A MODEL FOR TEACHING THE MECHANICS OF DYNAMIC FLOW LIMITATION

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The Problem

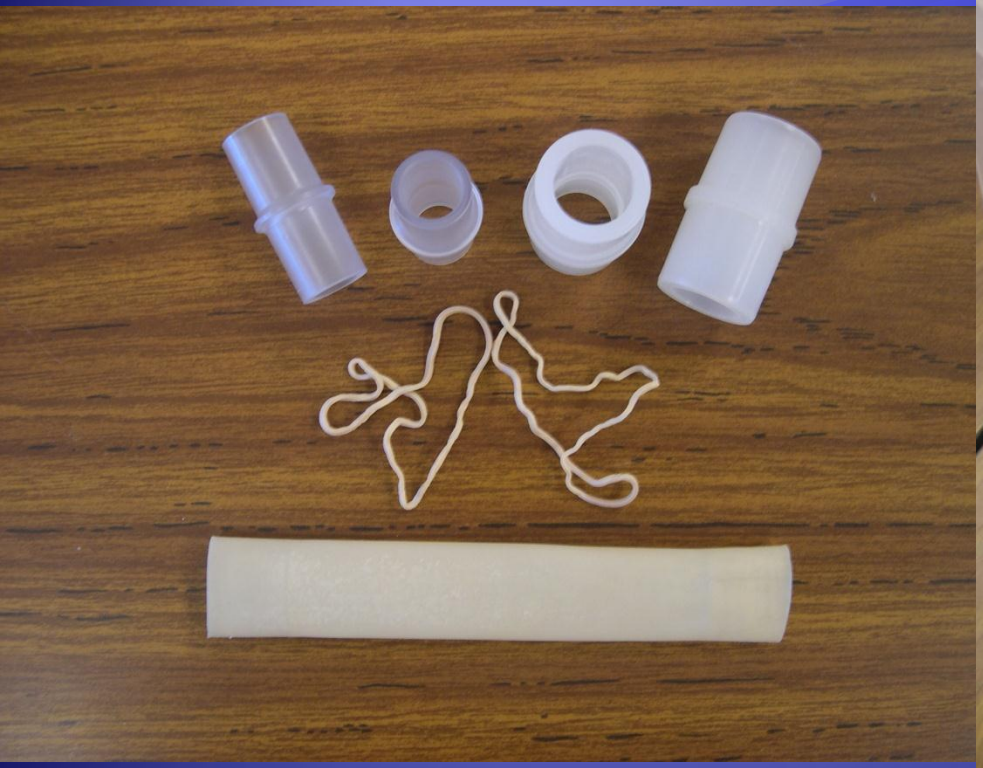
- Students sometimes have difficulty understanding or conceptualizing:
  - Air trapping and auto-peep (AP)
  - The theory of expiratory flow limitation in COPD patients
  - Why AP interferes with ventilator triggering
  - The idea that in patients with AP secondary to flow limitation; adding set PEEP may actually improve triggering

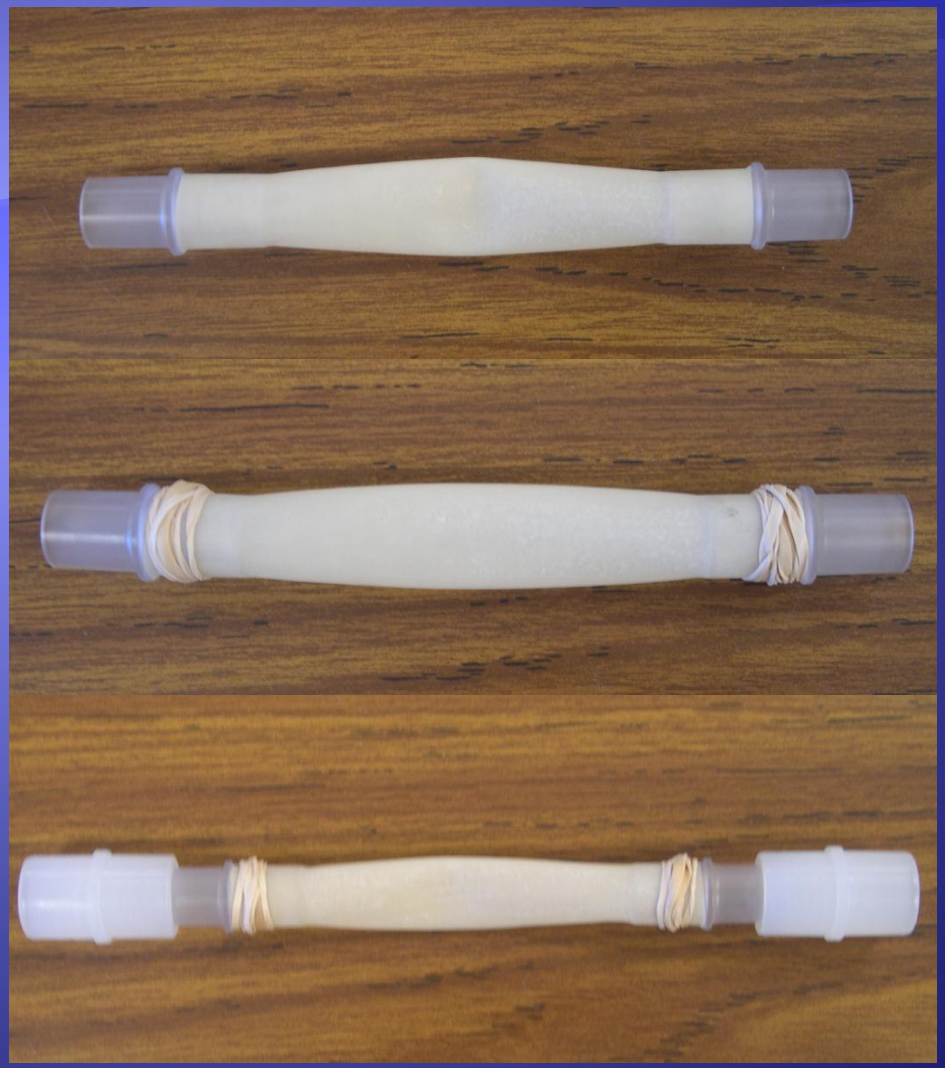
The Solution

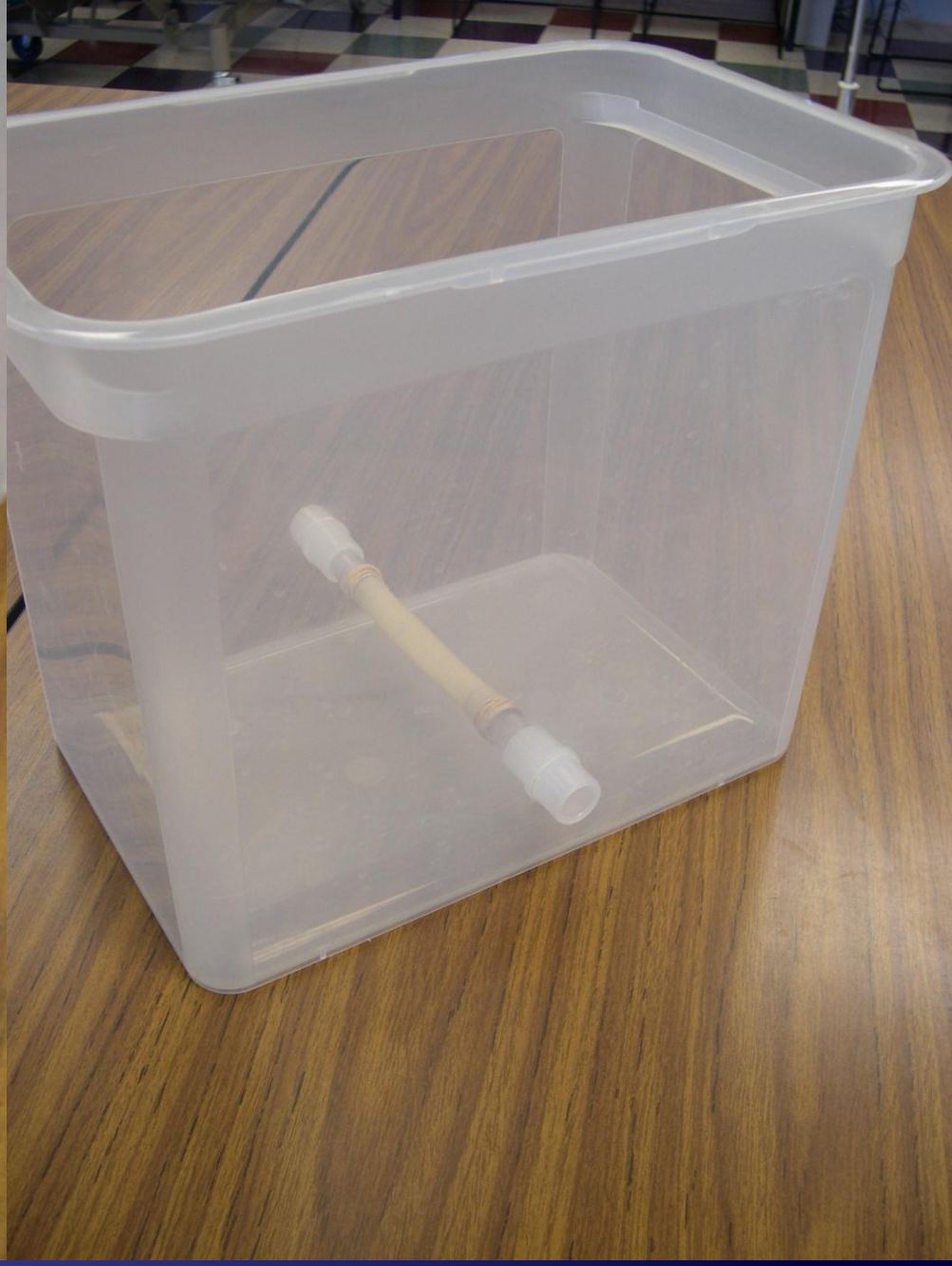
- Develop a simple model from ordinary respiratory and medical supplies that will functionally explain and simulate issues related to air trapping and auto-peep

The Model

- Plastic storage container (Sterilite Corporation, Townsend, MA)
- Two 15 I.D. x 22 O.D. mm adapters
- Two 12 I.D. x 15 O.D. mm adapters (Michigan Instruments, Grand Rapids, MI)
- One 15 mm Penrose drain
- 13/16" drill bit, aquarium sealant, rubber bands, and water





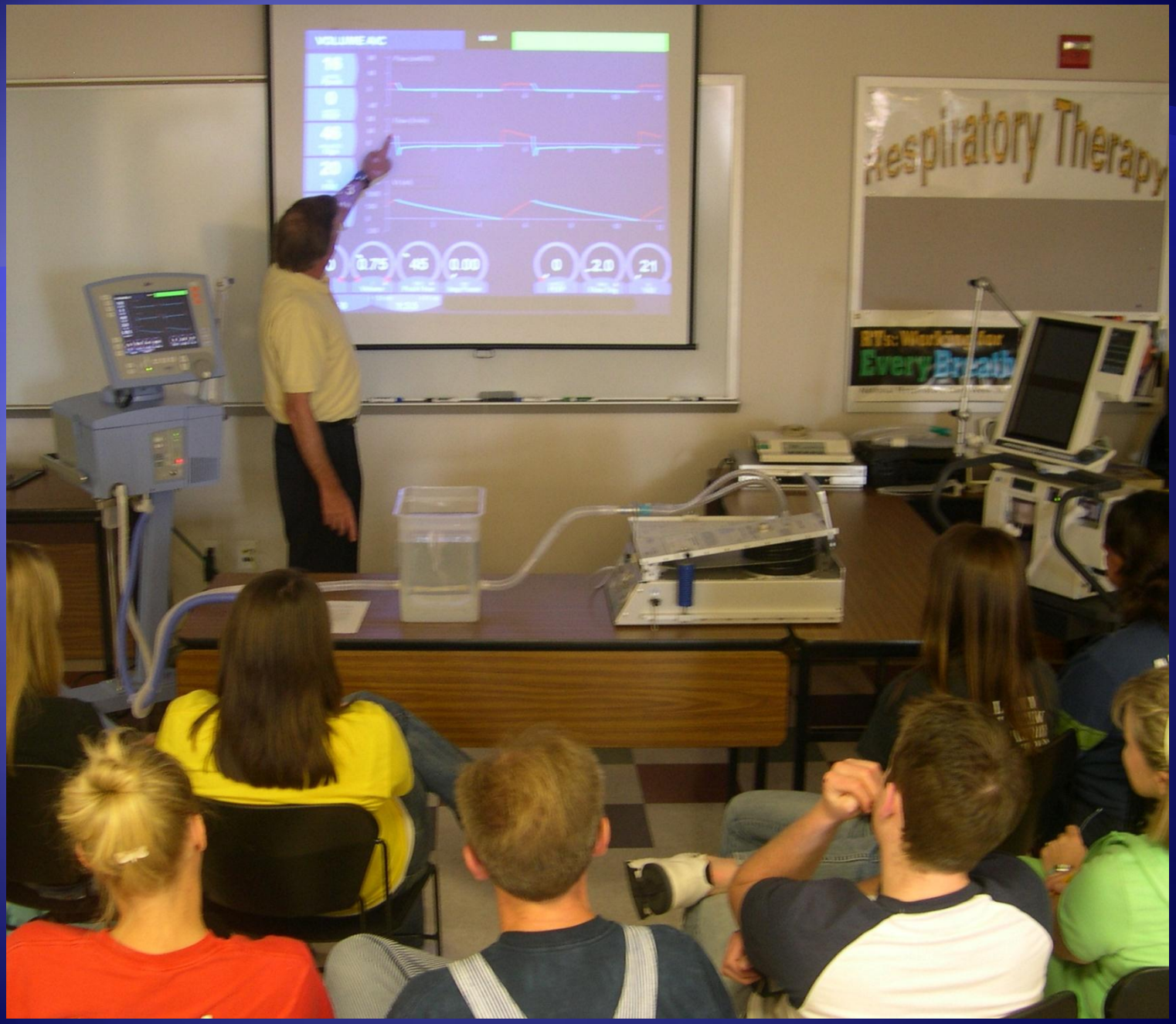


Helpful hints

- The holes in the side of the container should be 13/16”
- Insert the 22 mm adapter from the inside
- Be sure to use sealant on both the inside and outside of the container
- The water level determines the amount of air trapping. A nearly full container is recommended.

What the Model Simulates

- Air trapping due to expiratory airflow limitation
- The effect of auto-peep on a patient's ability to trigger the ventilator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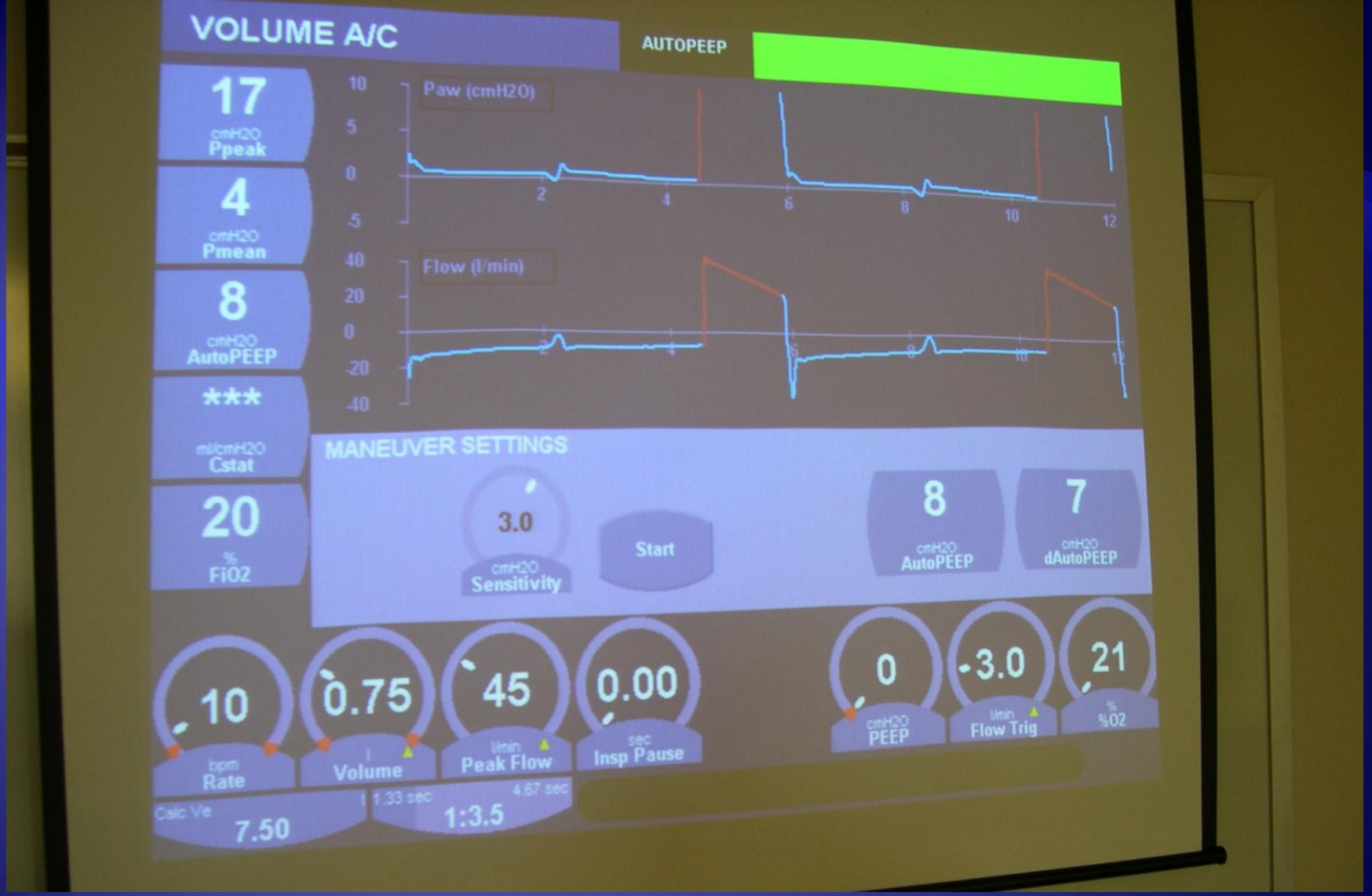
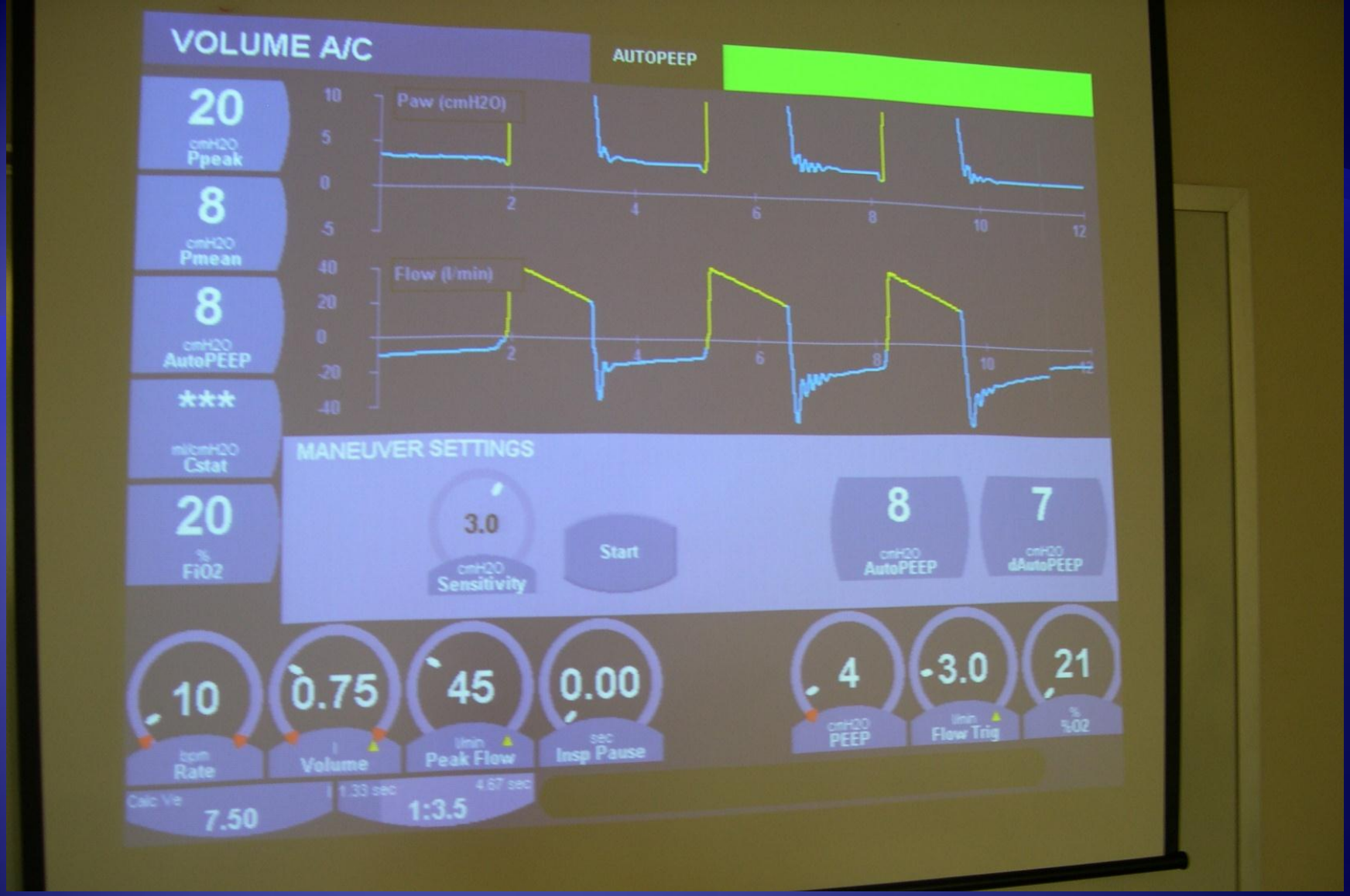
Respiratory Therapy

Airway at end-exhalation with zero set PEEP and total PEEP equal to 8 cmH_2O

Airway at peak inspiration

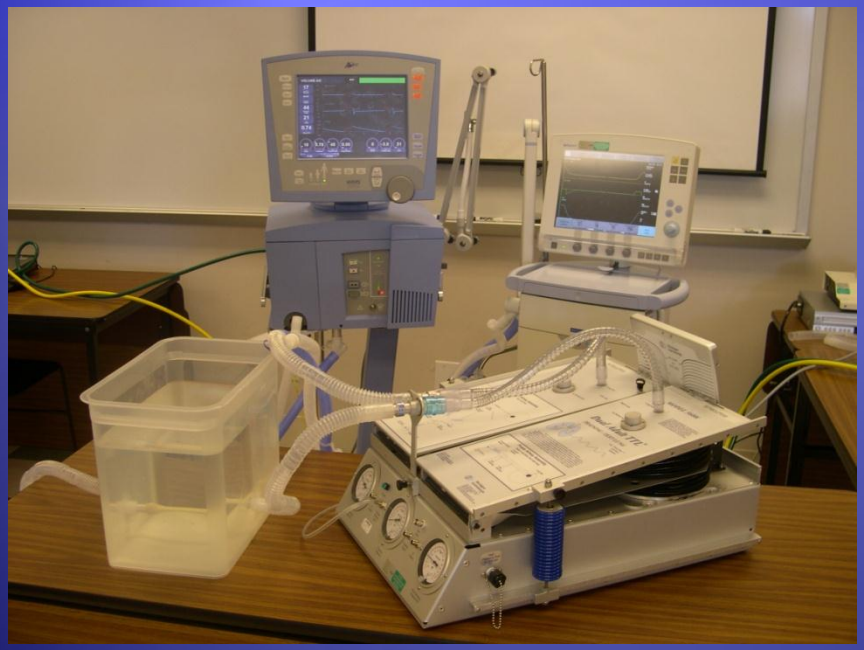


Graphics showing missed triggers secondary to air trapping and auto-peep

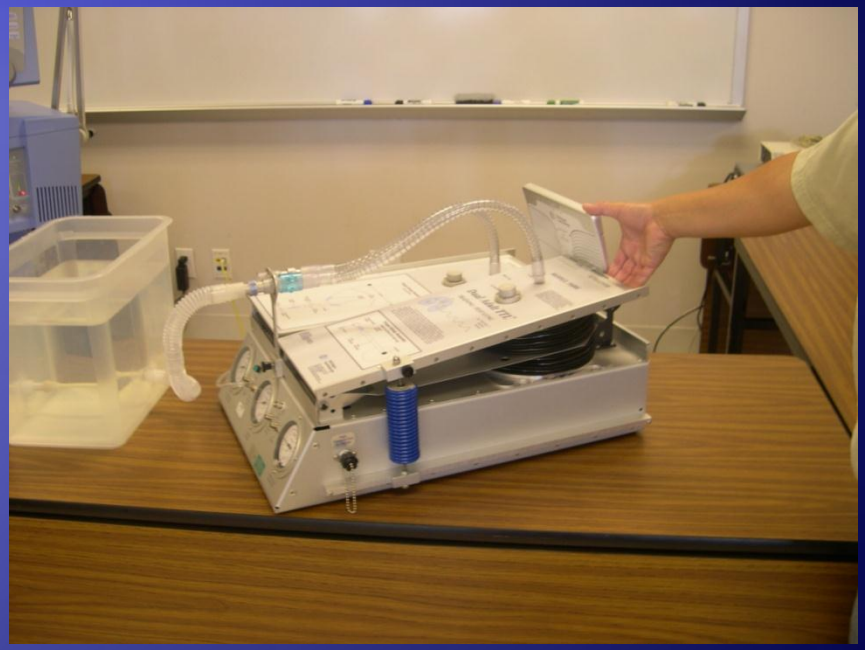


Graphics after application of set PEEP and reduction of auto-PEEP showing correction of missed triggers

Automatic triggering using second ventilator attached to driving chamber



Manual triggering



Conclusion

- Students respond positively to the airway model.
- Of 12 students, 8 strongly agreed and 4 agreed that the model enhanced their comprehension of air trapping and auto-peep (4.67 on a five point Likert scale)
- The model serves as a useful aid and is now a permanent fixture in our lab.