

Virtual Reality Simulation Training for Surgical Procedures and Back Table Set Up for Nursing and Scrub Technician Students: Innovations in Education

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Disclosure

- **Dr. David Rovinsky is employed in part by Smith & Nephew who have supplied the training VR headsets and the platform OSSO VR©**

Agenda

1. Introduction



4. Operator Experience

2. Objectives



5. Data Analysis

3. Methods



6. Discussion



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Introduction

Introduction

How do scrub technicians/nurses *CURRENTLY* train?

- Observing a senior scrub tech or nurse in operating room (OR)
- Then, supervised practice until proficient

Drawbacks

- Lack of consensus
- Lack of standardized training regimens

**Is there a
solution?**



VIRTUAL REALITY?!.....how?

- **Offers a dynamic and interactive learning environment that can replicate the OR setting**
 - realistic, low-stress environment!
- **Provide repetitive practice without risk to patients or waste of resources**
- **Potentially serve as a quick refresher before surgery**
- **Standardized method for teaching scrub techs/nurses a new procedure for the first time**

Introduction - Previous Research

- **Blumstein et al. (2020)**
 - Showed that VR training is an effective modality for teaching complex surgical procedures such as tibial shaft fracture intramedullary nailing
- **Seymour, et al (2002)**
 - Use of VR significantly improved OR performance of residents
- **Ahlberg, et al. (2011)**
 - Showed that surgical residents who underwent VR training were significantly less likely to commit technical errors
- **Araujo et al. (2014)**
 - Single short-duration VR simulator practice positively impacted surgeons' generic and specific skills performance

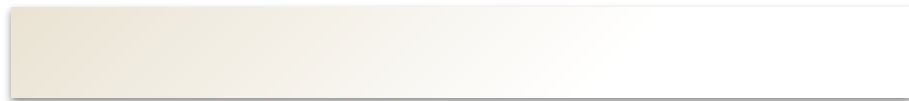
However,

- Limited research into the efficacy of educational VR training for surgical scrub techs/nurses
- Limited research in VR training for orthopedic procedures



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Objectives



Objectives

1. To evaluate the effectiveness of the OSSO VR CORI TKA training program in teaching nursing students the skills necessary for TKA procedures

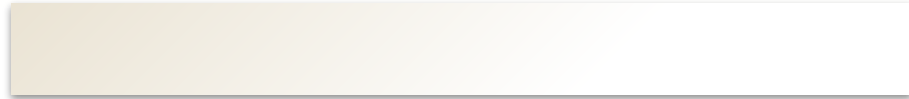
2. To assess the acceptance and perceived value of the VR training program among nursing students

3. To compare the performance and confidence levels of students who undergo VR training with those who receive traditional training methods



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Methods



Methods

- **Study Design:**
 - Randomized, controlled, single-blinded study
 - Nursing students from the University of Hawaii system will be randomly assigned to either the VR training group or the control group receiving traditional training
- **Participants:**
 - **Inclusion Criteria:**
 - Nursing students enrolled in the University of Hawaii system
 - Completion of foundational coursework in surgical nursing
 - Provision of informed consent to participate
 - **Exclusion Criteria:**
 - Prior experience in TKA procedures.
 - Conditions contraindicating VR use (e.g., severe motion sickness)
- **Sample Size:**
 - 20 participants will be recruited, with 10 students in the VR training group and 30 in the control group
- **Intervention:**
 - **VR Training Group:** Students will use the Osso VR CORI TKA training program for a total of 10 hours over two weeks
 - **Control Group:** Students will receive traditional training methods, including lectures, textbooks, and hands-on practice with models, for the same duration



04 Operator Experience

OSSO^{VR}









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Data Analysis

Data Analysis

- **Data Collection:**
 - Pre- and post-training tests will be administered to both groups to measure changes in knowledge and skills
 - Performance in TKA procedures will be evaluated by experienced surgical instructors using a standardized rubric.
 - The acceptance questionnaire will be administered to the VR training group after the intervention
- **Analysis:**
 - Data will be analyzed using appropriate statistical methods to compare pre- and post-training scores within and between groups. The level of significance will be set at $p < 0.05$.

Pre- and Post-Training Knowledge Tests

Pre-Training Knowledge Test:

Participant ID: _____

Date: _____

Instructions: Please answer the following questions to the best of your ability. This test is to assess your current knowledge of Total Knee Arthroplasty (TKA) procedures.

1. What are the primary components of a total knee arthroplasty prosthesis?
 - o a) Femoral component, tibial component, and patellar component
 - o b) Humeral component, ulnar component, and radial component
 - o c) Femoral component, fibular component, and tibial component
 - o d) Humeral component, radial component, and patellar component
2. Describe the steps involved in preparing a knee for TKA surgery.
3. What are common complications associated with TKA?
4. What are the indications for performing a TKA?
5. Explain the importance of proper alignment during TKA.

Participant Initials: _____

Date: _____

Post-Training Knowledge Test:

Participant ID: _____

Date: _____

Instructions: Please answer the following questions to the best of your ability. This test is to assess your knowledge of Total Knee Arthroplasty (TKA) procedures after completing the VR training program.

1. What are the primary components of a total knee arthroplasty prosthesis?
 - o a) Femoral component, tibial component, and patellar component
 - o b) Humeral component, ulnar component, and radial component
 - o c) Femoral component, fibular component, and tibial component
 - o d) Humeral component, radial component, and patellar component
2. Describe the steps involved in preparing a knee for TKA surgery.
3. What are common complications associated with TKA?
4. What are the indications for performing a TKA?
5. Explain the importance of proper alignment during TKA.

Participant Initials: _____

Date: _____

Skills Assessment Checklists

Skills Assessment Checklist for Total Knee Arthroplasty (TKA) Procedure

Participant ID: _____

Date: _____

Instructions: Please use the following checklist to evaluate the participant's skills in performing the TKA procedure. Rate each item on a scale of 1 to 5, where 1 = Needs Improvement and 5 = Excellent.

Preparation and Setup:

1. Identifies and prepares surgical instruments
 - 1 2 3 4 5
2. Demonstrates proper aseptic technique
 - 1 2 3 4 5
3. Prepares the knee for surgery
 - 1 2 3 4 5

Procedure Execution:

4. Makes accurate incision and exposes the knee joint
 - 1 2 3 4 5
5. Properly aligns and secures the prosthetic components
 - 1 2 3 4 5
6. Demonstrates proficiency in using surgical instruments
 - 1 2 3 4 5

Post-Operative Management:

7. Closes the wound correctly
 - 1 2 3 4 5
8. Provides appropriate post-operative care instructions
 - 1 2 3 4 5

Overall Performance:

9. Completes the procedure efficiently
 - 1 2 3 4 5
10. Demonstrates confidence and competence
 - 1 2 3 4 5

Evaluator Name: _____

Evaluator Signature: _____

Skills Assessment Checklist for Total Knee Arthroplasty (TKA) Procedure

Participant ID: _____

Date: _____

Performance Evaluation Rubric

Performance Evaluation Rubric for Total Knee Arthroplasty (TKA) Procedure

Participant Name: _____

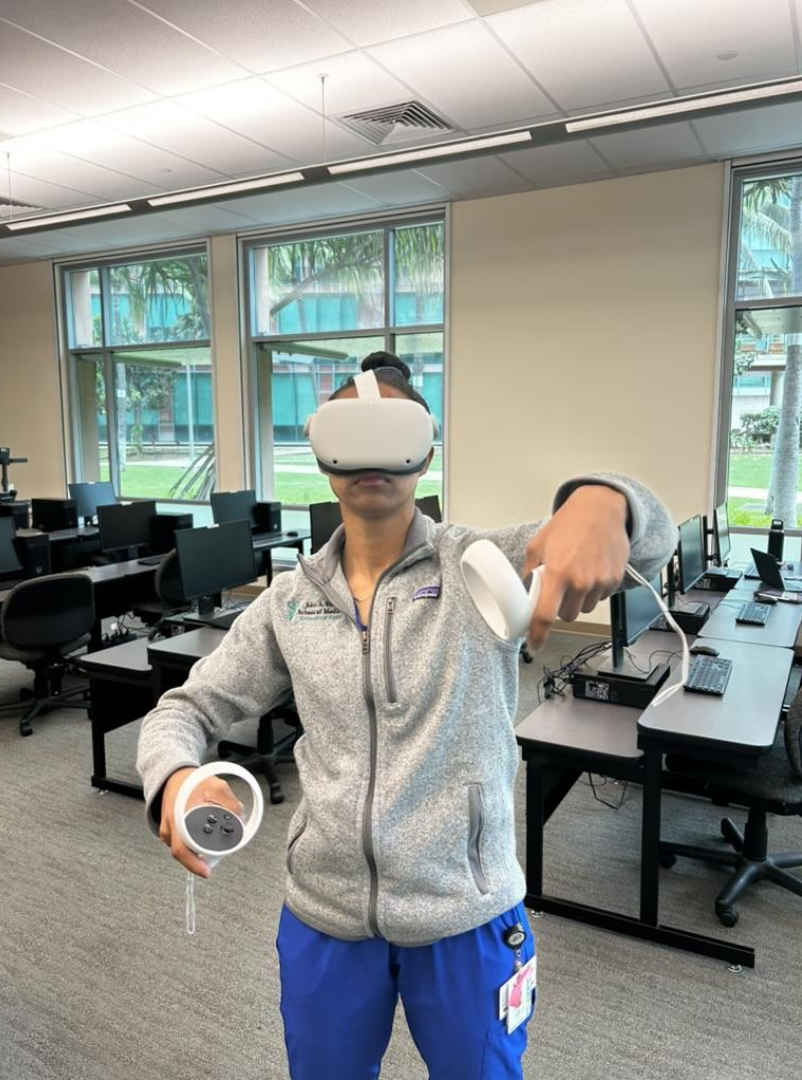
Date: _____

Instructions: Please use the following rubric to evaluate the participant's performance in the TKA procedure. Each category should be rated on a scale of 1 to 10, with specific criteria defined for each score.

1. Time and Motion:
 - 1-3: Many unnecessary moves
 - 4-6: Efficient time/motion but some unnecessary moves
 - 7-10: Economy of movement and maximum efficiency
2. Instrument Handling:
 - 1-3: Repeatedly makes tentative or awkward moves with instruments
 - 4-6: Competent use of instruments although occasionally appeared stiff or awkward
 - 7-10: Fluid moves with instruments and no awkwardness
3. Knowledge of Instruments:
 - 1-3: Frequently reached for the wrong instrument or used an inappropriate instrument
 - 4-6: Knew the names of most instruments and used appropriate instrument for the task
 - 7-10: Obviously familiar with the instruments required and their names
4. Flow of Operation and Forward Planning:
 - 1-3: Frequently stopped operating or hesitant in next task or subtask
 - 4-6: Demonstrated ability for forward planning with steady progression of operative procedure
 - 7-10: Obviously planned course of operation with effortless flow from one move to the next
5. Knowledge of Specific Procedure:
 - 1-3: Deficient knowledge. Needed specific instruction at most operative steps
 - 4-6: Knew all important aspects of the operation
 - 7-10: Demonstrated familiarity with all aspects of the operation

Evaluator Name: _____

Evaluator Signature: _____



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Discussion

Discussion

If our study demonstrates the potential benefits of VR training, it will hopefully...

- **Encourage broader adoption of VR in surgical education**
- Enhance training efficacy for scrub techs, nurses, and eventually all involved personnel
 - Through a fun, simple, and low-pressure environment
- Improve subject preparedness and confidence
- Increase overall patient safety, surgical efficiency, and surgical outcomes
- **Provide opportunity for subjects to undergo not only back table setup, but also the surgical procedure**
 - Something they would not be able to do in reality
 - Provides insight into the procedure itself
 - Further fosters a cohesive and collaborative working environment

Pave the way for implementation of advanced technology and standardization of training for OR personnel

A large step forward from the “see one, do one, and teach one” approach that is currently in practice

References

- Seymour NE. VR to OR: a review of the evidence that virtual reality simulation improves operating room performance. *World J Surg.* 2008;32(2):182–188. doi:10.1007/s00268-007-9307-9 [PubMed:18060453]
- Araujo SE, Delaney CP, Seid VE, et al. Short-duration virtual reality simulation training positively impacts performance during laparoscopic colectomy in animal model: results of a single-blinded randomized trial : VR warm-up for laparoscopic colectomy. *Surg Endosc.* 2014;28(9):2547–2554. doi:10.1007/s00464-014-3500-3 [PubMed: 24619335]
- Ahlberg G, Enochsson L, Gallagher AG, et al. Proficiency-based virtual reality training significantly reduces the error rate for residents during their first 10 laparoscopic cholecystectomies. *Am J Surg.* 2007;193(6):797–804. doi:10.1016/j.amjsurg.2006.06.050 [PubMed: 17512301]
- Blumstein G, Zukotynski B, Cevallos N, et al. Randomized trial of a virtual reality tool to teach surgical technique for tibial shaft fracture intramedullary nailing. *Journal of Surgical Education.* 2020;77(4):969-977. doi:10.1016/j.jsurg.2020.01.002

Thank you for listening!

Any questions or advice?

