (tkfitzgerald@wisc.edu)
- Andrew McLaughlin – BPAG and BSAC (asmclaughlin@wisc.edu)

Client: Shannon DiMarco, sdimarco@uwhealth.org
Advisor: Darilis Suarez-Gonzalez, dsuarez@wisc.edu

Function:

The team's client, Shannon DiMarco from the Clinical Simulation Program at UW School of Medicine and Public Health, requests that a specialized, bed-mounted workstation that temporarily converts a standard hospital bed into a stable, ergonomic procedural platform be prototyped. Clinical simulation centers rely heavily on hands-on procedural training to prepare for real-world patient care. Specialized simulation suites often replicate acute care environments however, they frequently face severe spatial constraints, leaving insufficient room for dedicated, freestanding procedural tables alongside the patient bed. Current solutions like standard folding tables or rolling utility carts are poorly suited for this environment. They lack structural stability, take up valuable floor space, and do not securely interface with clinical equipment. The goal of this project is to create a device that can securely attach to existing bed architecture without damaging hospital equipment, which will allow healthcare trainees to perform procedures such as line insertions, suturing, and airway management in the constrained environment. The device must support static and dynamic loads of medical task trainers, withstand routine chemical sanitation, and feature a mechanism for rapid deployment and compact in-room storage.

Client requirements:

- The product should attach securely to a standard hospital bed, creating a hard surface for procedural learning.
- The product should be made of a material that will resist simulated fluids (fake blood and lubricants), as well as sanitization chemicals.
- The product must be light, easily transportable, and contain a folding component for compact storage.

Design requirements:

1. **Physical and Operational Characteristics**

a. Performance requirements

The bed-mounted modular procedural surface (sim-surface) will be used by UW-Madison's clinical simulation students. Pediatric procedural training will be performed on the surface, using anatomical model. The surface should be able to bear the weight of the tools used throughout the simulation, which should not exceed 10lbs. [1] The design must securely attach to a standard hospital mattress, and remain securely attached and static once installed. The final design must also be easy to store in the limited space available to the simulation room, and must withstand frequent transportation between storage and training sessions.

b. Safety

The final design must not include any sharp edges that can cause harm to the user who is practicing on the sim-surface. Furthermore, it must securely attach to the mattress and remain static during use, thereby minimizing the risk of injury if the surface were to move during training. Additionally, the material that is utilized for the surface must abide by applicable FDA regulations.

c. Accuracy and Reliability

The final design must span the full width and length of the bed, and contain a mechanism for attaching to the bottom of the mattress. The final design must contain a feature that allows for compact storage, but does not pose any risk for leakage of liquids onto the mattress. Additionally, this device should improve the working conditions for the students performing the procedural training.

d. Life in Service

The client wants the simulation training surface to be durable and to last for many years through numerous clinical simulations. The device is not expected to experience a large load, and therefore should not be subject to significant fatigue. The target life in service is 5 years.

e. Shelf Life:

When not in use, the training surface should be able to switch to a compact design that will be stored within the limited space of the procedural training room. The final design must be able to withstand room temperature conditions and must be able to stay in storage for the entirety of its life in service.

f. Operating Environment:

The training surface should be directly attached to the bed over the mattress, establishing a stable workstation in which different pediatric training models can be used. The training surface will have simulations that will expose it to liquids and exudates that resemble bodily fluids. The average person should be easily able to switch between the full-size and compact design while easily applying it to the surface.

g. Ergonomics

The surface must be able to fold and compact in a way that facilitates easy transport by a single person. This will involve the surface folding to a size that is not awkward to maneuver, as well as giving the individual moving the surface a clear and easy way to hold it.

h. Size

While unfolded, the surface must completely cover the top of a standard hospital bed mattress. Most hospitals use mattresses that are 36" wide and 80" long. When compact, the surface should be able to be stored easily in a confined space, likely a storage closet. [2]

i. Weight

The client has specified that the surface should weigh no more than 20 lbs in order to facilitate easy transportation.

j. Materials

The surface is intended to be used for a variety of medical simulations involving fake blood and other fluids. Taking this into consideration, the material should be relatively water-resistant and easy to clean and reuse over the course of its lifespan. The material should also be lightweight in order to comply with the 20 lb weight limit.

k. Aesthetics, Appearance, and Finish

This surface will be used in professional medical settings and should reflect that in its appearance. A neutral, static color would be best, especially one that easily contrasts with the simulation dummies and fluids that will be used on it.

2. **Production Characteristics**

a. Quantity:

The client expects one operating surface that transitions between a full table design and a compact stored design. In addition, the client is providing the bed to which our device will need to attach.

b. Target Product Cost:

The client has given $2000 to work with. These expenses will go toward the purchasing of materials for our prototype and final design. The finalized cost of the product will depend on the materials selected for the official design, and if the scope of our project shifts to max the operating service more intricate to facilitate procedural training that requires an electrical component.

3. **Miscellaneous**
    a. *Standards and Specifications*

When considering the expectation of the product, the client requested a procedural training workstation that can be mounted to the mattress. On the workstation, students will learn how to do suturing, line insertions, and airway management, specifically for pediatric care. Considering that the operating surface we are crafting will host training models and is purely used for educational purposes. It does not meet the following requirements to be considered a medical device per Section 201(h)(1) which states a medical device is:

> An instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory which is:
>
> - (A) recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,
> - (B) intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or
> - (C) intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of its primary intended purposes. The term "device" does not include software functions excluded pursuant to section 520(o). [3]

Due to this, our product will not have to adhere to medical device specifications designated by the FDA.

    b. *Customer*

The workstation must be reusable as it is intended for multiple training simulations over extended periods of time. It should be easy to transport and set up, as well as easy to store away after use. The station will be designed to maximize space by stationing directly over the hospital bed. It is crucial for the design to be both stable and easily sterilized to remove any adverse effects during each test simulation.

    c. *Patient-related concerns*

Training will be conducted using simulated fluids including fake blood and lubricants. Intensive sterilization such as the use of an autoclave will not be necessary for the design. Sanitization wipes and other regular cleaning materials will be satisfactory for cleaning and will be used between each simulation.

d. Competition

Per the client description of the project, the team is forced to create a training surface that will attach to the mattress of a bed to maximize space efficiency. Due to the novelty of this request, there is very little within the world of procedural training that meets the client's needs. However, the clients themselves have been trying alternative methods to accomplish these tasks.

The main method tried by the client was simple folding tables. These tables had a compact alternative design for storage and were cost-effective for limited budgets. However, the clients did not like them for multiple reasons. First and foremost, it was not stable enough for the procedural training they were conducting. In addition, even though the table did have a compact design, they believed it did not fully maximize their space.

In addition, there are workstations developed specifically for a medical space. For example, Capsa Healthcare has developed a wall-mounted workstation. This product has been actively used in patient rooms, medical and surgery departments, ICU, and many diverse healthcare environments. In addition to having flexible mounting arms and maximizing floor space, this design is ergonomic and assists in both patient and caretaker ease. However, this design fails in a few different ways. [4]

References

[1] “Vigour Med Store,” Vigour Med Store. Accessed: Sep. 17, 2026. [Online]. Available: https://vigourmedstore.com/products/laerdal-250-00250-infant-airway-management-trainer

[2] “What Is the Standard Size of a Hospital Bed Mattress?” Biology Insights, 8 Dec. 2025, https://biologyinsights.com/what-is-the-standard-size-of-a-hospital-bed-mattress/.

[3] Center for Devices and Radiological Health, “How to Determine If Your Product Is a Medical Device,” FDA, Dec. 2019, Accessed: Sep. 17, 2026. [Online]. Available: https://www.fda.gov/medical-devices/classify-your-medical-device/how-determine-if-your-product-medical-device

[4] “Wall Mounted Workstations Benefits | Capsa Healthcare,” Capsa Healthcare. Accessed: Sep. 17, 2026. [Online]. Available: https://www.capsahealthcare.com/blog/computer-workstations/wall-mounted-workstations-benefits-uses/