

Teaching Sterile Compounding in the Virtual World

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Objective

- ▲ The participant will discover how virtual reality can be used to teach cleanroom concepts to pharmacy students

Introduction to Purdue University College of Pharmacy

- ▲ Each class (P1 → P4) has ~160 students
- ▲ Current curriculum includes 2-credit hour Parenteral Products course
 - ❖ Spring semester of P3 year
 - ❖ Instruction on preparation of sterile IV admixtures
 - ❖ Emphasis on USP 797 regulations
 - ❖ IV room environment requirements, including proper attire

The Problem

- ▲ Cleanroom training of pharmacy students occurred mainly in classroom
- ▲ Four laboratory sessions to practice “hands-on” exercises
 - ❖ Five individual tabletop hoods
 - ❖ Only required to wear sterile gloves
- ▲ Only 2 hospitals in the West Lafayette, IN area with IV cleanrooms

The Problem

- ▲ Student feedback showed lack of comfort when performing appropriate IV procedures
- ▲ Many students never step foot in a cleanroom prior to APPE rotations
- ▲ Lack of physical space and funds to build a cleanroom on campus
- ▲ Cost to maintain a USP 797 compliant space as standards change

The Goal

- ▲ Develop an interactive environment that allows students to gain comfort and confidence with the layout and special procedures associated with an IV cleanroom
- ▲ Design cleanroom so that it would be adaptable for various scenarios and changing standards

The Solution

- ▲ Proposal for “Development of Virtual Reality USP 797 Compliant Clean Room”
 - ❖ \$70,000 educational innovation grant from Purdue University
- ▲ Partner with Envision Center for Data Perceptualization at Purdue to create a virtual cleanroom
 - ❖ Three computer technology students designed the layout over the course of a year after visiting multiple Indiana cleanrooms and merging aspects of each
 - ❖ Validated as USP 797 compliant by member of coordinating committee

The Technology

- ▲ Multi-wall immersive environment which works on wall sized panels as well as a portable display system
- ▲ Equipment involved:
 - ❖ 3-D glasses
 - ❖ Wireless controller for navigation
 - ❖ Head tracking device to adjust the view of the student



The Lab Session: Year 1

- ▲ Learning Objectives:
 - ❖ List the proper attire for the IV room.
 - ❖ Apply USP 797 standards for an IV room to evaluate a virtual IV room.
 - ❖ Evaluate a product preparation for accuracy.
 - ❖ Select the appropriate product for IV preparation.
 - ❖ Generate a recommendation for IV fluids based on the provided patient case information.

The Lab Session: Year 1

- ▲ Pre-assessment and proper attire
- ▲ Four stations
 - ❖ Product verification
 - ❖ Medication safety
 - ❖ Patient cases with drug information resources
 - ❖ Virtual cleanroom
- ▲ Post-assessment

The Lab Session: Year 1

Virtual Cleanroom Exercise

- ❖ Tour of the cleanroom
- ❖ Identification of various IV items
- ❖ Identification of inappropriate items within the cleanroom

Anteroom	Chemotherapy Room	Clean Room
Trissel's Handbook	Spill on Floor	Drink in Refrigerator
ADD-vantage Bags	Vancomycin Bottle in Hood	Overflowing Sharps Container
Linezolid Bottle	Cigarette in Hood	Cardboard Boxes
Large Volume IVF	Syringe Laying on Edge of Hood	Stock Bottle Blocking Syringe in Hood

The Lab Session: Year 1

Results

- ❖ 96% of students participated
 - ❖ 59% had no prior IV room experience
 - ❖ 88% agreed or strongly agreed that the lab met their expectations
- When resurveyed at end of the APPE experience, 92% of students that participated felt that the virtual environment was helpful to their understanding prior to the real experience

The Lab Session: Year 1

Feedback

- ❖ "...very hands-on and provided a realistic example of clean room standards and violations."
- ❖ "I got a great appreciation of what a clean room actually is. I think in a real clean room I would be overwhelmed with things and wouldn't appreciate them as much."
- ❖ "The 3-D technology is fun and... whenever you can get out of the classroom to learn is positive."

The Lab Session: Year 2

Learning Objectives:

- ❖ List the proper attire for the IV room.
- ❖ Apply USP 797 standards for an IV room to evaluate a virtual IV room.
- ❖ Evaluate a medication order for accuracy and safety.
- ❖ Select the appropriate product for IV preparation.
- ❖ Produce a final recommendation for the preparation and administration of an IV product that is safe and accurate, based on an assigned medication problem.

The Lab Session: Year 2

- ^ Pre-assessment and proper attire
- ^ One station
 - ❖ Virtual cleanroom
- ^ Post-assessment

Assigned Problems

Potassium chloride	Heparin
Gentamicin	Norepinephrine
Amiodarone	Diltiazem
Methylprednisolone	Insulin
Vinblastine	Cisatracurium

PURDUE UNIVERSITY The Lab Session: Year 2

^ Virtual Cleanroom Exercise

- ❖ Tour of cleanroom
- ❖ Identification of inappropriate items
- ❖ Explanation of assigned problem by student
 - Select the correct vial from the shelf
 - Discuss the appropriate diluent and infusion rate (if applicable)
 - Feedback regarding errors provided only after complete explanation

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^ Results:

Statement	Pre-Assessment	Post-Assessment
Medication errors can significantly impact patient outcomes	96% A/SA	96% A/SA
The likelihood of a skilled pharmacist making an error is low	57% D/SD	64% D/SD
My potential for making an error upon entering practice is low	73% D/SD	73% D/SD

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^ Results:

Statement	Pre-Assessment	Post-Assessment
I perceive medication errors to be more significant after completing this lab	N/A	75% A/SA
My experience in the virtual clean room has enhanced my understanding of clean room procedures	N/A	88% A/SA
The problem assigned for this lab reinforced my understanding of order processing within the clean room setting	N/A	90% A/SA

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^ Feedback

- ❖ "The virtual clean lab was a great experience, especially for students with little experience in the environment."
- ❖ "Fun lab. It gave me a lot of perspective of what a cleanroom is like."
- ❖ "Great exercise to have us interpret IV orders!"
- ❖ "I think this is a good experience, [I] saw what a cleanroom looks like and also how to avoid errors that could occur during IV preparation."

PURDUE UNIVERSITY The Virtual Cleanroom

^ Time for a tour!

- ❖ Anteroom
- ❖ Chemo prep room
- ❖ IV room
- ❖ What's wrong with this picture?
- ❖ IV product preparation assignment



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Anteroom



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Anteroom



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Chemo Room



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IV Room



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IV Room



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IV Room



What's Wrong?



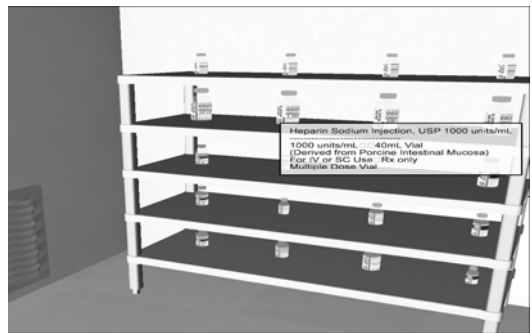
What's Wrong?



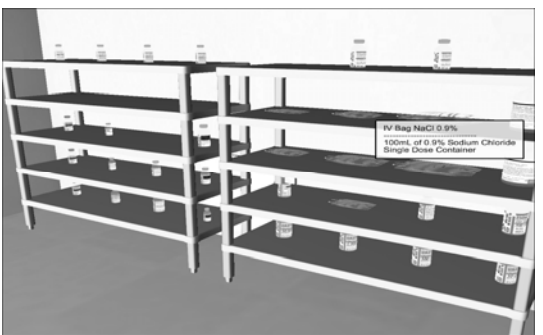
IV Product Selection



IV Product Selection



IV Product Selection



Future Plans

- ▲ Continue to incorporate virtual clean room into training of P3 students
- ▲ Session to be mandatory
- ▲ Enhance programming for use with interactive glove

Conclusion

- ⤴ Unique solution developed for a complex problem
- ⤴ Allowed students to gain hands-on training in a virtual environment modeled from actual cleanrooms throughout Indiana
 - ❖ Majority of students felt their confidence with and understanding of IV cleanrooms had improved as a result
- ⤴ Progressive and effective way to provide an introduction to an IV cleanroom and its common components, aseptic procedures, USP 797 requirements, and medication safety

Assessment Question

- ⤴ True or False. The design for the virtual clean room was created from the imagination of the computer technology students.

Assessment Question

- ⤴ The virtual cleanroom has been used to illustrate which of the following points:
 - a. USP 797 compliance
 - b. Medication errors
 - c. Common items found within an IV preparation environment
 - d. All of the above

Assessment Question

- ⤴ True or False: The majority of P3 students at Purdue University's College of Pharmacy that attended, felt that the virtual cleanroom enhanced their understanding of cleanroom procedures.

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