Virtual/Augmented Reality for Health Professions Education Symposium

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Jone Tiffany, DNP, RN, CNE, CHSE, ANEF – Professor of Nursing, Bethel University
Margaret Verkuyl, NP-PHC MN – Nursing Professor, Centennial College

ANCC

Continuing Nursing Education

International Nursing Association for Clinical Simulation & Learning is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation

DISCLOSURES

- **Conflict of Interest**

- Michelle Aebersold, Associate Editor for Clinical Simulation in Nursing
- Salam Daher, reports no conflict of interest
- Cynthia Foronda, Nursing Education Consultant for Wolters Kluwer, Macy Foundation Faculty Scholar
- Jone Tiffany – Nursing Education Consultant for Wolters Kluwer
- Margaret Verkuyl, reports no conflict of interest

- Mindi Anderson (INACSL Conference Administrator) reports no conflict of interest
- Erin Killingsworth (INACSL Lead Nurse Planner) reports no conflict of interest

Successful Completion

- Attend 100% of session
- Complete session evaluation in app

LEARNING OBJECTIVES

Upon completion of this educational activity, participants will be able to:

1. Define terms associated with virtual and augmented reality simulation technologies in nursing and health professions education.
2. Describe two-three examples of virtual and augmented reality simulation technologies available for nursing and health professions education.
3. Identify available resources to assist in the use, design, and/or evaluation of the various virtual and augmented reality simulation technologies existing for nursing and health professions education.
4. Summarize the literature associated with existing virtual and augmented reality simulation technologies.
5. Provide at least one example of how to integrate a virtual and an augmented reality simulation technology into their program.
6. Identify debriefing strategies following a simulation-based experience using virtual and augmented reality simulation technologies.
7. Discuss approaches that incorporate virtual and/or augmented reality simulation technologies into traditional on campus vs. distance-based educational programs.

UNIVERSITY OF MIAMI
SCHOOL of NURSING
& HEALTH STUDIES

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Introductions

Who Are You?

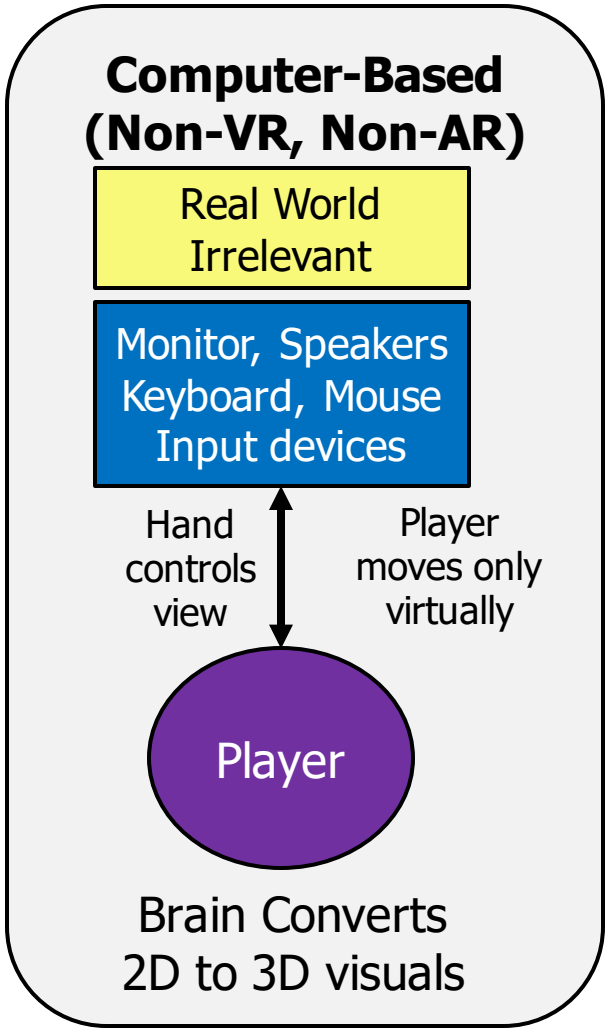
GO TO **WWW.MENTI.COM** AND USE THE CODE **14 13 68**

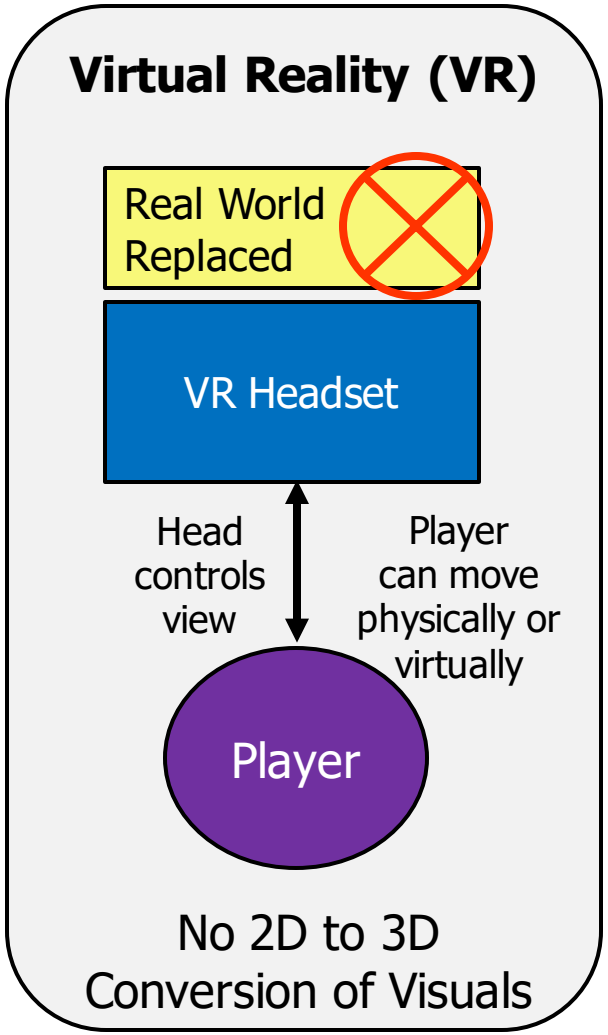
Schedule

0800-0820: Introductions
0820-0830: Overview of the day
0840-0915 History
0915-0945: Systematic review
0945-1000: Examples
1000-1015: Break
1015-1045: Examples
1045-1215: Process
1215-1300: Lunch
1300-1400: Experience VR / AR
1400-1500: Art of Serious Games Design

History and Background

Reality-Virtuality Spectrum


Computer-Based
(Non-VR, Non-AR)
Real World
Irrelevant
Monitor, Speakers
Keyboard, Mouse
Input devices
Hand
controls
view
Player
moves only
virtually
Player
Brain Converts
2D to 3D visuals


Virtual Reality (VR)
Real World
Replaced
VR Headset
Head
controls
view
Player
can move
physically or
virtually
Player
No 2D to 3D
Conversion of Visuals


oculus


htc
STEAMVR
POWERED

Augmented Reality (AR)

Real World
Part of Simulation

AR Headset
or
Spatial AR

Head controls view

Player physically moves

Player

No 2D to 3D Conversion of Visuals

Computer-Based (Non-VR, Non-AR)

Real World
Irrelevant

Monitor, Speakers
Keyboard, Mouse
Input devices

Hand controls view

Player moves only virtually

Player

Brain Converts 2D to 3D visuals

Virtual Reality (VR)

Real World
Replaced

VR Headset

Head controls view

Player can move physically or virtually

Player

No 2D to 3D Conversion of Visuals

Augmented Reality (AR)

Real World
Part of Simulation

AR Headset
or
Spatial AR

Head controls view

Player physically moves

Player

No 2D to 3D Conversion of Visuals

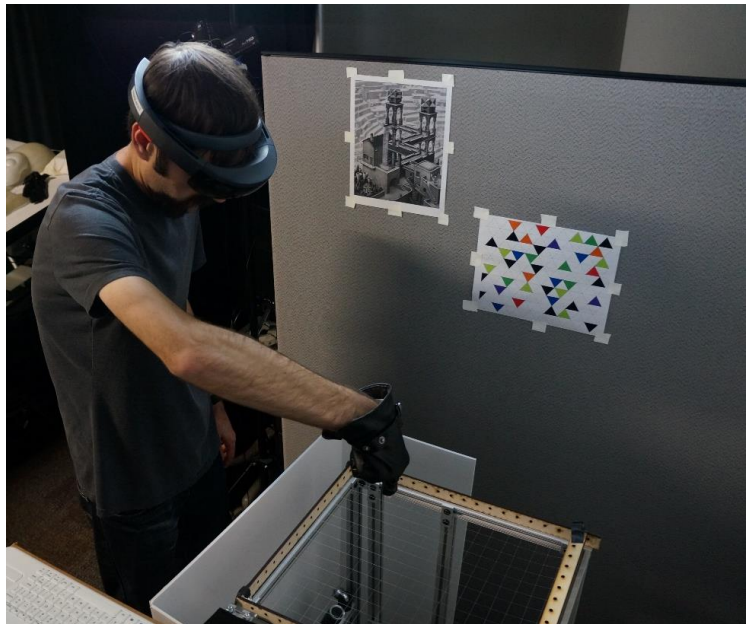
Virtual Reality

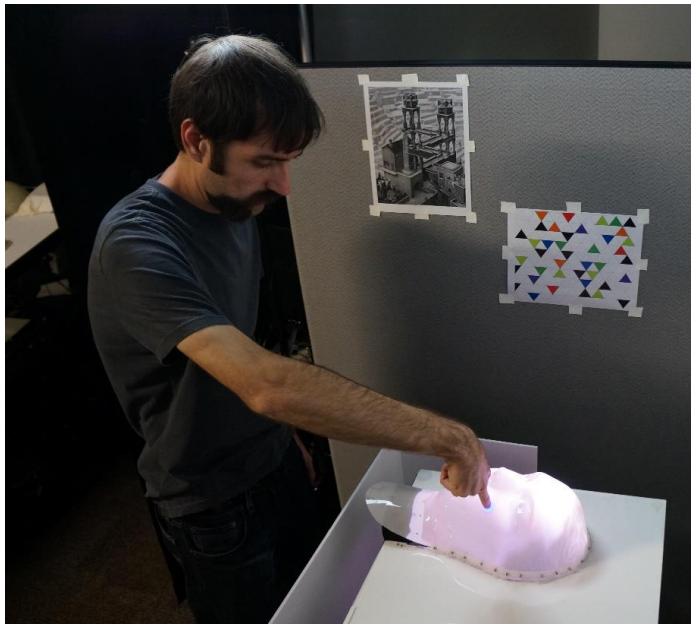
completely replaces the user's real-world environment with a simulated one

Virtual Reality Nursing Scenario

Augmented Reality

A view of a physical, real-world environment whose elements are augmented by computer-generated sensory input (e.g. visual, auditory, haptic, olfactory)





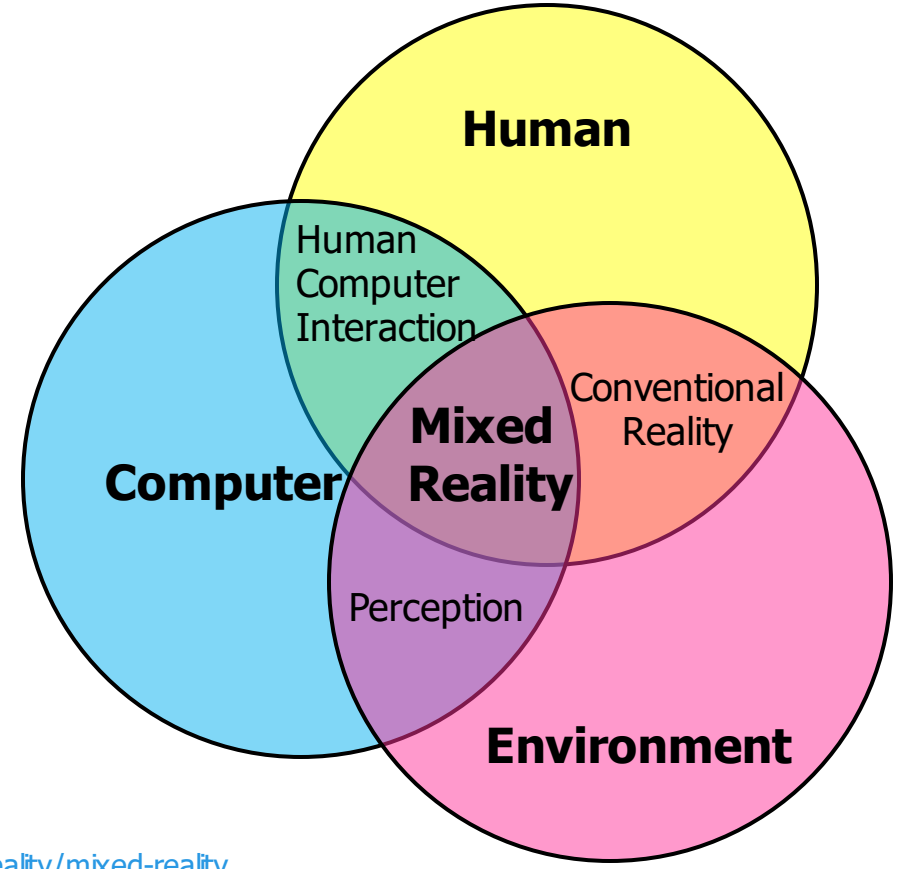
AR-HoloLens

HoloHeart


HoloLens App Preview: Holo Heart
Type here to search
9:05 AM
3/7/2019

Mixed Reality

Mixed reality is the result of blending the physical world with the digital world



https://docs.microsoft.com/en-us/windows/mixed-reality/mixed-reality

Diminished Reality

is a term used to describe the control over one's reality and the ability to block out real or digital information.

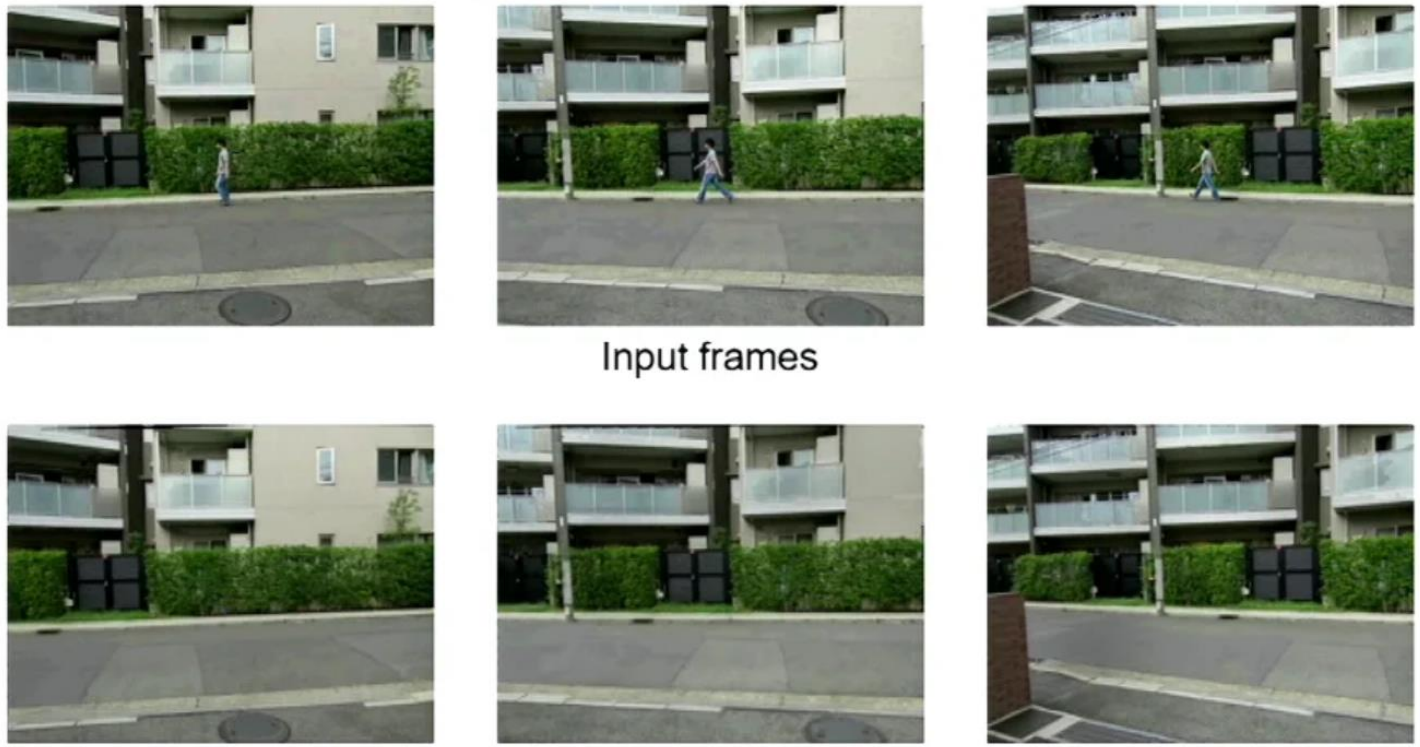


Photo from
Kunihiro Hasegawa
and Hideo Saito

Head-Mounted Displays (HMDs)

are a type of computer display devices that are worn on the head meant for a total immersion of the user no matter where the user's head may turn.

AR Headsets (examples)

HoloLens

Magic Leap

VR Headsets (examples)

Oculus

Vive

Areas of AR/VR in Healthcare

- **For the Patient**
  - Physical Rehabilitation (e.g. Gait, extremities, Amblyopia)
  - Psychological Rehabilitation (e.g. PTSD, Phobias, autism)
  - Addiction
  - Distraction
    - Pain management
    - Companion / Virtual Assistant
  - Familiarization
    - With procedure
    - Virtual coaching

Areas of AR/VR in Healthcare

- **For the Provider (Learning / Training / Assessment)**
  - Outside of the Patient (e.g. PVP, shader lamps)
  - Inside of the patient (e.g. virtual colonoscopy)
  - The Patient's view (e.g. retina simulation)
  - Interaction with environment (e.g. battle field, ER, Trauma center)
  - Interaction with Peers

Benefits of using AR/VR

- Engaging / distracting
- Interactive
- Repeatable / Controllable
- Safe Practice
- Use of Physical Space

Drawbacks of using AR/VR

- Cybersickness
- Eye strain
- Neck strain
- Trip Hazard (wires)
- Mismatch of Physical Space with Virtual Space
- Pain desensitization

The Research

Synthesis of Research

Virtual simulation

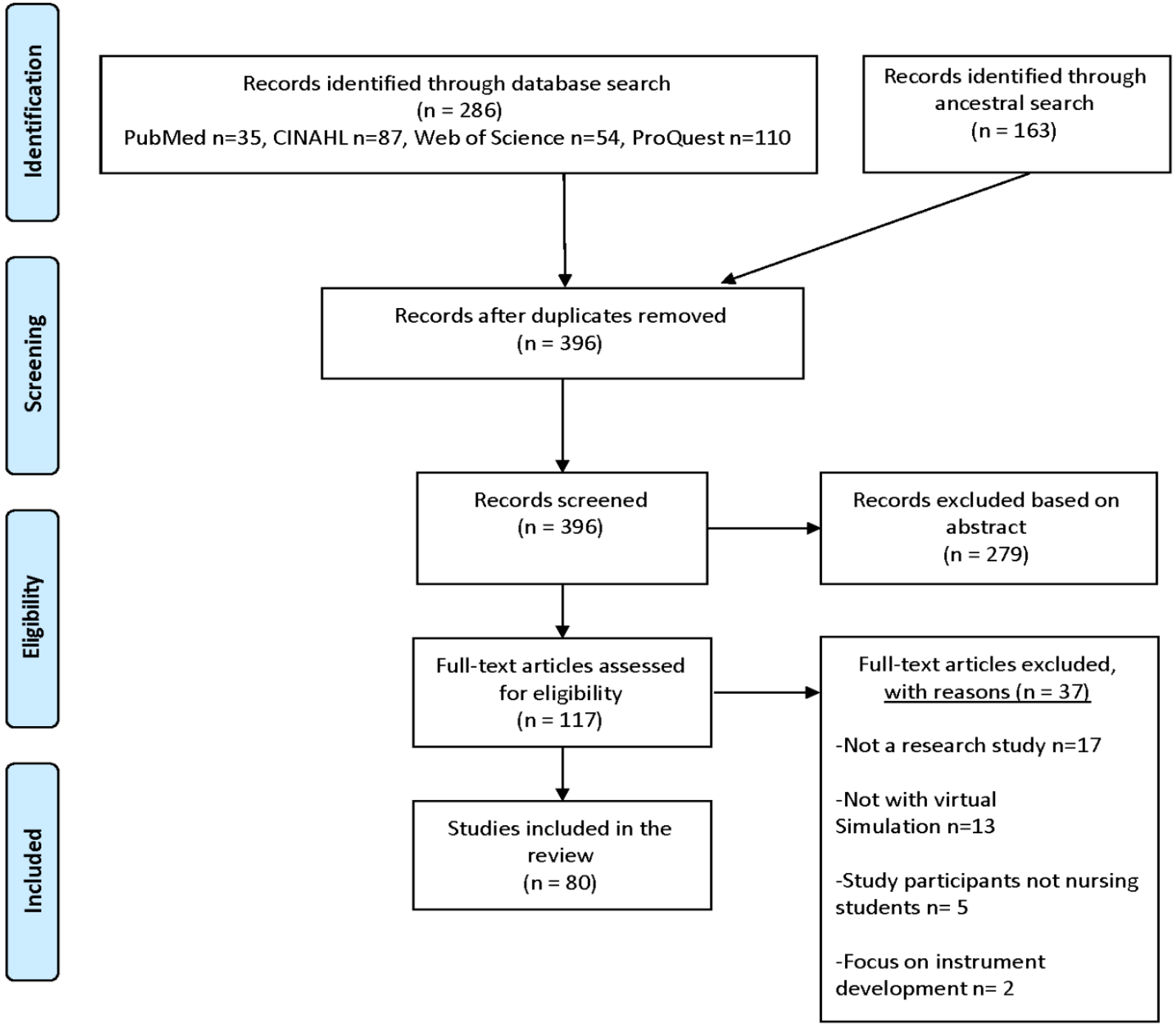
- Improved knowledge compared to customary methods (Gu, Zou, Chen, 2017)
- Decreased time to skill achievement (Farra, et al., 2015)
- Increased retention of material over time (Farra, Miller, Timm, & Schafer, 2013)
- Fun/ Positive / Satisfied (Foronda, et al., 2016; Liaw, et al, 2014; Sunnqvist, et al., 2016; Tilton, et al., 2015; Ulrich, et al., 2014; Verkuyl, et al, 2017).

Systematic Review

- Team of 5 individuals
- Reviewed articles from 1996-2018
- Applied PRISMA Guidelines
- Rated articles using Melnyk and Fineout-Overholt's Levels of Evidence
- "How does virtual simulation impact learning outcomes?"

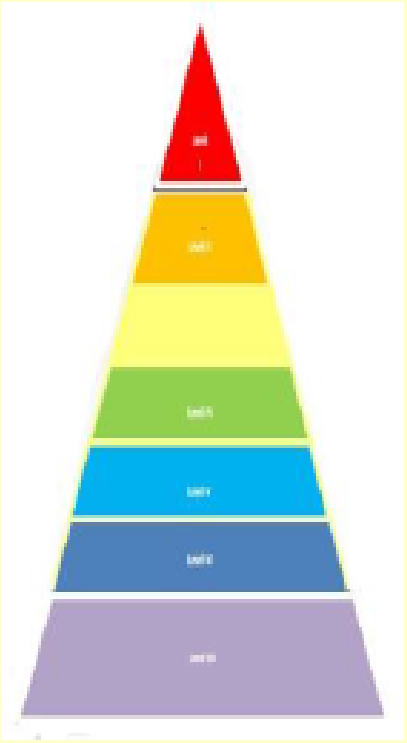
Foronda, C.L., Fernandez-Burgos, M., Nadeau, C., Kelly, C., Henry, M. (In Review). Virtual Simulation in Nursing Education: A Systematic Review Spanning 1996-2018. *Society for Simulation in Healthcare.*

Flow Chart


Identification
Screening
Eligibility
Included
Records identified through database search
(n = 286)
PubMed n=35, CINAHL n=87, Web of Science n=54, ProQuest n=110
Records identified through ancestral search
(n = 163)
Records after duplicates removed
(n = 396)
Records screened
(n = 396)
Records excluded based on abstract
(n = 279)
Full-text articles assessed for eligibility
(n = 117)
Full-text articles excluded, with reasons (n = 37)
-Not a research study n=17
-Not with virtual Simulation n=13
-Study participants not nursing students n= 5
-Focus on instrument development n= 2
Studies included in the review
(n = 80)

Rating the Evidence

Evidence Pyramid.



Level 1: Systematic Reviews & Meta-analysis of RCTs; Evidence-based Clinical Practice Guidelines

Level 2: One or more RCTs

Level 3: Controlled Trials (no randomization)

Level 4: Case-control or Cohort study

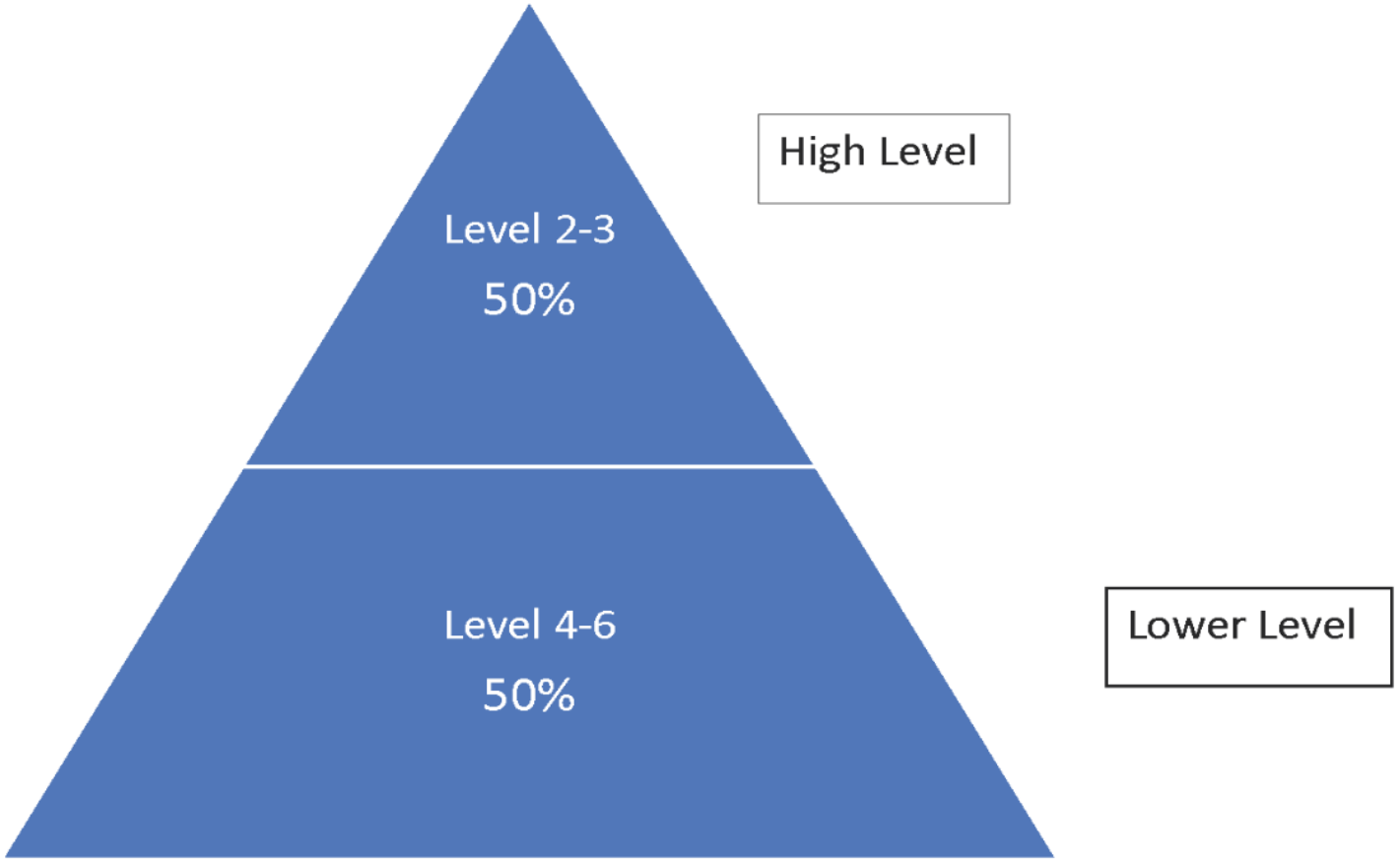
Level 5: Systematic Review of Descriptive and Qualitative studies

Level 6: Single Descriptive or Qualitative Study

Level 7: Expert Opinion

Melnyk, BM, Fineout-Overholt, E. *Evidence-based practice in nursing and healthcare: A guide to best practice. * 3rd ed. Philadelphia: Wolters Kluwer Health; 2015.

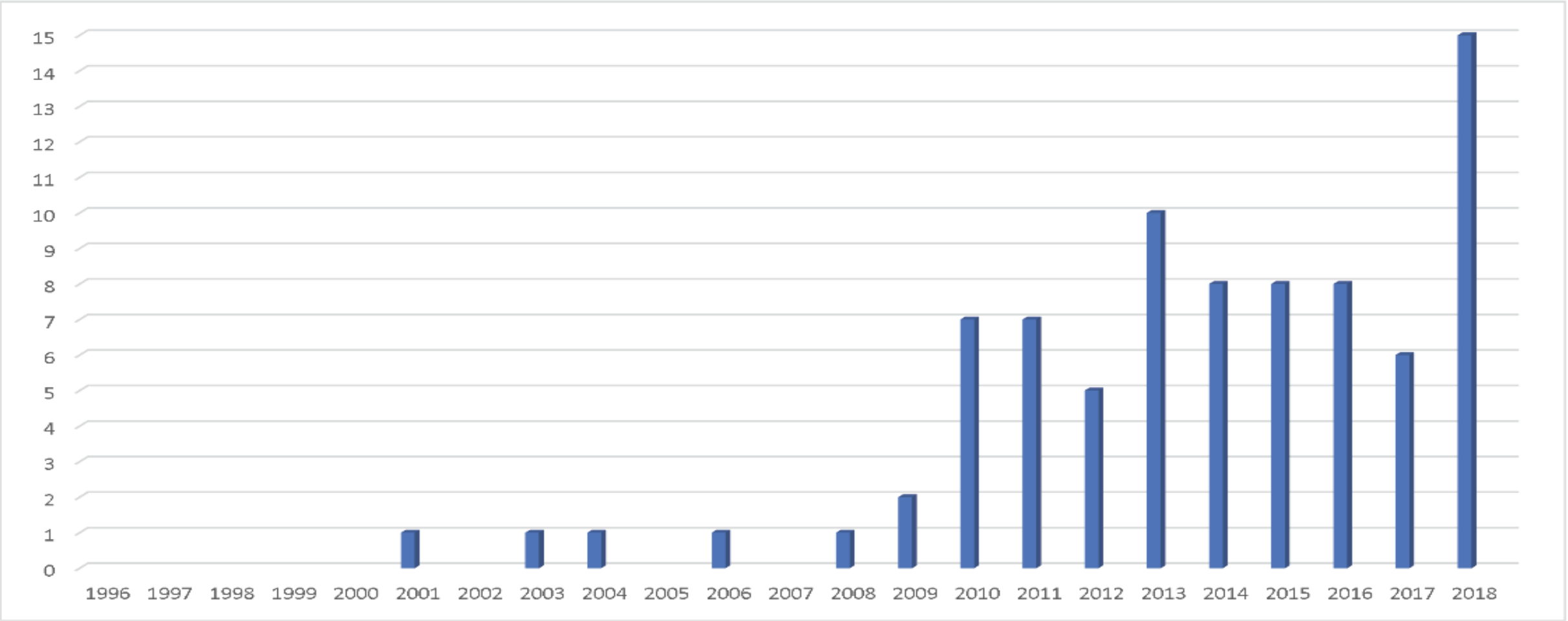
Results



Level of evidence of the research studies

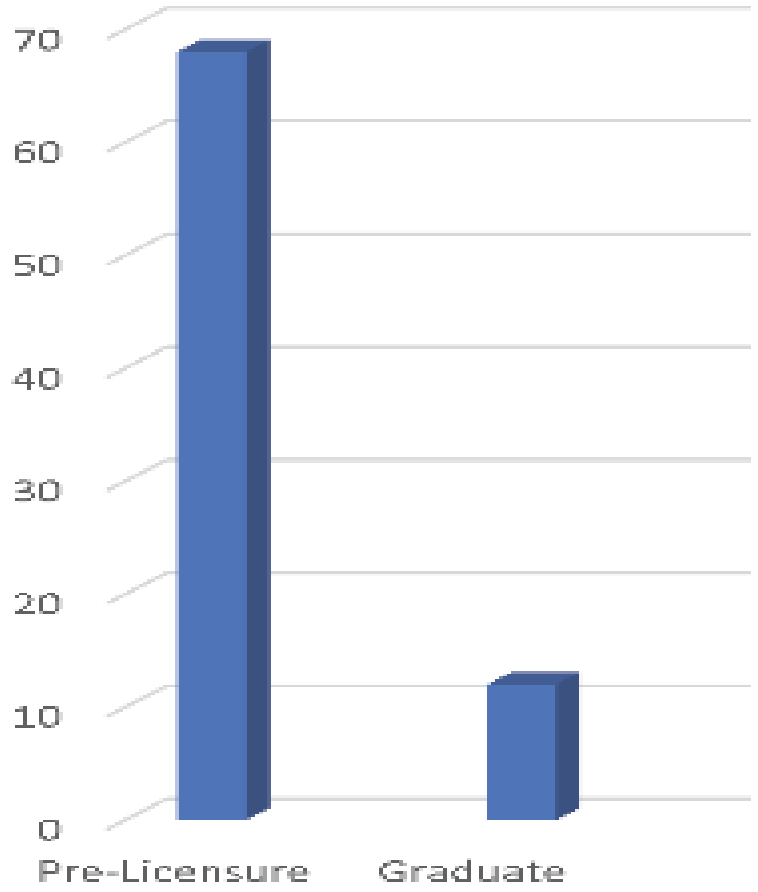
Foronda, C.L., Fernandez-Burgos, M., Nadeau, C., Kelly, C., Henry, M. (In Review). Virtual Simulation in Nursing Education: A Systematic Review Spanning 1996-2018. *Society for Simulation in Healthcare.*

Results



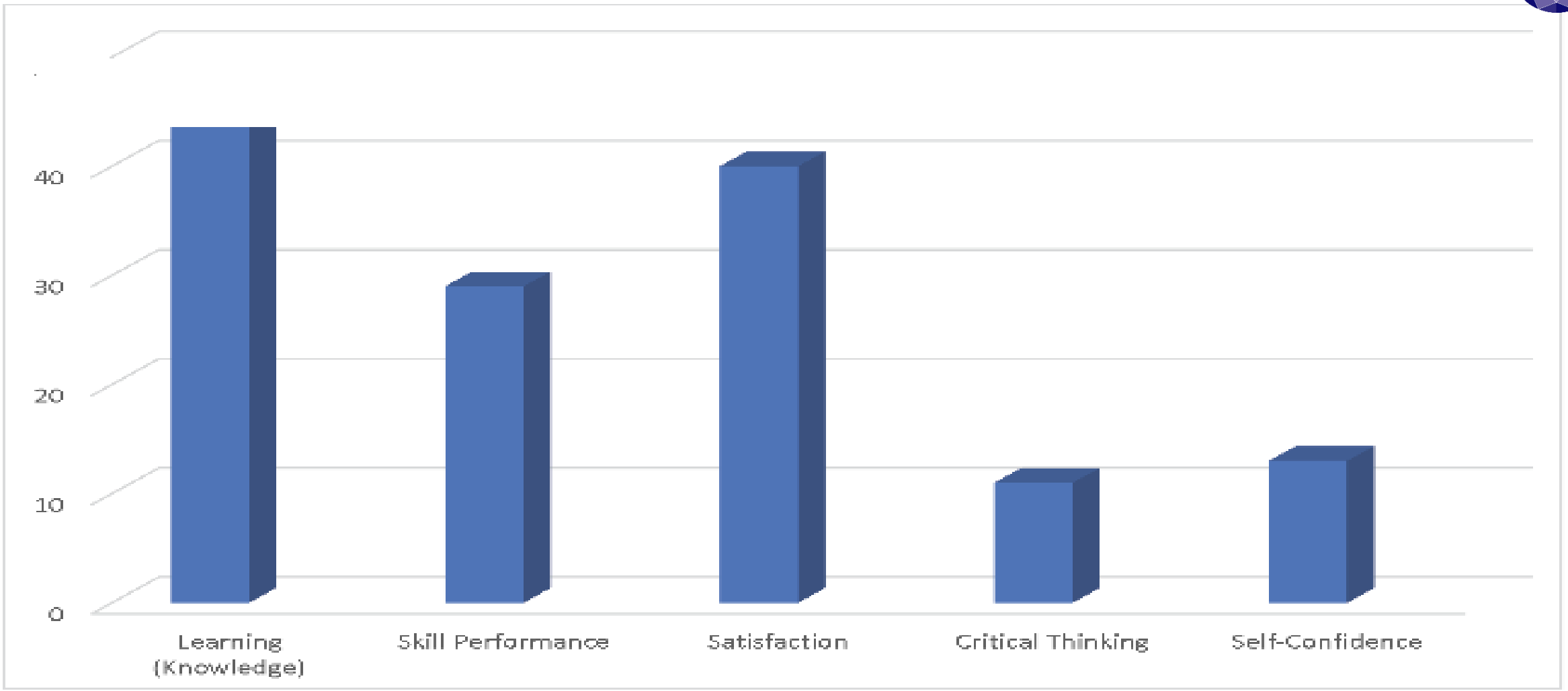
Research study publication by year

Results



Level of learner of the reviewed studies

Results



Number of times the outcomes were investigated in the reviewed studies

Results

The majority of the evidence (*n*=69 studies, 86%) suggested that the intervention of virtual simulation resulted in improved student learning outcomes.

Results

When looking at the 17 RCT's, the majority (*n*=12, 70%) of studies demonstrated that virtual simulation lead to statistically significant gains in learning outcomes when compared to traditional methods.

Results

Areas of common bias identified:

Identify the effect size/s

Conduct a power analysis to determine adequate sample size

Blind study personnel

Identify confounding factors

Report confidence intervals

Examine perceptions of learning instead of hard metrics/ objective measures of student learning

Limitations

Limited search terms

Over-reporting of positive findings

Only examined nursing education

Wide range of uses prohibiting a meta-analysis

Recommendations

1) Attempt to decrease bias
2) Use Simulation Research Reporting Guidelines

   (Cheng, et al., 2016)
3) Express description of the simulation components including
   a) level of fidelity,
   b) immersion, and
   c) bodily form of the patient

   (Cant, et al, 2019).

Conclusion

Use of virtual simulation is increasing in nursing education.

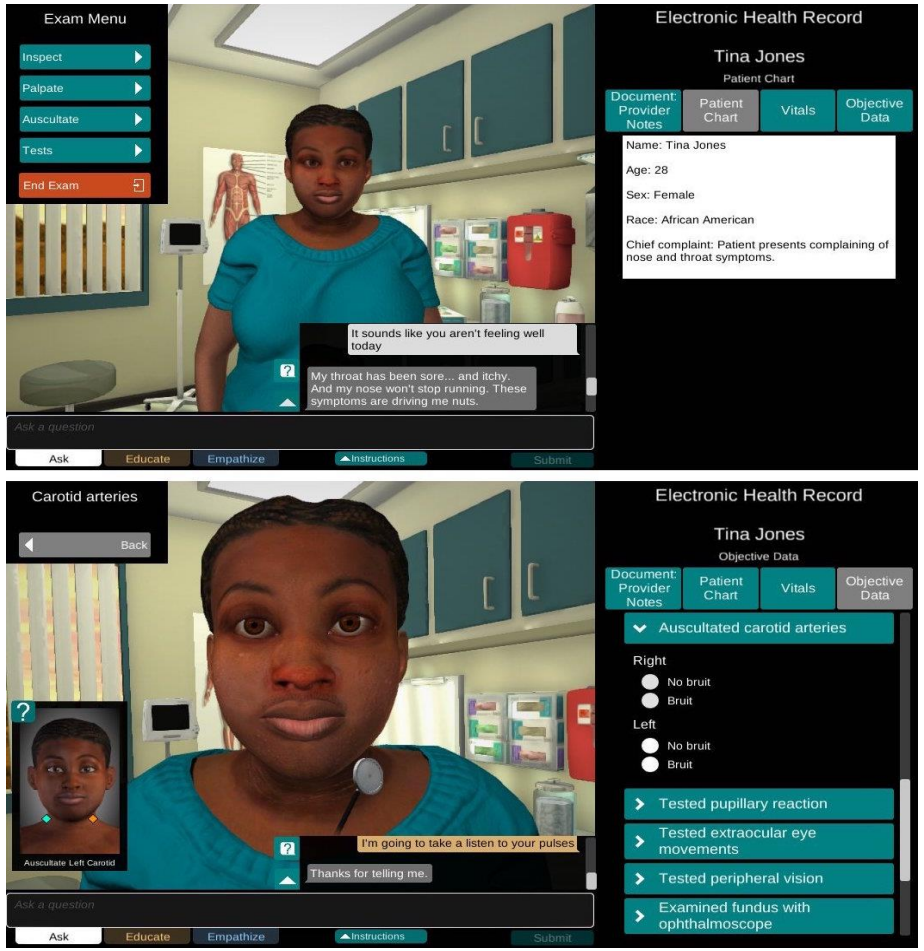
The preponderance of evidence suggest it improves learning outcomes.

Virtual simulation is a pedagogy of the now and the future!

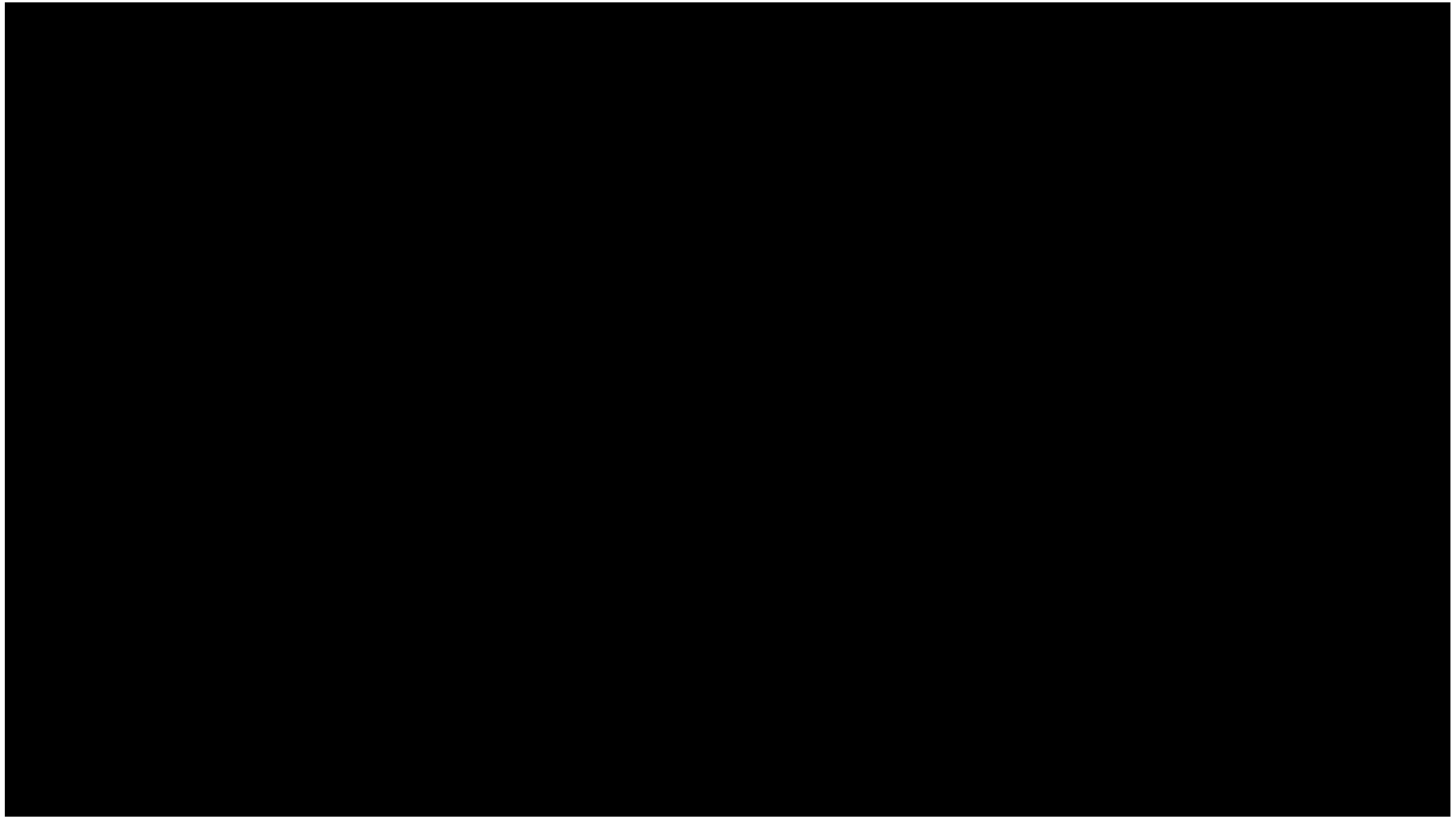
Technologies Applications

vSim for Nursing®

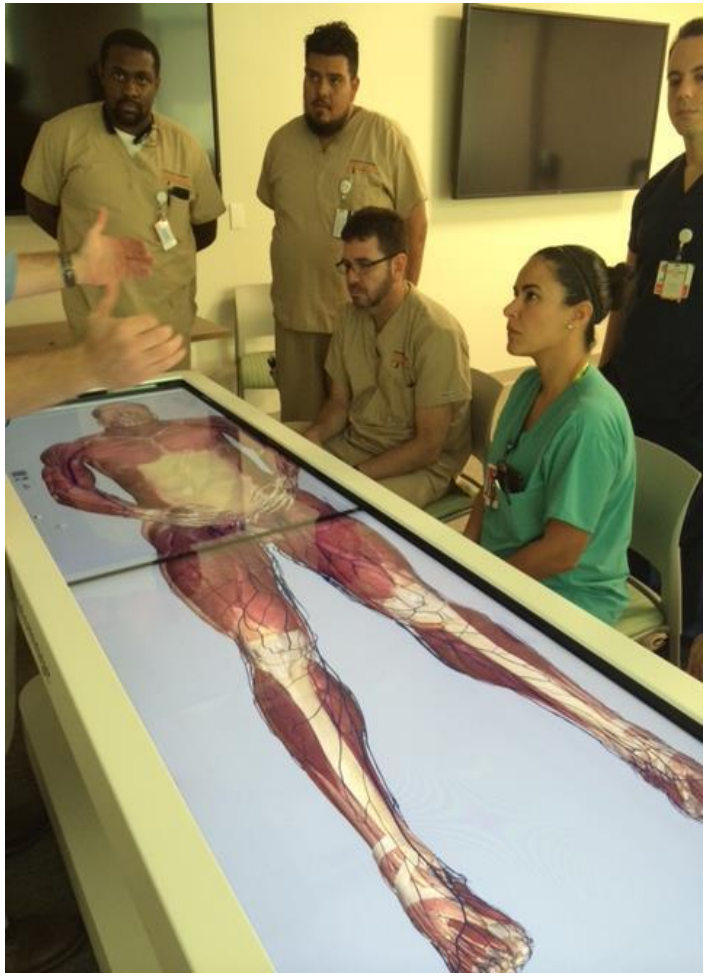
Digital Clinical Experiences®

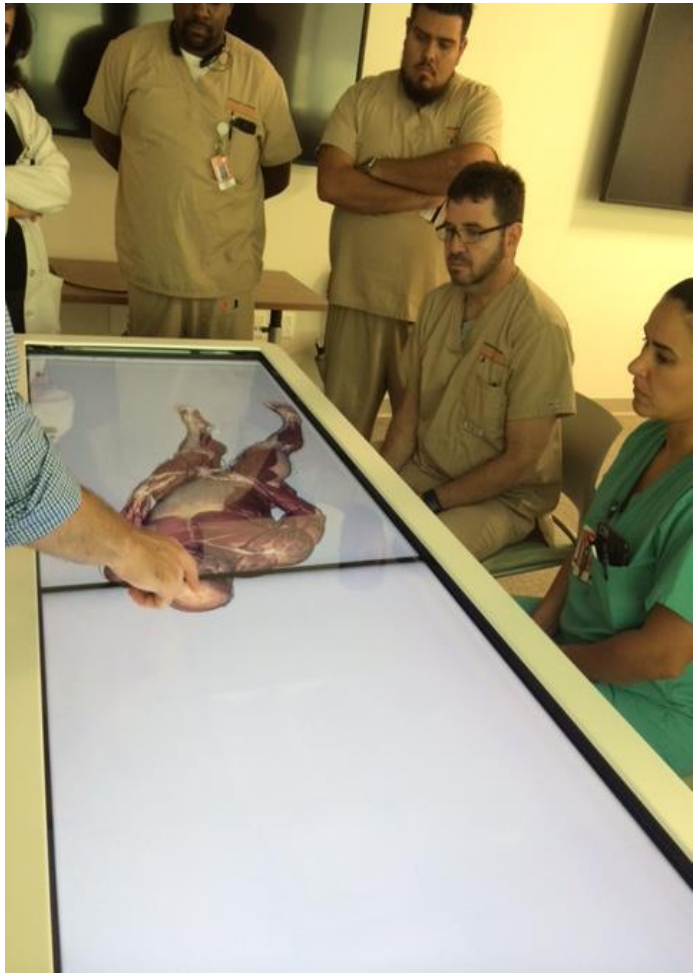


Virtual Gaming Simulations



Anatomage





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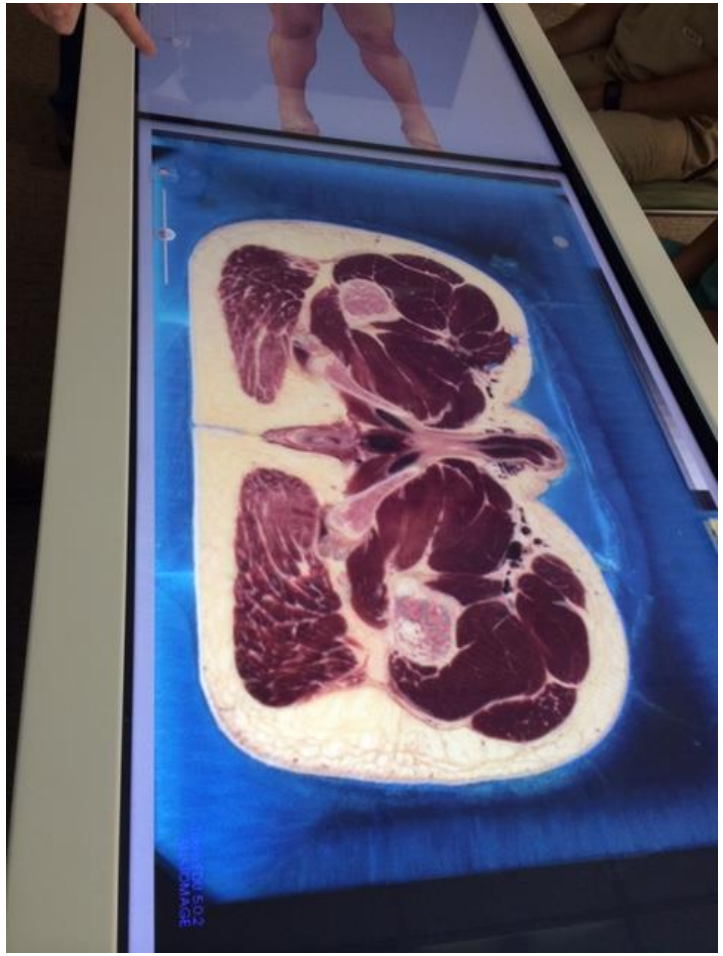


https://www.youtube.com/watch?v=hHy9pMJ_sgQ&list=PLt_liLQ3dXEyDFSL1LkMBaDDC5ua59iD6&index=1

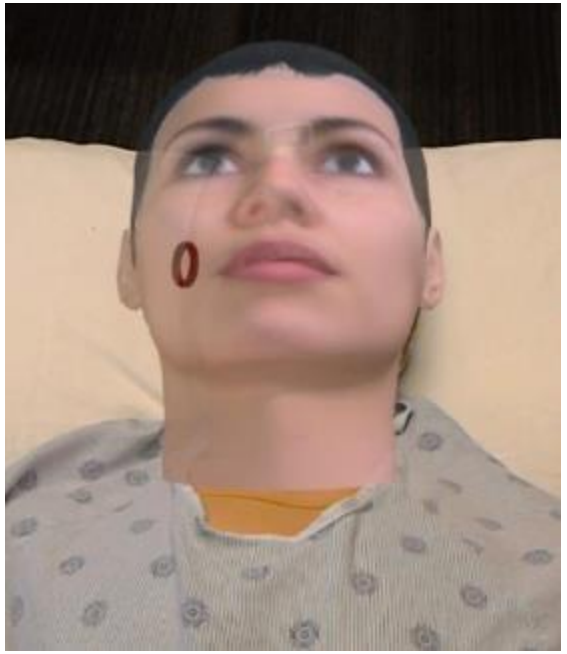
Device and Workflow

Microsoft HoloLens was utilized as the AR device.

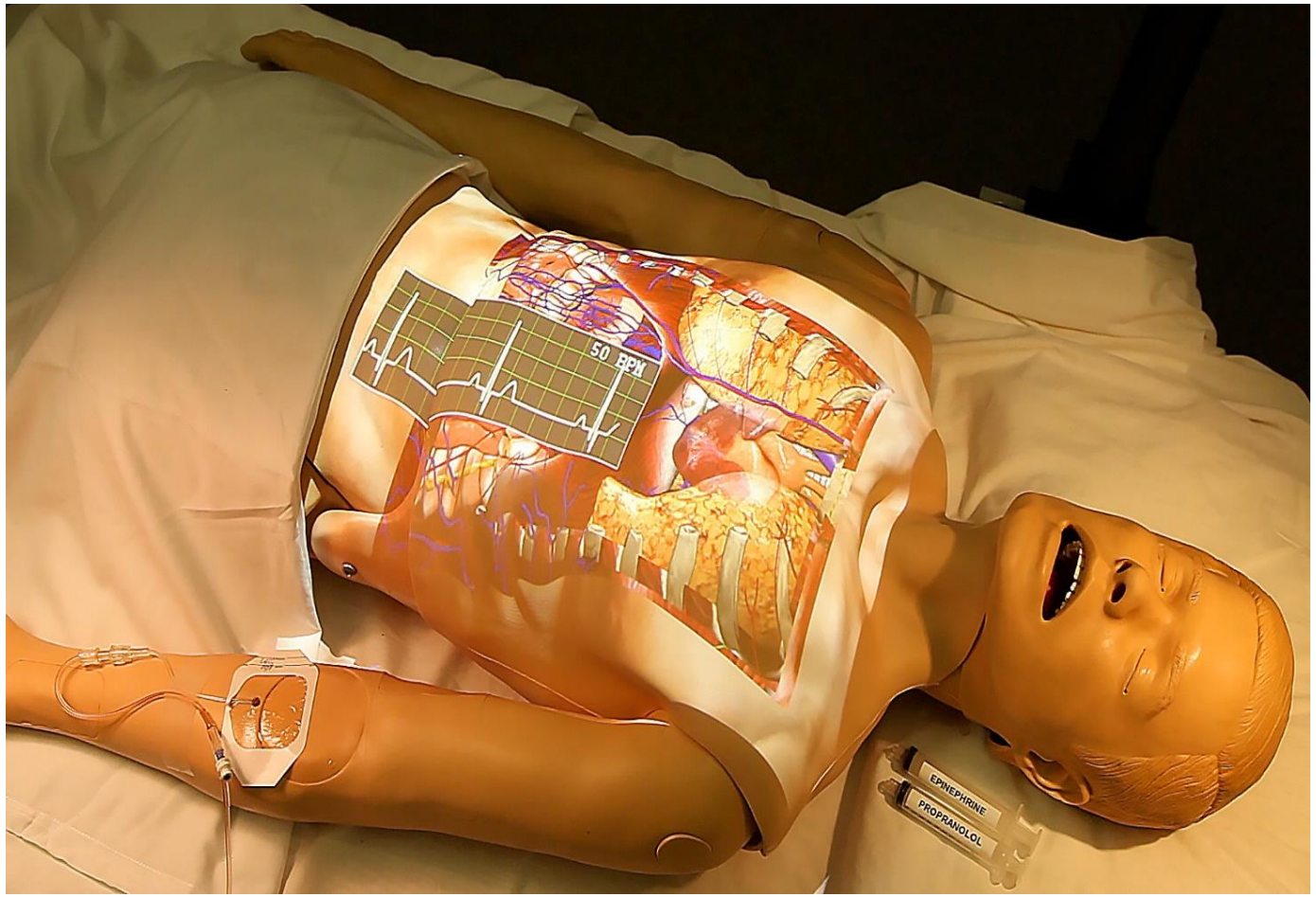
AprilTag was placed on the head of the mannequin to project the AR facial model.

KEG was applied to stabilize the model.

Stop tracking after the model was stable.

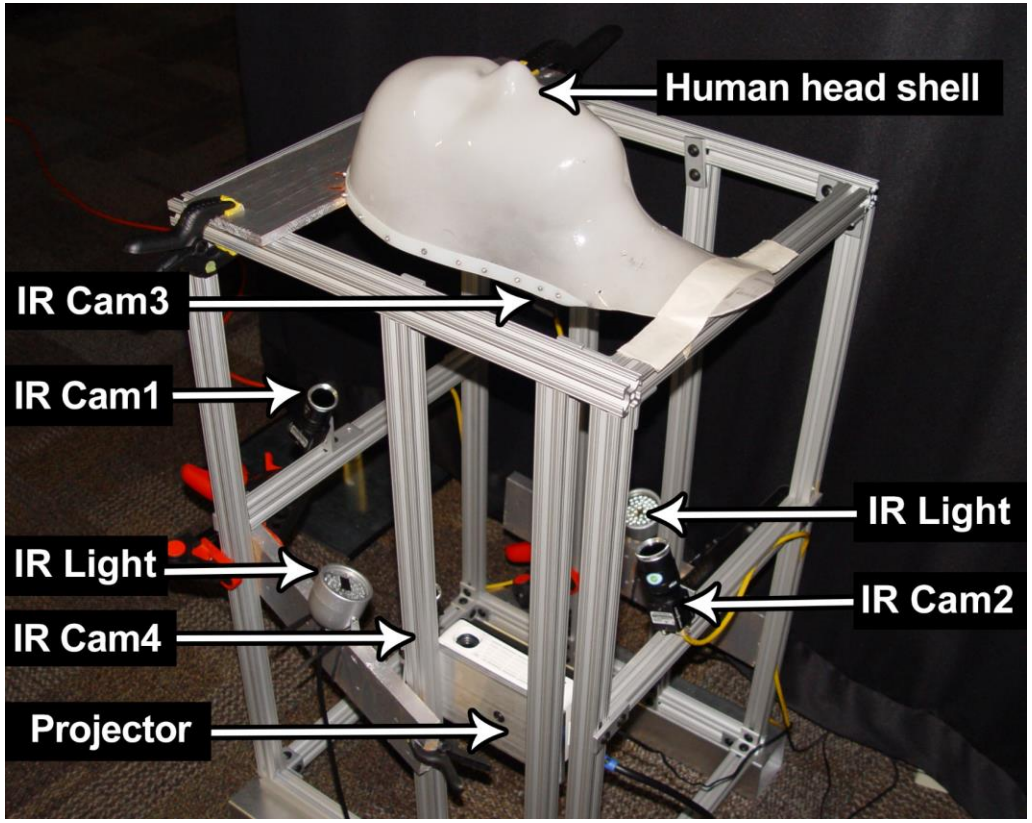


Augmented Reality



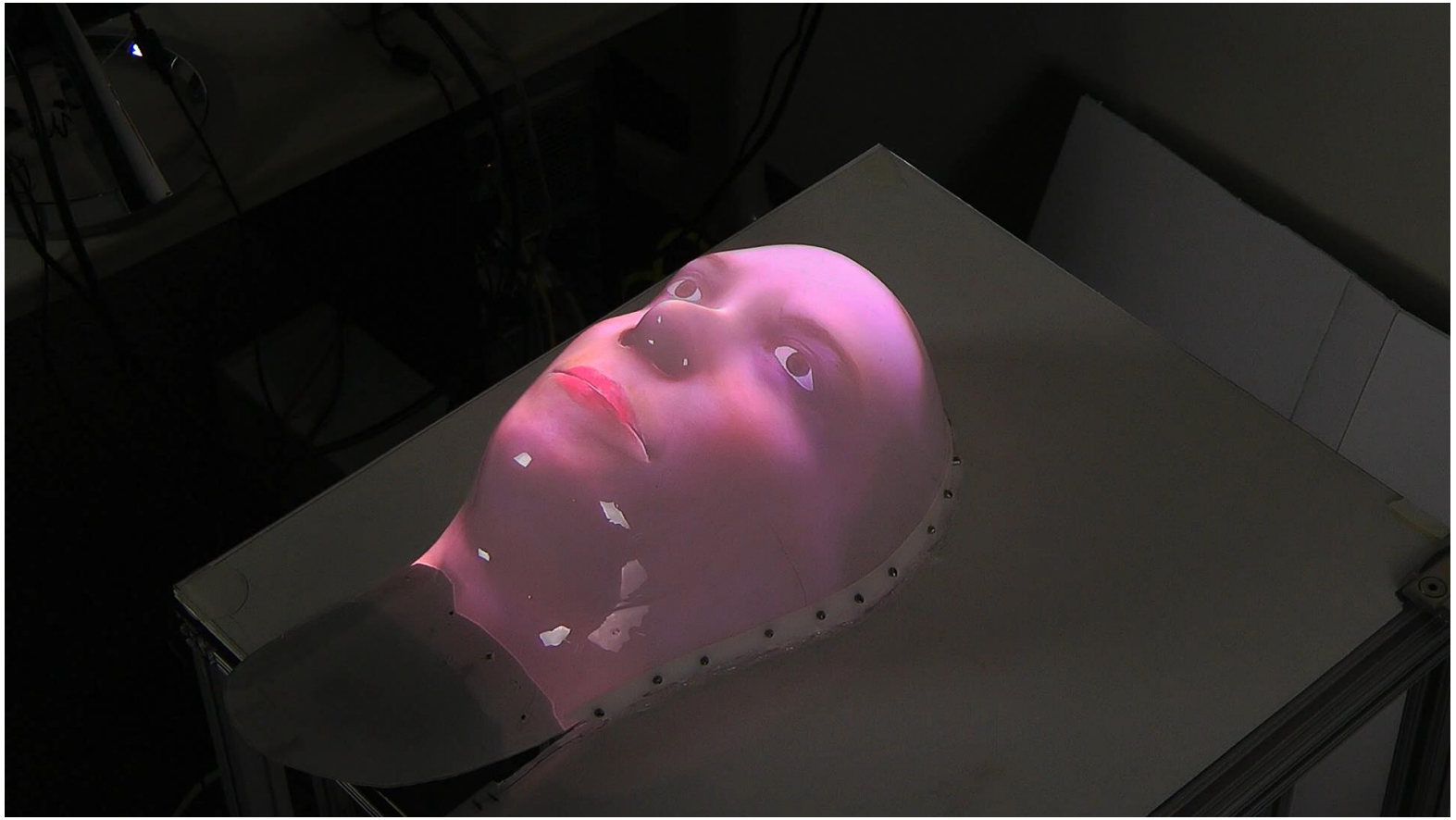
BodyExplorer augmented reality patient simulator. Copyright Joseph T. Samosky, University of Pittsburgh, Pittsburgh, PA, 2015. Reprinted by permission of Joseph T. Samosky, University of Pittsburgh, Pittsburgh, PA, 2017.

Physical Virtual Patient

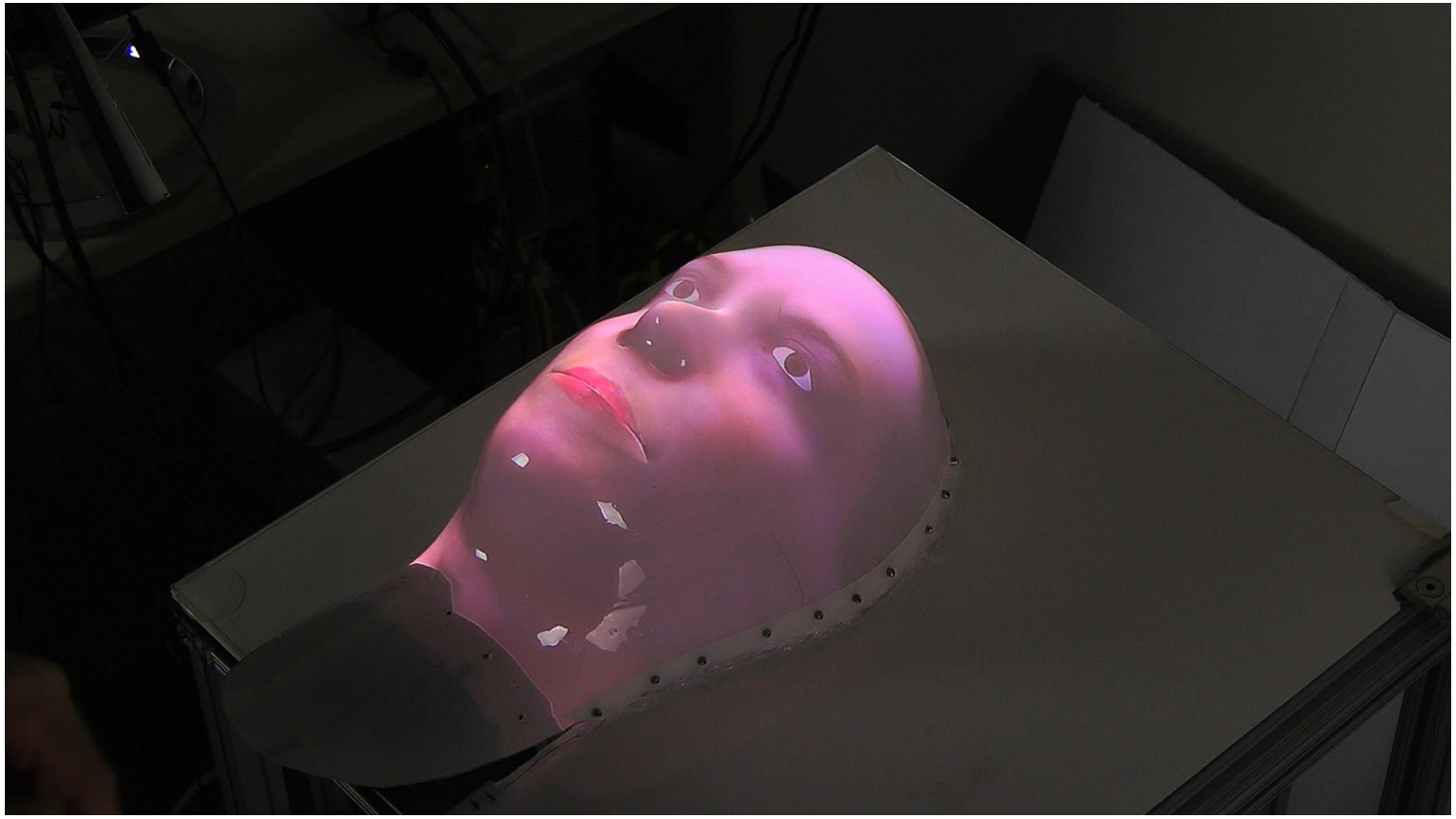


J. Hochreiter, S. Daher, A. Nagendran, L. Gonzalez, G. Welch, in *Presence: Teleoperators and Virtual Environments*, 2016 and in *IEEE Virtual Reality*, 2015

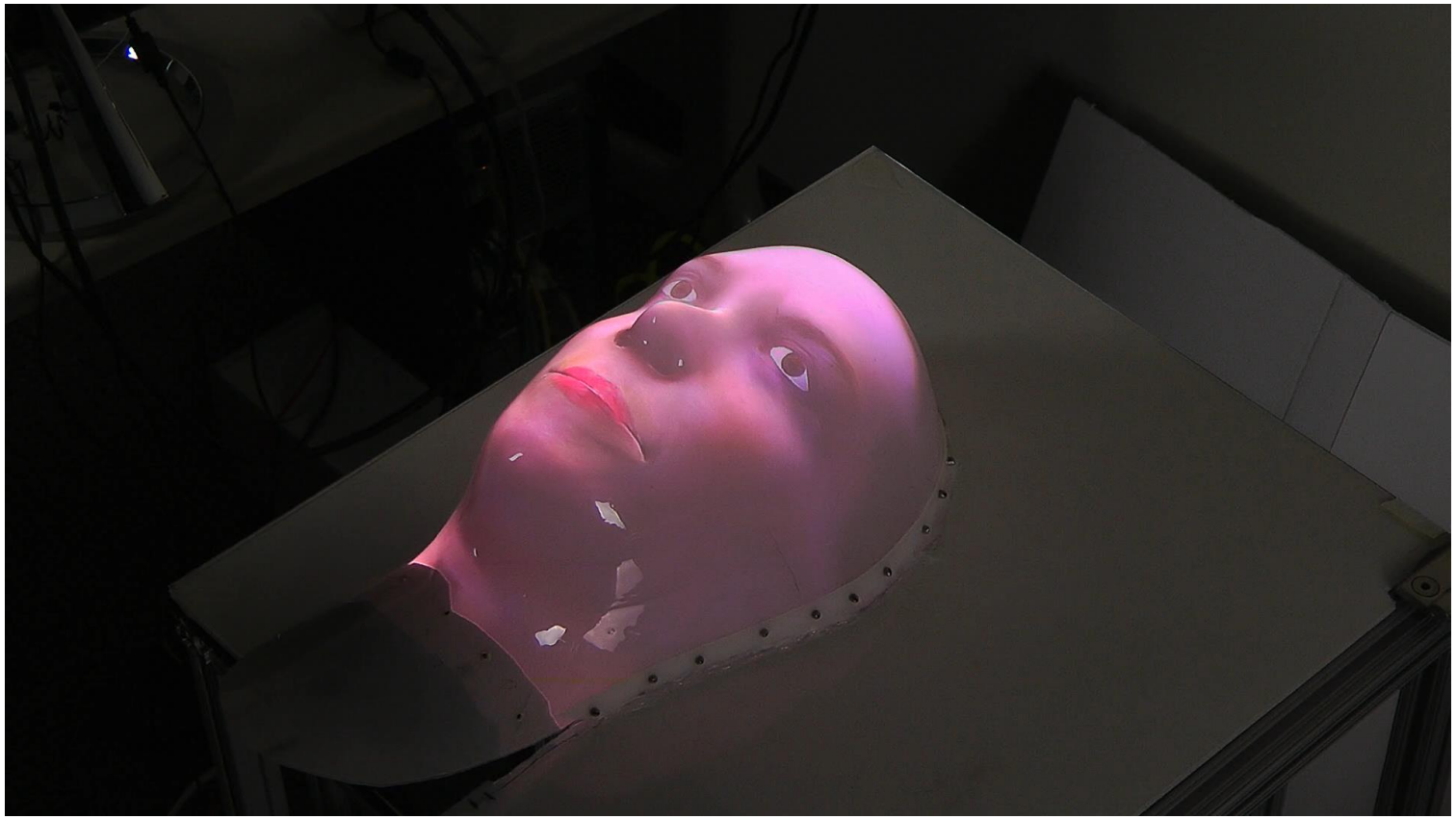
Physical Virtual Patient ("capillary refill")



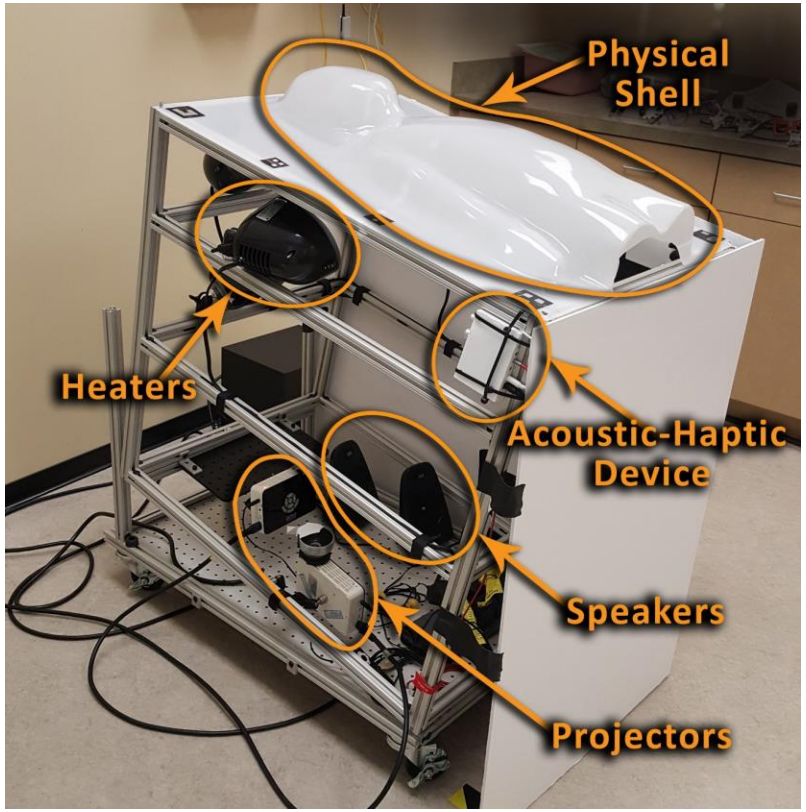
Physical Virtual Patient (regions)



Physical Virtual Patient (tug lips)



Physical Virtual Patient



S. Daher, J. Hochreiter, R. Shubert, L. Gonzalez, J. Cendan, M. Anderson, D. Diaz, G. Welch to appear in *Simulation in Healthcare Journal* 2019

Physical Virtual Patient

HMD AR vs. Spatial AR

HMDs

- Narrow Field of View
- Heavy
- Look funny
- Synchronization across multiple users
- Cybersickness

Spatial AR (Projection)

- Occlusion (front projection)
- Distortions

SimTabs™

Innovation in Learning, Inc. Used by permission. (2019)
www.simtabs.com

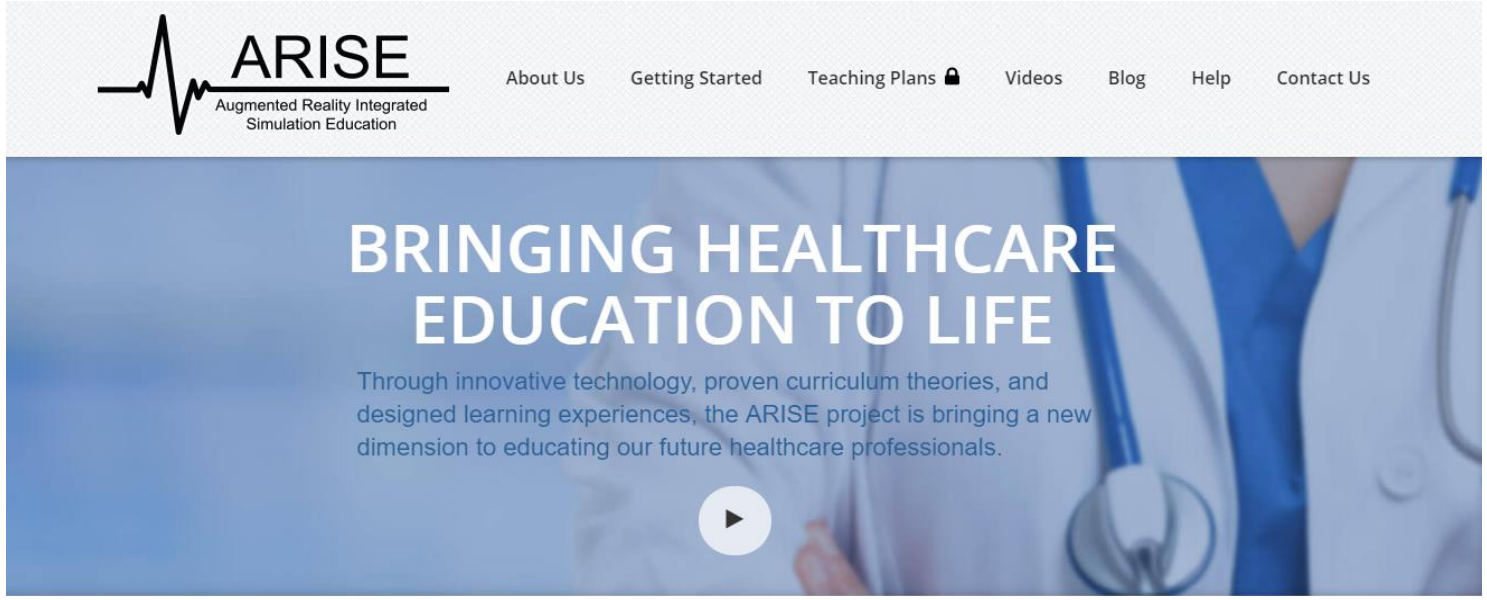
Inclusivity Assignment

@INACSL | #INACSL2019

Virtual Public Health Clinical


I am not
telling you that it is
going to be easy
I am telling you
that it is going to be
worth it.
VIOLENCE
POWER AND CONTROL
VIOLENCE
That's what makes me so scared. What do you think it will be like when I have to leave here and go back to Johnny? Like - I'll REALLY be looking pregnant then. How do I stay safe and protect my baby?

ARISE PROJECT



Augmented Reality Integrated Simulation Education

http://ariseproject.com/

Heart VR-
Immersive VR

Virtual Simulations in Education

Clear objectives that align with curriculum

Introduction

Faculty prep

Grading

Prebrief

Enactment (simulation)

Debrief

Introduction

Faculty Prep (new research)

Understand content

Thorough knowledge of virtual simulation (recent play)

Understand how to 'play' the virtual simulation

Excited about the virtual simulation

Support person re: virtual simulation & technology

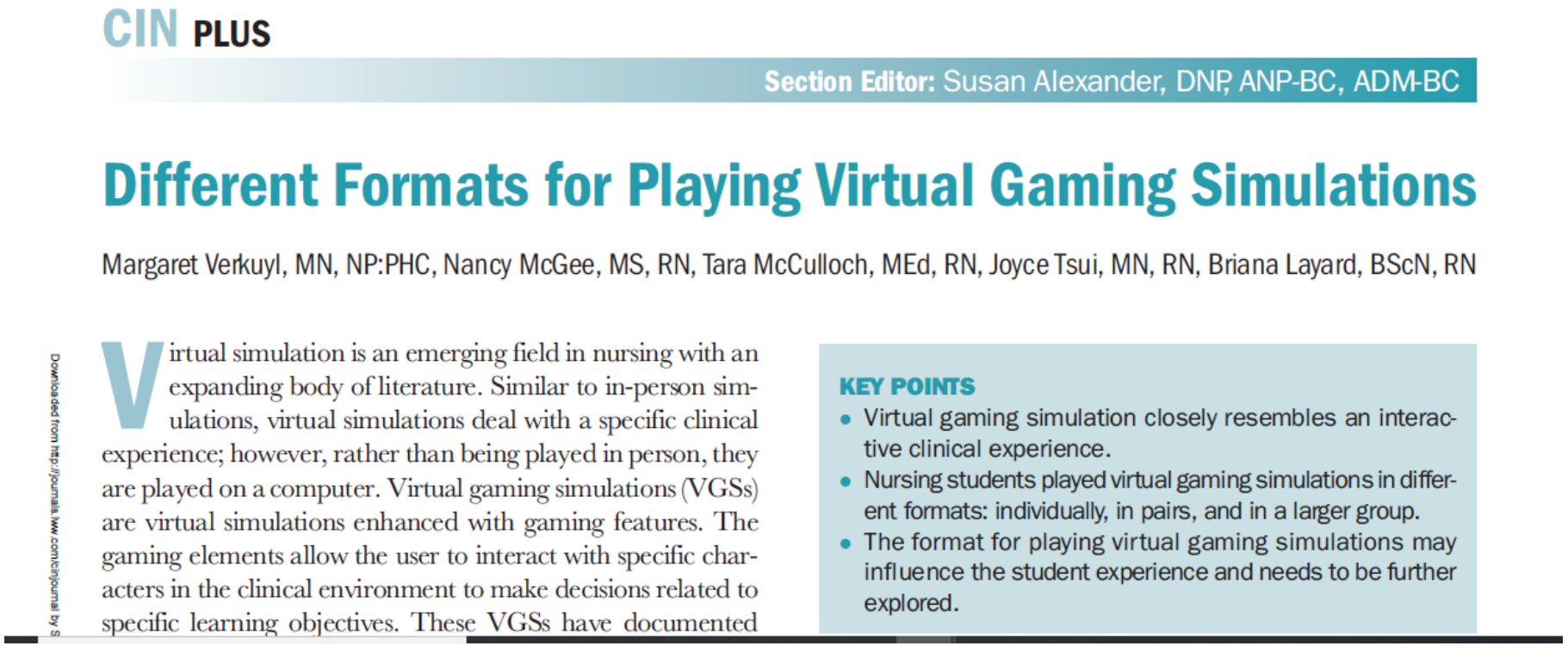
Grading

Prebrief

Learning outcomes
Technology
Access to virtual simulation
How to play
Expectations
Support

Oral, Written, Video Tutorial

Enaction (Simulation)



CIN PLUS

Section Editor: Susan Alexander, DNP, ANP-BC, ADM-BC

Different Formats for Playing Virtual Gaming Simulations

Margaret Verkuyl, MN, NP:PHC, Nancy McGee, MS, RN, Tara McCulloch, MEd, RN, Joyce Tsui, MN, RN, Briana Layard, BScN, RN

Virtual simulation is an emerging field in nursing with an expanding body of literature. Similar to in-person simulations, virtual simulations deal with a specific clinical experience; however, rather than being played in person, they are played on a computer. Virtual gaming simulations (VGSs) are virtual simulations enhanced with gaming features. The gaming elements allow the user to interact with specific characters in the clinical environment to make decisions related to specific learning objectives. These VGSs have documented

KEY POINTS

- Virtual gaming simulation closely resembles an interactive clinical experience.
- Nursing students played virtual gaming simulations in different formats: individually, in pairs, and in a larger group.
- The format for playing virtual gaming simulations may influence the student experience and needs to be further explored.

Debriefing

Why Debrief

- Where the **learning** occurs
- Make connections to practice

Questions related to debriefing virtual experiences.

What way do we usually debrief?

What is the problem with virtual simulation??

Virtual Simulation Debriefing Options

In-person debrief

Self debrief

Synchronous virtual debrief

Asynchronous debrief

In-Person Debriefing

The gold standard
Four to ten participants
Two debriefers

Self-Debriefing

Integrated throughout

Offered at the end with guided questions (offers immediate debrief)

Identifies learner's strengths and challenges

Synchronous Virtual Debriefing

Virtual platform

Similar format to in-person

Asynchronous Virtual Debriefing

Discussion board
Specific debriefing questions
Identified number of postings in an online learning system/Blog
Time limits

Debriefing Research

Clinical Simulation in Nursing (2018) 19, 1-7

ELSEVIER

Check for updates

Clinical Simulation in Nursing

www.elsevier.com/locate/ecsn

Featured Article

Comparison of Debriefing Methods after a Virtual Simulation: An Experiment

Margaret Verkuyl, MN, NP, PHC[a,*], Lynda Atack, PhD, RN[a], Tara McCulloch, MEd, RN[a], Linda Liu, MN, RN, CPMHN(c)[b], Lorraine Betts, MN, RN, CHSE[b], Jennifer L. Lapum, PhD, RN[c], Michelle Hughes, MEd, RN[a], Paula Mastrilli, PhD, RN[d], Daria Romaniuk, PhD, RN[c]

[a]Community of Health Studies, Centennial College, Toronto, Ontario M1K 5E9, Canada

Debriefing Research

Clinical Simulation in Nursing (2018) 20, 7-14

ELSEVIER

Clinical Simulation in Nursing

www.elsevier.com/locate/ecsn

Featured Article

Virtual Gaming Simulation: Exploring Self-Debriefing, Virtual Debriefing, and In-person Debriefing

Margaret Verkuyl, MN, NP:PHC[a,*], Jennifer L. Lapum, PhD, RN[b], Michelle Hughes, MEd, RN[a], Tara McCulloch, MEd, RN[a], Linda Liu, MN, RN, CPMHN(c)[c], Paula Mastrilli, PhD, RN[d], Daria Romaniuk, PhD, RN[b], Lorraine Betts, MN, RN, CHSE[d]

Combination of Debriefs (Study Results Coming Soon!!)

Self-debrief plus in-person small group

Self-debrief plus in-person large group

Timing of Combined Debriefs

Immediate self-debrief
1-2 weeks later group debrief

Process of Using Virtual Experiences

Enactment or simulation

- Individual
- Pairs
- Group

Debrief

- Self-debrief
- Synchronous virtual debrief
- Asynchronous on line debrief
- In-person group debrief
- Combine debriefing methods

Questions for all Faculty?

Lunch Break-12:15-1pm

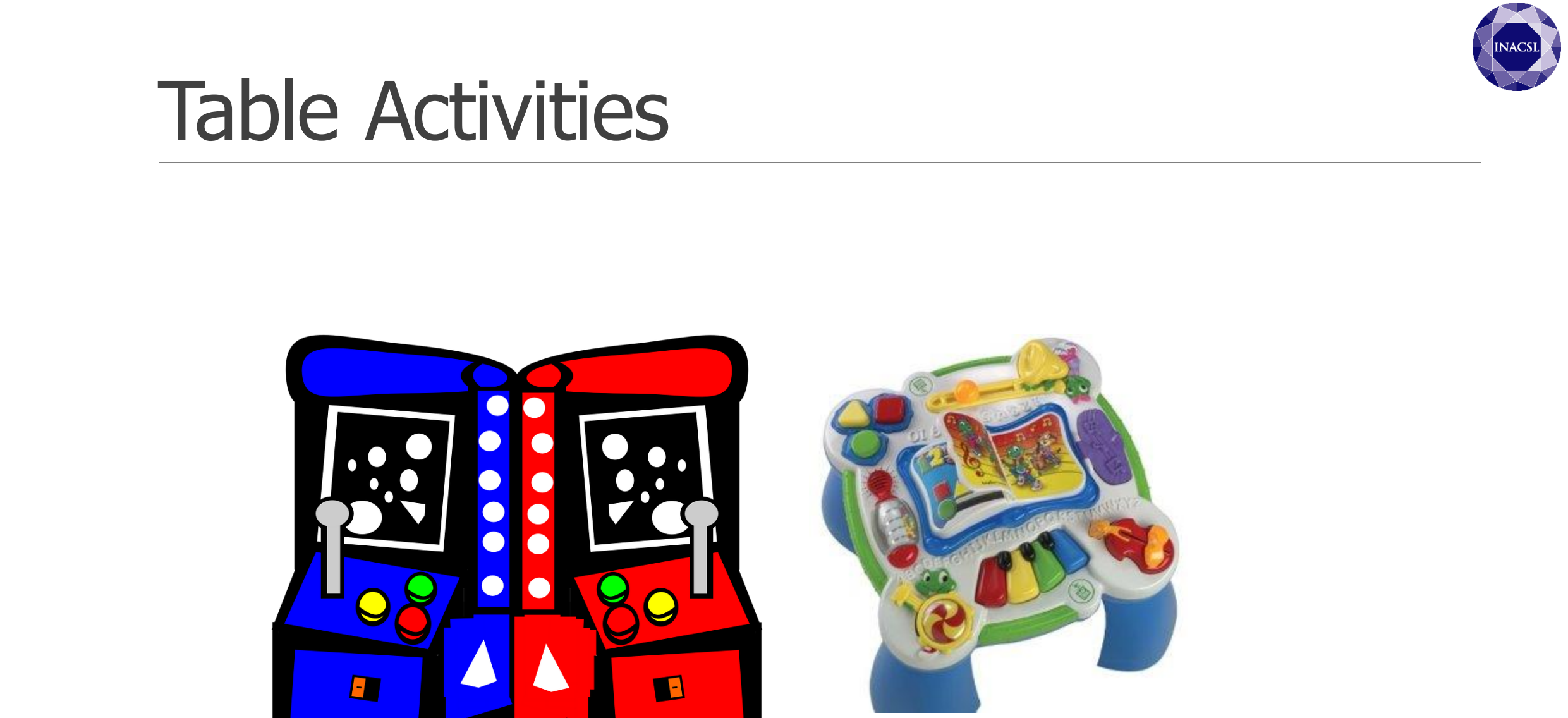


Table Activities

The Art of Serious Game Design

Naza Djafarova,
Leonora Zefi,
Mariam Ahmed,
Anastasia Dimitriadou
Margaret Verkuyl

Ryerson University
The Chang School of Continuing Education

Outline

Intro

Game Design Demo

Debrief

The Art of Serious Game Design

A hands-on workshop for developing educational games: Facilitator guide

Digital Education Strategies, The Chang School of Continuing Education, Ryerson University

READ BOOK

Download this book

Intro

https://de.ryerson.ca/games/research

Intro

Play Time!

Game
Design
Demo

Icebreaker

Introduce yourself to your design group. Share your name and the name of your favourite game.

Game Design Demo

Brainstorming #1

Use the cards to **generate ideas** for your game in **5 minutes.**

Game Design Demo

Decide on a topic in nursing to make into a Game.

2 minutes

Brainstorming #2

Use the cards to **refine your ideas** for your game in **5 minutes.**

Game Design Demo

Paper Prototyping

Draw a prototype
based on your ideas
in **5 minutes.**

Game
Design
Demo

Present your game

Debrief

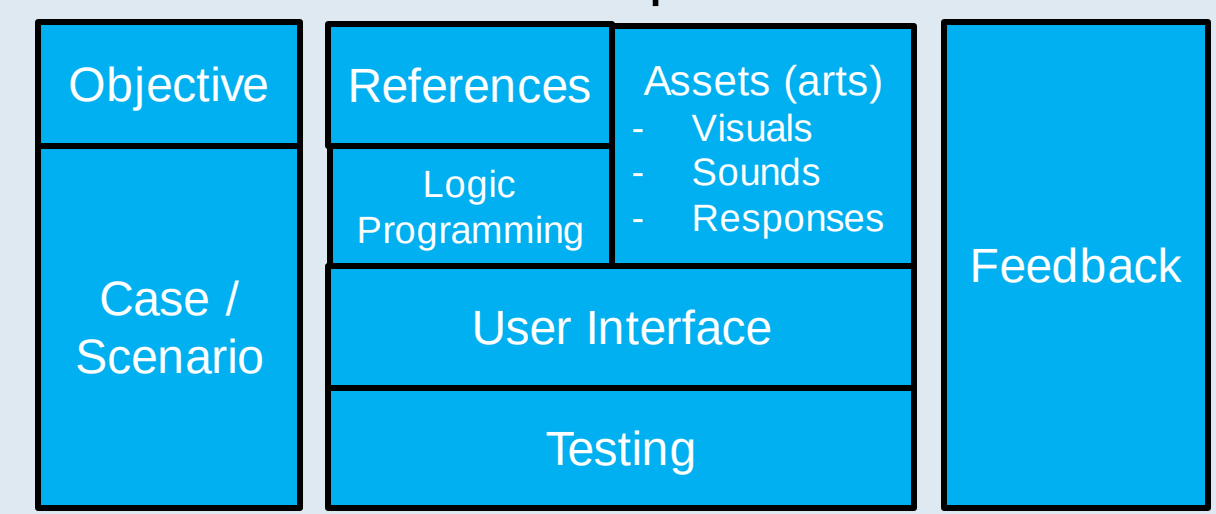
Feedback

1. What did you learn during the process?
2. What key items should you consider when creating or choosing games for nursing?

Debrief

Development

Serious Games Development Process



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Free Resources VGS

All Virtual Gaming Simulations Found in the Virtual Healthcare Experience and more will be added as they come available
https://de.ryerson.ca/games/nursing/hospital/

Mental Health Modules and VGS
https://de.ryerson.ca/games/nursing/mental-health/
Pediatric VGS
https://de.ryerson.ca/games/nursing/post-op/
Maternity Series Modules and VGS
https://de.ryerson.ca/games/nursing/maternity/
Prenatal VGS Only
https://de.ryerson.ca/games/nursing/maternity/prenatal/game/#/
L&D VGS Only
https://de.ryerson.ca/games/nursing/maternity/labour-and-delivery/game/#/
Post Partum VGS Only
https://de.ryerson.ca/games/nursing/maternity/postpartum/game/#/

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