# Is Virtual Reality a Valid Teaching Model for Neonatal Procedures?

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SCAN ME

## INTRODUCTION

- Neonatal procedures are **high risk events that occur infrequently.**
- Umbilical venous catheterization (UVC) is an emergent procedure to catheterize a newborn baby using the umbilical vein (Figure 1).
- **Virtual reality (VR) simulations can be used by providers to practice technical skills without risking patient safety.**
- We have **developed a prototype for teaching the (UVC) procedure in a virtual environment** to allow practitioners to repeatedly practice the UVC procedure at their own pace and when needed.

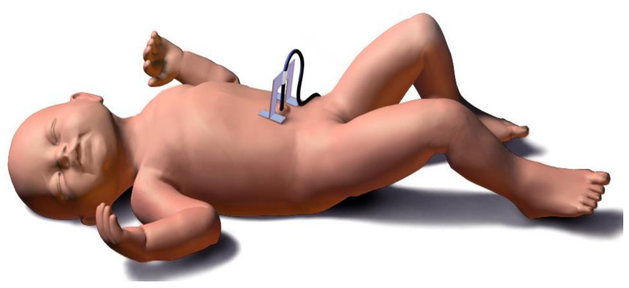


***Figure 1.*** *Completed UVC procedure*

## OUTCOMES

1. Developed a curriculum to teach low lying umbilical venous catheter placement in VR.
2. Created a tutorial mode that teaches users the VR interactions needed to complete the walkthrough.
3. Create a walkthrough mode that teaches users the procedure step-by-step.
4. Assessed the realism and potential efficacy of the simulator with experts

## METHODS

- A **cross-disciplinary team** of engineers and neonatologists developed the simulator following **a participatory design approach** (Figure 2).
- **Unity was used to develop the software** and Unity's XR interaction toolkit was used to implement interactions (Figure 3) in the head mounted display (HMD).
- The **"Step System"** was developed in Unity to structure the steps of the procedure to deliver instructions (Figure 4).
- The software was **deployed to the Meta Quest 2 HMD.**
- **Initial simulation testing occurred with seven NNPs (Group 1).** An **additional seven NNPs were recruited** for testing (Group 2) **after feedback from Group 1 was incorporated.**

## METHOD CONT.

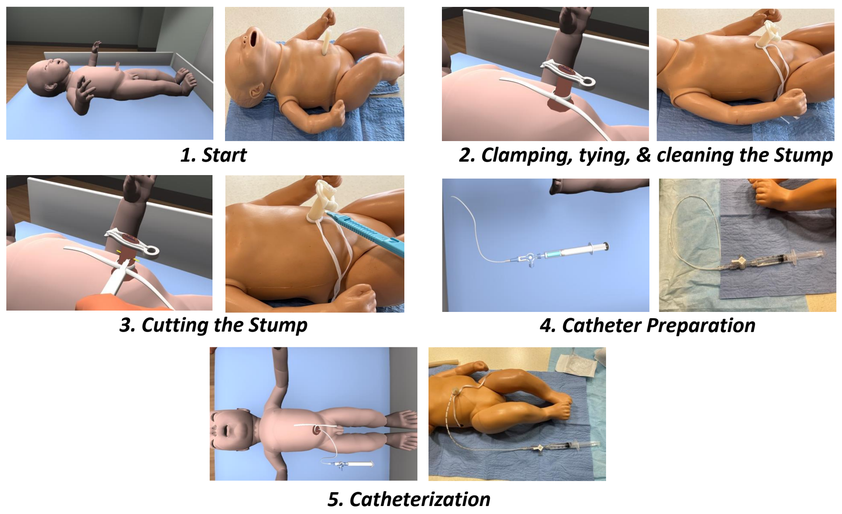



***Figure 2.*** *Implemented steps*

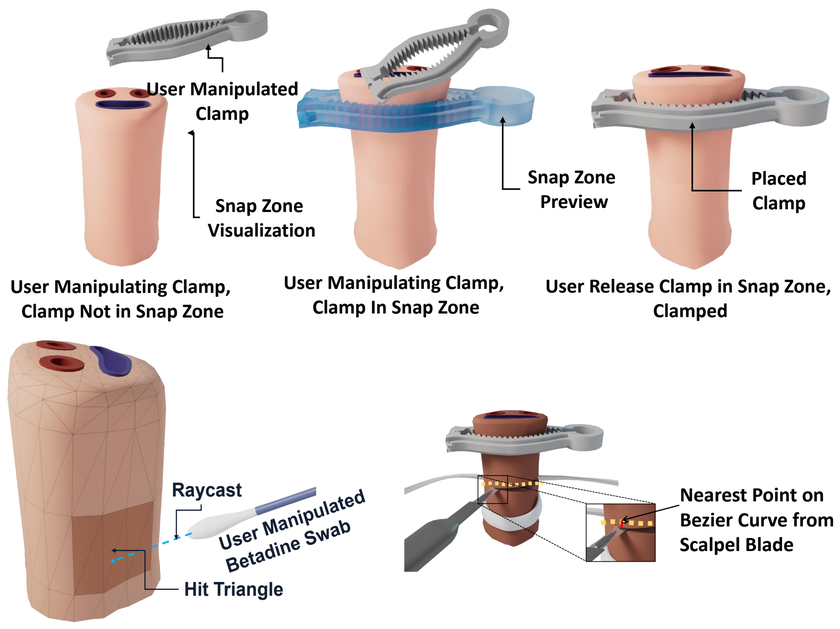



***Figure 3.*** *Virtual interactions*

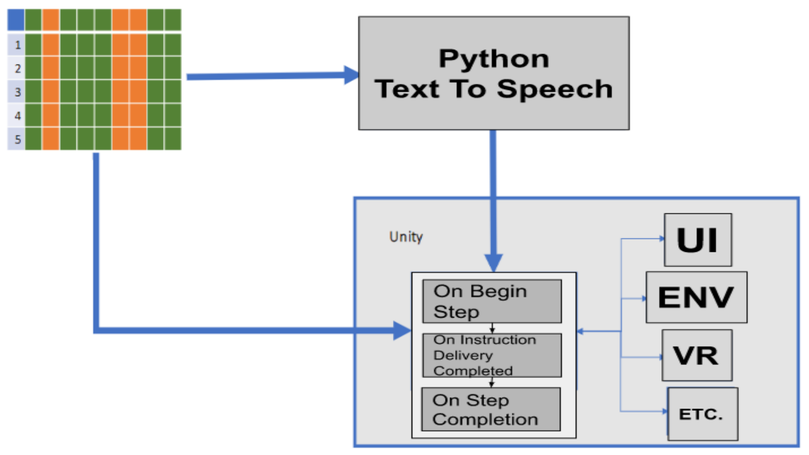



***Figure 4.*** *Software architecture*

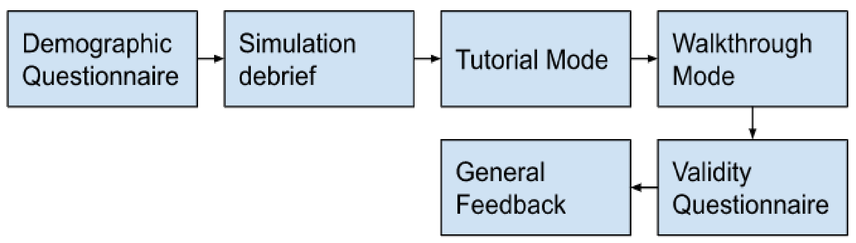


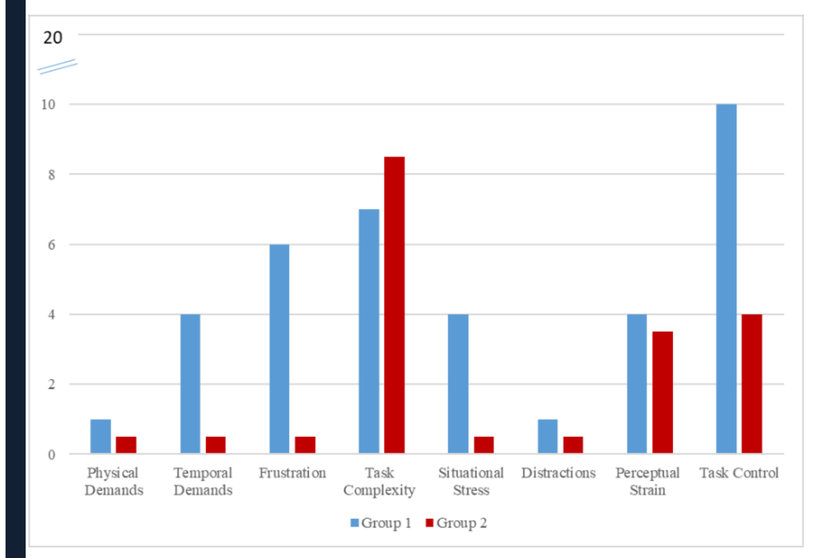

***Figure 5.*** *Data collection protocol*

## RESULTS

### *Demographics:*

| | Total | Group 1 | Group 2 |
|---|---|---|---|
| **Gender** | | | |
| Male | 1 | 0 | 1 |
| Female | 13 | 7 | 6 |
| **Age (years), mean (range)** | 45 (33-67) | 48 (35-65) | 42 (33-67) |
| **Years of experience, mean (range)** | 12 (2-37) | 13 (3-28) | 12 (2-37) |
| **UVC proficiency** | | | |
| Novice | 0 | 0 | 0 |
| Beginner | 0 | 0 | 0 |
| Proficient | 0 | 0 | 0 |
| Expert | 14 | 7 | 7 |
| **VR proficiency** | | | |
| Novice | 12 | 6 | 6 |
| Beginner | 2 | 1 | 1 |
| Proficient | 0 | 0 | 0 |
| Expert | 0 | 0 | 0 |

### *SIM-TLX:*




### *Content & Face Validity:*

| Statement | Group 1 Median, (Range) | Group 2 Median, (Range) |
|---|---|---|
| **The baby model is realistic** | 5, (4-5) | 4, (4-5) |
| **The patient preparation for UVC is realistic** | 4, (2-5) | 4, (2-5) |
| **The UVC tools are realistic** | 3, (2-4) | 4, (3-5) |
| **The instructions are very clear** | 4, (4-5) | 4, (4-5) |
| **The environment is realistic** | 4, (3-5) | 4, (3-5) |
| **The simulation was effective in teaching umbilical cord anatomical landmarks** | 3, (2-4) | 4, (3-5) |
| **The simulation was effective in teaching patient preparation** | 4, (3-5) | 4, (3-5) |
| **The simulation was effective in teaching catheter preparation** | 3, (2-5) | 4, (2-5) |
| **The simulation was effective in teaching UVC placement** | 3, (2-4) | 4, (3-4) |
| **The simulation was effective in simulating the environment** | 4, (3-5) | 5, (3-5) |
| **Overall teaching utility** | 4, (3-5) | 4, (3-4) |

### *System Usability (AVG ± STD):*

- ***Group 1: 67.14 ±7.8***
- ***Group 2: 71.02 ±14.1***
- ***Marked improvement between groups***

## CONCLUSIONS

After optimization, **Group 2 found the UVC simulator to be realistic and effective**. Both groups felt the **simulator was easy to use and did not cause physical or cognitive strain.** All participants felt the UVC simulator **provided a safe environment to make mistakes**, and the **majority would recommend this experience to trainees**. Our framework allowed for **rapid incorporation of feedback from Group 1 which led to a marked improvement in the feedback from Group 2.**

***Future Work:***

- Conduct transfer validity study with novices.
- Develop VR modules for other neonatal procedures.
- Explore other Extended Reality (XR) technologies to understand the best method for educational delivery.

jump ARCHES | ILLINOIS Health Care Engineering Systems Center, GRAINGER COLLEGE OF ENGINEERING | OSF HEALTHCARE

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