Validation Design of a Computer-Based Simulation for Scrub Role Competency

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INTRODUCTION

- Over 310 million surgeries occur worldwide each year; 40–50 million in the U.S.
- The scrub role is critical for patient safety, requiring technical, cognitive, and anticipatory skills.
- Traditional apprenticeship-style training limits opportunities for standardized, deliberate practice.
- Computer-based simulation (CBS), including screen-based and virtual reality (VR) modalities, offers safe, repeatable, and scalable training.
- Evidence shows CBS improves scrub role knowledge and performance, yet few studies examine validation, long-term skill retention, or clinical transferability
- **Problem**: Current CBS tools lack validation and role-specific assessment measures, especially in military settings where limited surgical exposure challenges skill sustainment and readiness.

RESEARCH QUESTION

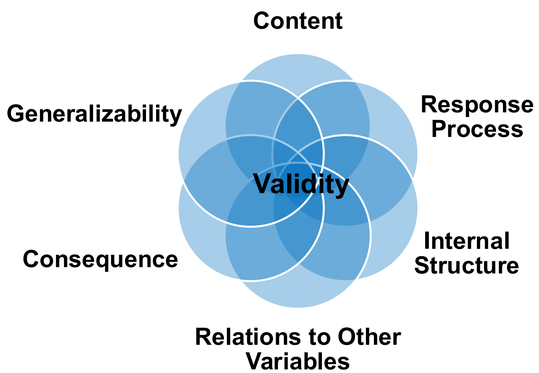
To what extent does the PeriopSim Hemicolectomy module demonstrate content validity, reliability, and usability for scrub role training?

CONCEPTUAL FRAMEWORK

- Guided by **Messick's contemporary validity framework**, a comprehensive model for evaluating the accuracy and meaning of educational assessments
- Integrates classical validity concepts (concept, construct, and criterion-related validity) into a single framework of six interrelated evidence sources:
  - **Content:** Alignment of module tasks and scoring with the target competencies
  - **Response process:** Examinee and rater behavior alignment with intended measurement and scoring
  - **Internal structure:** Consistency and coherence of scores according to expected relationships
  - **Relations to other variables:** Expected correlations with similar measures and not with unrelated or conceptually distinct variables
  - **Consequence:** Intended and unintended outcomes of score use
  - **Generalizability:** Extent to which results transfer across groups and contexts

DESIGN

- Validation study applied Messick's framework to evaluate the PeriopSim Hemicolectomy module for scrub role competency
- Module selected for relevance to trauma surgery and perioperative readiness



METHODOLOGY

- **Phase 1: Instrument Development**
  - Refined and validated the "Scrub Role Simulator: Content Validity and Usability" (SRS-CVU) instrument using a Delphi method
  - Calculated content validity ratios (CVR) and content validity index (CVI) with expert panel ratings
- **Phase 2: Content Validity**
  - Second expert panel evaluated module content validity using SRS-CVU
  - Calculated intraclass correlation coefficients (ICC) per item after module completion and overall CVI
- **Phase 3: Reliability and Performance**
  - Military perioperative nurses and surgical technologists completed the module three times separated by one week
  - Calculated ICCs for performance consistency
  - Analyzed differences by role and self-reported competency using t-tests and ANOVA
- **Phase 4: Usability**
  - Assessed end-user perceptions with the System Usability Scale (SUS) and qualitative feedback
  - Calculated agreement using ICCs
  - Evaluated relationships with prior CBS exposure using Spearman's rank correlation

VALIDITY EVIDENCE BY AIM

	Aim 1	Aim 2	Aim 3	Aim 4
Content	✓	✓	-	-
Response process	✓	✓	✓	✓
Internal structure	✓	✓	✓	✓
Relations to other variables	-	-	✓	✓
Consequence	-	-	-	-
Generalizability	✓	✓	✓	✓

DISCUSSION

Challenges
- Balanced participant recruitment and scheduling within military duties and clinical workload
- Sustained participant engagement across multiple study activities

Limitations
- Findings of Aim 3 & 4 reflected a homogenous sample of active-duty perioperative nurses and surgical technologists, limiting generalizability
- Evaluated only the Hemicolectomy module on computer and tablets; results may not extend to other modules or VR platforms

Strengths
- First perioperative and military nursing study to evaluate CBS validity, reliability, and usability for scrub role training
- Resulted in development and validation of a novel instrument (SRS-CVU) to evaluate content validity and usability of scrub role CBS
- Grounded in Messick's contemporary validity framework, ensured comprehensive psychometric assessment
- Included both independent nurse and surgical technologist participants, enhancing generalizability and operational realism

PERIOPERATIVE NURSING IMPLICATIONS

- Validated CBS platforms provide standardized, repeatable training essential for scrub role competency and patient safety
- Validated SRS-CVU establishes a method for evaluating content validity and usability across scrub specific simulation software and platforms
- Establishes evidence for CBS addresses critical gaps, supports AORN guidelines for competency verification, and strengths both civilian and military perioperative practice

Scan for electronic poster and references

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