A Model for Evaluating Healthcare Simulation Systems

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Introduction

- Laboratory for Investigation, Validation, and Verification of Emerging Simulators
  - LIVES Lab
LIVES Lab: Mission

- To establish a functional model to evaluate healthcare simulation systems based on sound scientific principles, national and international standards, and industry-established best practices.
- To inform the greater medical community of the effectiveness, ease of use, consumer satisfaction, reliability, validity, and durability of medical simulators and simulations.
LIVES Lab: Stakeholders

- Established by: National Center for Collaboration in Medical Modeling & Simulation (NCCMMS)

- NCCMMS is a joint venture
  - Eastern Virginia Medical School (EVMS)
  - Old Dominion University’s Virginia Modeling, Analysis, and Simulation Center (VMASC)
The LIVES Lab Team

Multidisciplinary:
- clinical medicine and nursing,
- professional graduate medical and healthcare education,
- bioengineering,
- human factors psychology,
- computer science,
- modeling, simulation, and visualization,
- and others.
One goal: Apply Human Factors assessment methods to medical and healthcare training simulators and simulations.

Assessment process comparable to that used for medical devices intended for direct patient use.

Methods include:
- Rigorous experimental design
- Test cases
- Validated questionnaires
- Performance metrics
- Established standards and guidelines
LIVES Lab: Standards

- **ANSI/AAMI HE75**
  - HF Engineering: Design of medical devices
- **ANSI/HFES 200**
  - HF Engineering of software user interfaces
- **ANSI/AAMI/IEC 62366**
  - Application of usability engineering to medical devices
- **ISO/IEC 25010**
  - Systems and software quality evaluation
- Among others...
LIVES Lab: Current Work

- Assess current healthcare simulators that exist on the marketplace
- Define an evaluation process based on current standards (e.g., the ISO25010)
The evaluation process:
- Addresses the purpose and requirements of the simulator
- Establishes a quality model
- Employs hierarchical/cognitive task analyses (HTAs & CTAs)
  - For the training task
  - For the simuland task
- Includes Subject-Matter Expert (SME) interviews
- Addresses best clinical practices
- Includes user testing
LIVES Lab: Current Work

- Initial evaluation: Virtual I.V. Self-Directed Learning System
- Two goals:
  - To test the established evaluation process
  - To deliver a comprehensive report to potential users and consumers of the system that may inform purchasing decisions and system usage
Established Quality Model

- System purpose
- User population
- SME population
- Functionality
- Reliability
- Usability
- Efficiency
- Maintainability
- Portability
Usability tests:
- HTA/CTA
- Standards checklists
- SME interviews
- User testing
  - Questionnaires
  - Performance metrics
  - Unstructured user interviews
Initial Results:

- Interface easy to use, but some problem areas (e.g., icon design) identified
- Follows most standards, but falls short on fault tolerance and customizability
- SMEs and users agreed on the usefulness of the system, but noted some problems (irreversible errors, lack of flexibility, poor representation of psychomotor tasks)
- May properly train procedural skills, but not social or psychomotor skills
Process Evaluation

- The evaluation demonstrated the utility of the established process
- Areas of improvement were identified and addressed
- Established working procedures among members of the multidisciplinary team
- First step to establishing a body of simulation/simulator evaluations
LIVES Lab is a new entity that will work to inform the greater user community of healthcare and medical simulators and simulations.

LIVES will apply scientifically sound testing procedures derived from established industry standards with a multidisciplinary approach.

LIVES is an independent entity that does not produce competing products for the medical simulation market.
Questions?

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