Virtual Reality and Augmented Reality for Dental Education

Cortino Sukotjo DDS, Ph.D, MMSc, FACP
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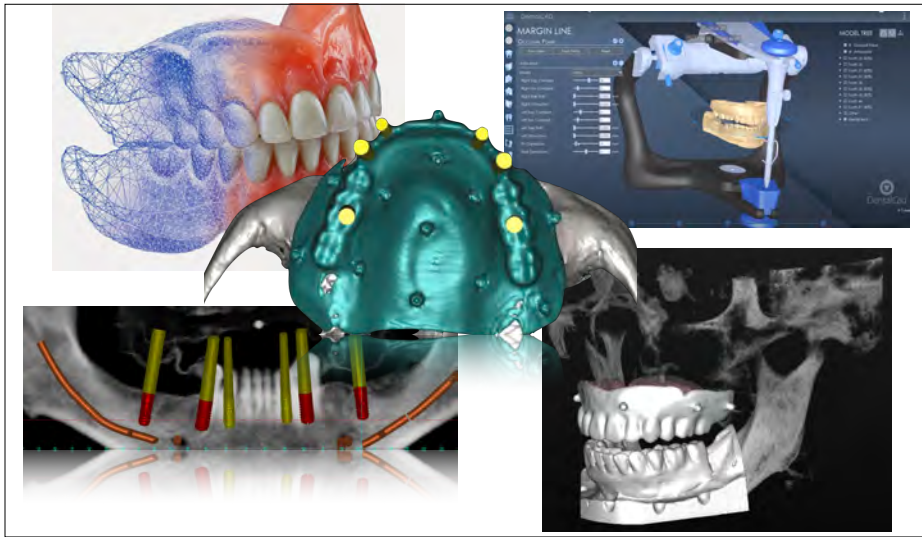
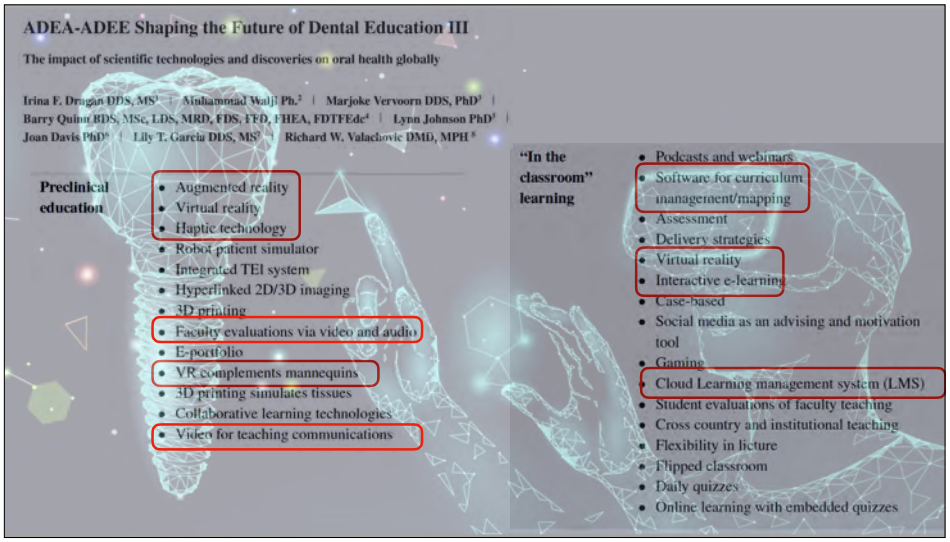
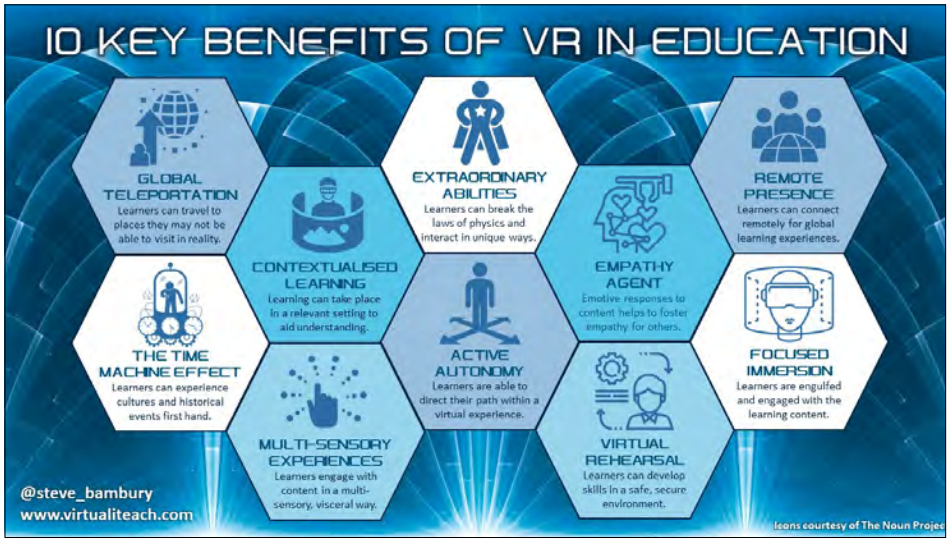
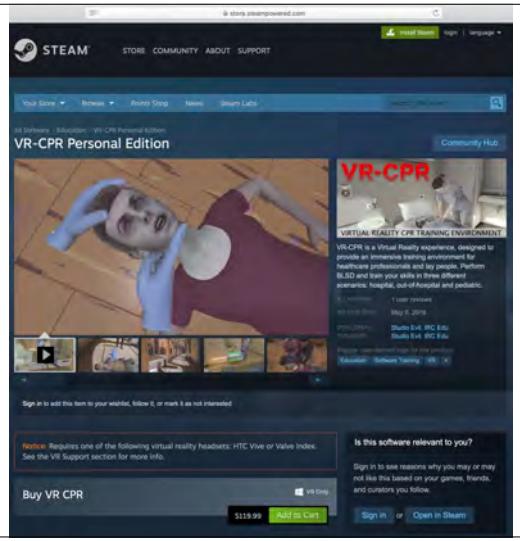
University of Illinois at Chicago, College of Dentistry




ADEA-ADEE Shaping the Future of Dental Education III
The impact of scientific technologies and discoveries on oral health globally
Irina F. Dragan DDS, MS[1] | Ainhammad Wajji Ph.[2] | Marjoke Vervoorn DDS, PhD[3] | Barry Quinn BDS, MSc, LDS, MRD, FDS, FFD, FHEA, FDTFEdc[4] | Lynn Johnson PhD[5] | Joan Davis PhD[6] | Lily T. Garcia DDS, MS[7] | Richard W. Valachovic DMD, MPH[8]
Preclinical education
Augmented reality
Virtual reality
Haptic technology
Robot patient simulator
Integrated TEI system
Hyperlinked 2D/3D imaging
3D printing
Faculty evaluations via video and audio
E-portfolio
VR complements mannequins
3D printing simulates tissues
Collaborative learning technologies
Video for teaching communications
"In the classroom" learning
Podcasts and webinars
Software for curriculum management/mapping
Assessment
Delivery strategies
Virtual reality
Interactive e-learning
Case-based
Social media as an advising and motivation tool
Gaming
Cloud Learning management system (LMS)
Student evaluations of faculty teaching
Cross country and institutional teaching
Flexibility in lecture
Flipped classroom
Daily quizzes
Online learning with embedded quizzes


10 KEY BENEFITS OF VR IN EDUCATION
GLOBAL TELEPORTATION
Learners can travel to places they may not be able to visit in reality.
EXTRAORDINARY ABILITIES
Learners can break the laws of physics and interact in unique ways.
REMOTE PRESENCE
Learners can connect remotely for global learning experiences.
CONTEXTUALISED LEARNING
Learning can take place in a relevant setting to aid understanding.
EMPATHY AGENT
Emotive responses to content helps to foster empathy for others.
THE TIME MACHINE EFFECT
Learners can experience cultures and historical events first hand.
ACTIVE AUTONOMY
Learners are able to direct their path within a virtual experience.
FOCUSED IMMERSION
Learners are engulfed and engaged with the learning content.
MULTI-SENSORY EXPERIENCES
Learners engage with content in a multi-sensory, visceral way.
VIRTUAL REHEARSAL
Learners can develop skills in a safe, secure environment.
@steve_bambury
www.virtualiteach.com
Icons courtesy of The Noun Project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VR-CPR
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Buy VR CPR
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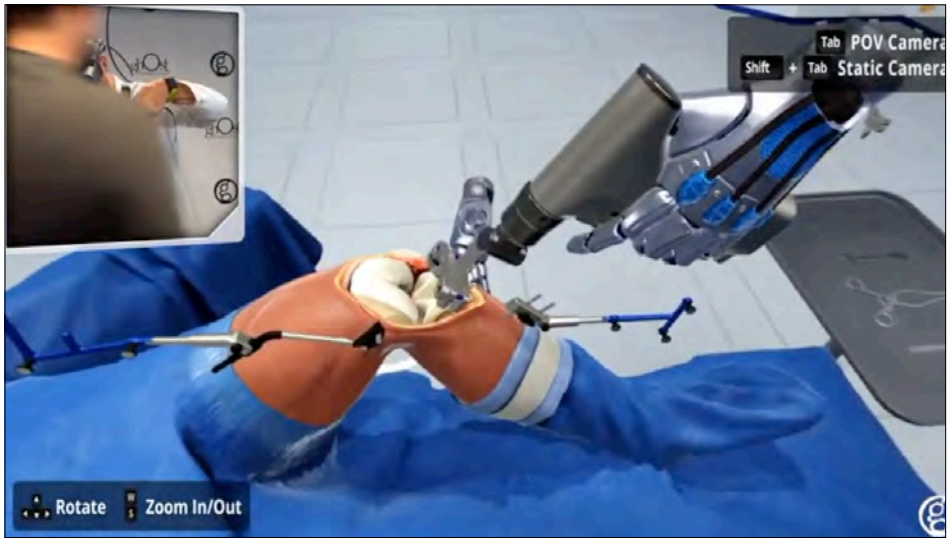
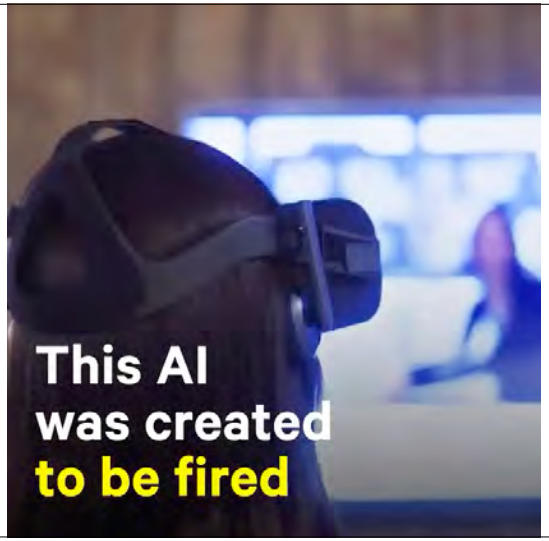
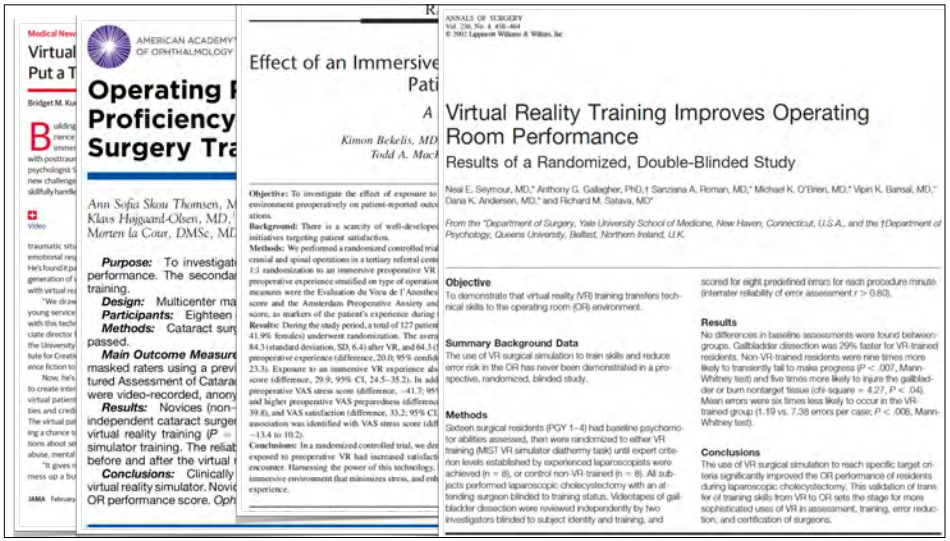
Children's Hospital Los Angeles
00:20
100/70 (80)
Doctor, what do you want to do?


BBC
NEWS
Coronavirus: Mixed reality headsets help medics treat Covid-19 patients
U.K. doctors use mixed reality to reduce contact with Covid-19 patients


Tab POV Camera
Shift + Tab Static Camera
Rotate
Zoom In/Out


This AI
was created
to be fired


Labster
Biology Simulations



Virtual Reality Training Improves Operating Room Performance

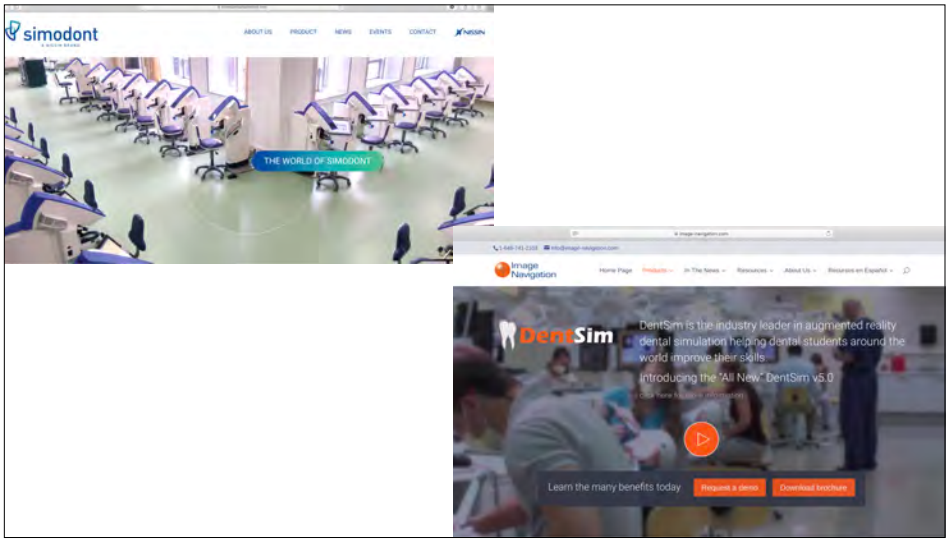
Results of a Randomized, Double-Blinded Study

Virtual education: Dental morphologies in a virtual teaching environment

Innovation in Response to the COVID-19 Pandemic Crisis

Disruptions during a pandemic: Gaps identified and lessons learned

- Time and Location dependent
- Machine dependent
- Parts dependent
- Rehearsal limitation
- Does not simulate clinical setting



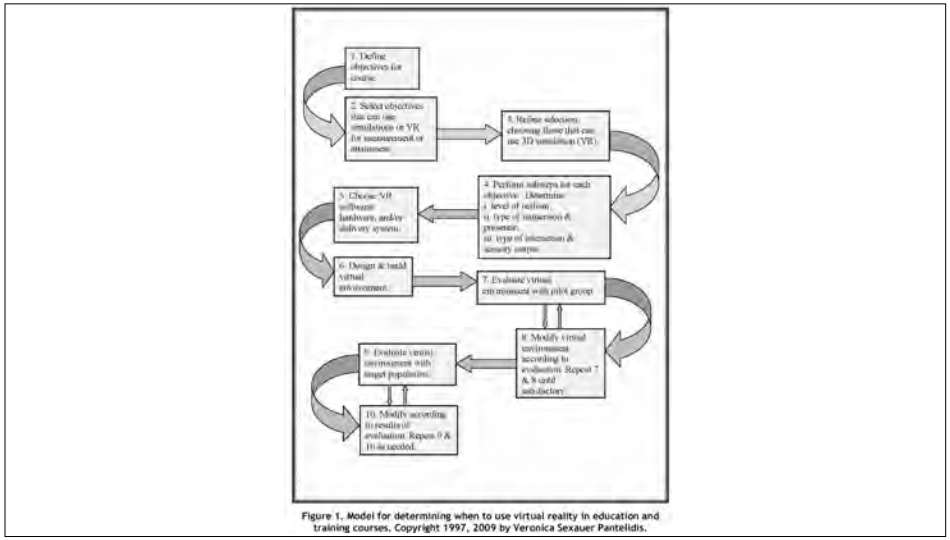
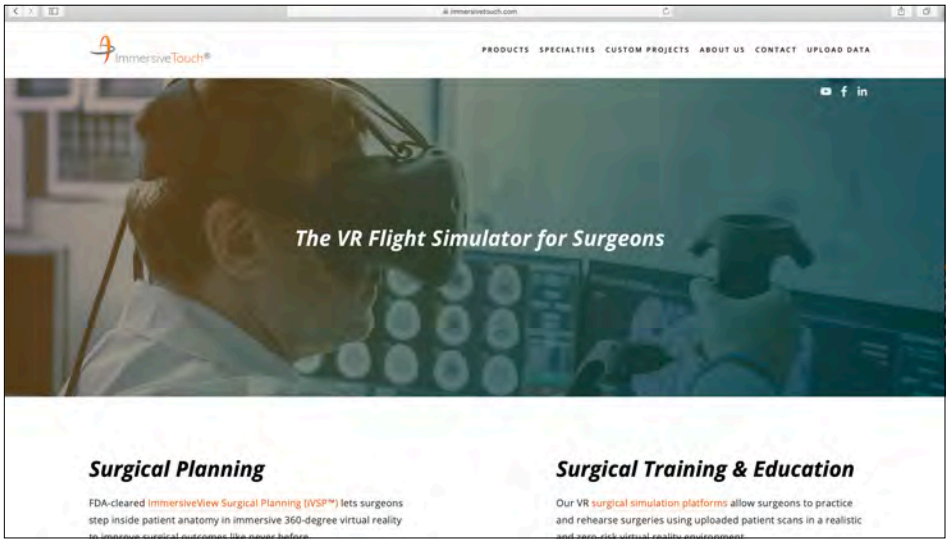
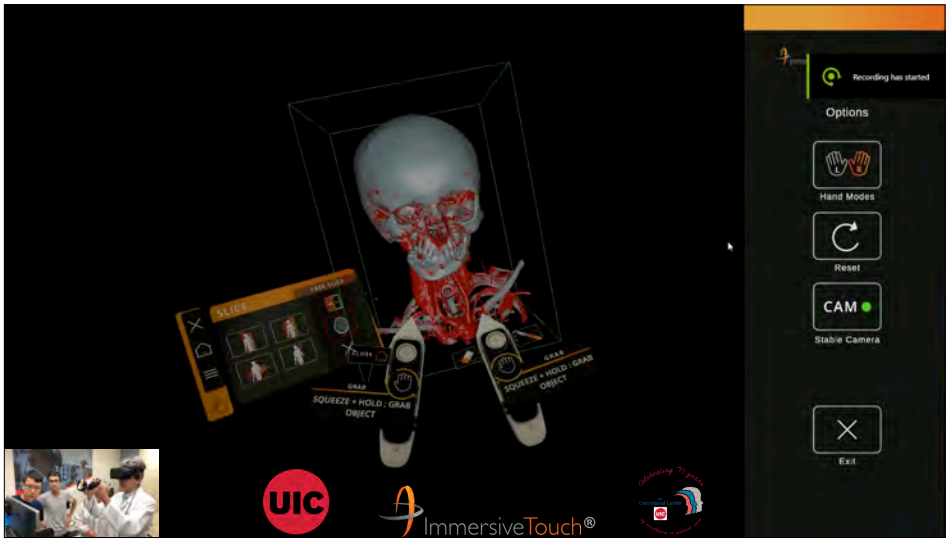


Figure 1. Model for determining when to use virtual reality in education and training courses. Copyright 1997, 2009 by Veronica Sexauer Pantelidis.



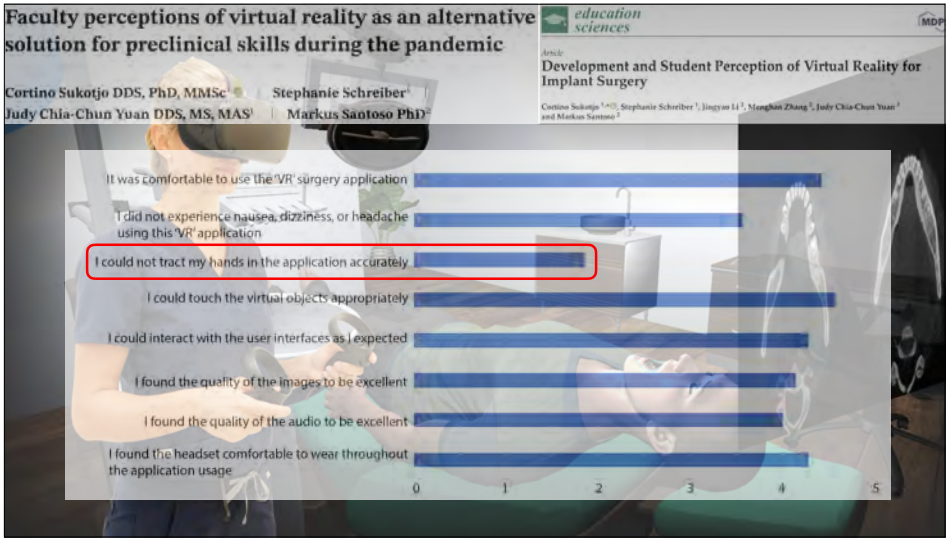


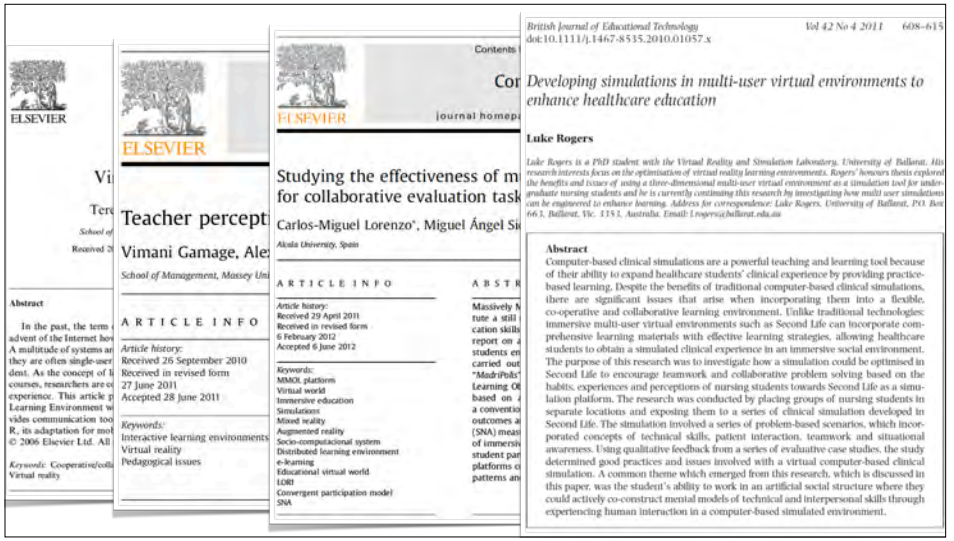
Single-user Dental Implant VR Simulation

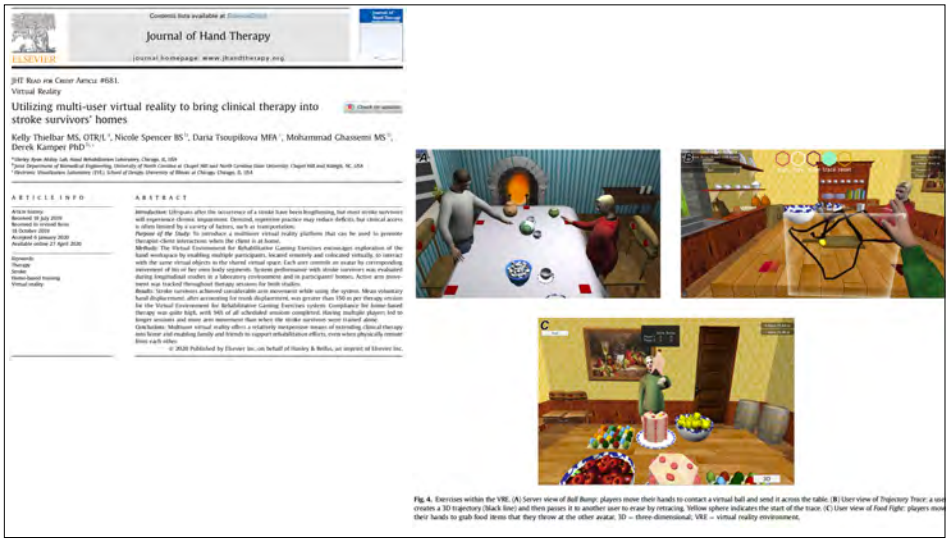
By:
Markus Santoso Ph.D & Cortino Sukotjo Ph.D

UIC

Single User







Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

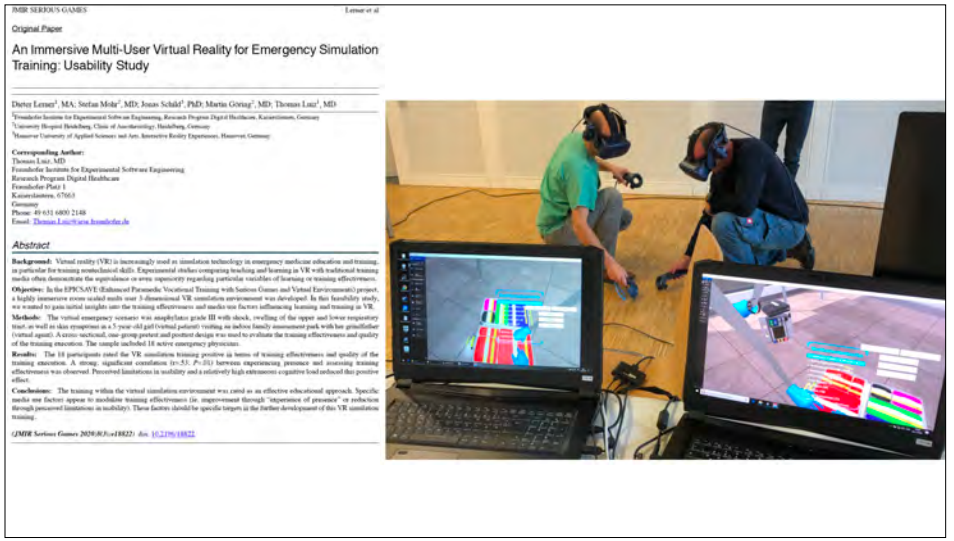
Utilizing multi-user virtual reality to bring clinical therapy into stroke survivors' homes

Kelly Thielbar MS, OTR/L[a], Nicole Spencer BS[b], Daria Tsoupikova MFA[c], Mohammad Ghassemi MS[b], Derek Kamper PhD[b,c]

ARTICLE INFO

ABSTRACT

Fig. 4. Exercises within the VRE. (A) Server view of *Ball Bump*: players move their hands to contact a virtual ball and send it across the table. (B) User view of *Trajectory Trace*: a user creates a 3D trajectory (black line) and then passes it to another user to erase by retracing. Yellow sphere indicates the start of the trace. (C) User view of *Food Fight*: players move their hands to grab food items that they throw at the other avatar. 3D = three-dimensional; VRE = virtual reality environment.



JMIR SERIOUS GAMES

Original Paper

An Immersive Multi-User Virtual Reality for Emergency Simulation Training: Usability Study

Dieter Lerner[1], MA; Stefan Mohr[2], MD; Jonas Schild[3], PhD; Martin Göring[2], MD; Thomas Luiz[1], MD

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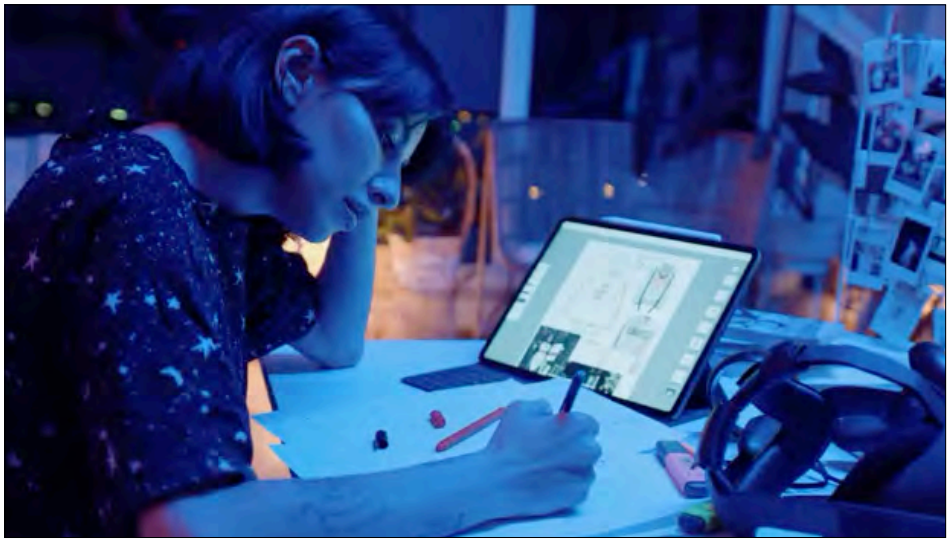
Email: Thomas.Luiz@iese.fraunhofer.de

Abstract

METAVERSE

METAVERSE (n.)
The virtual world that will usher in the next phase of internet

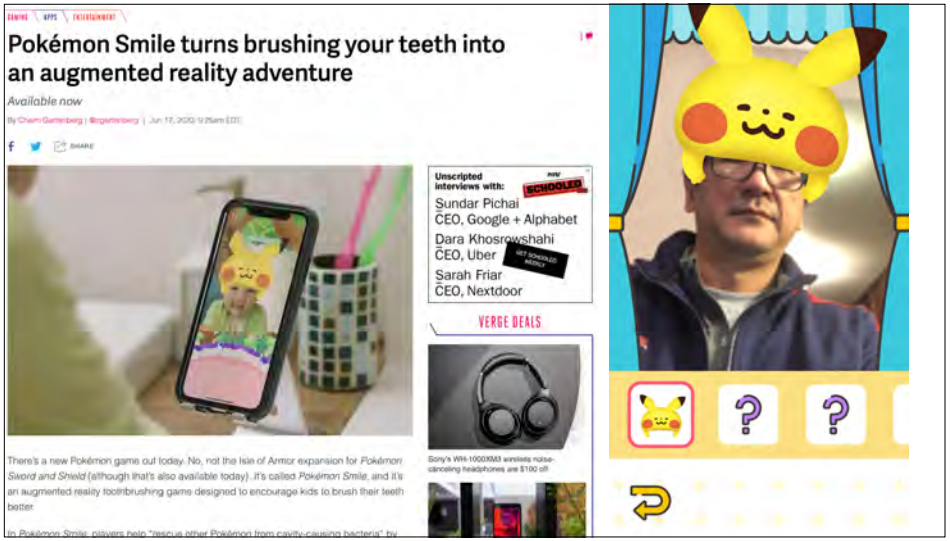


Multi-users Dental Implant VR Simulation

(with 2 Oculus Quests)

Markus Santoso Ph.D & Cortino Sukotjo Ph.D

Multi-User



Pokémon Smile turns brushing your teeth into an augmented reality adventure

Available now

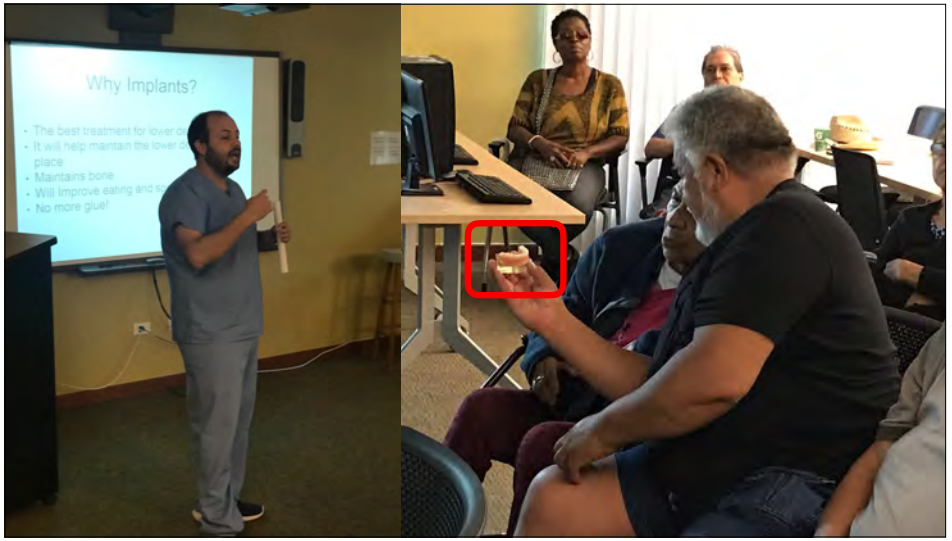
Unscripted interviews with:
Sundar Pichai
CEO, Google + Alphabet
Dara Khosrowshahi
CEO, Uber
Sarah Friar
CEO, Nextdoor

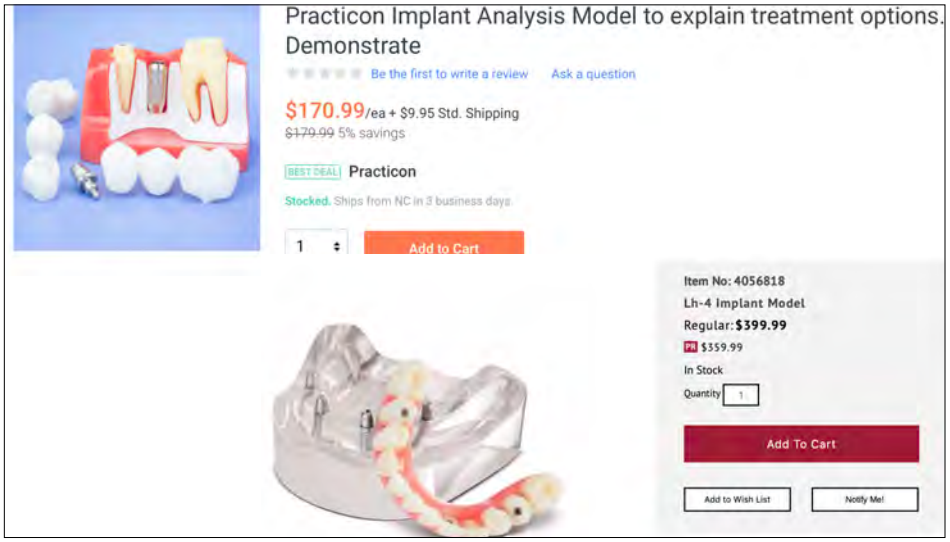
VERGE DEALS

Sony's WH-1000XM3 wireless noise-canceling headphones are $100 off

There's a new Pokémon game out today. No, not the Isle of Armor expansion for *Pokémon Sword and Shield* (although that's also available today). It's called *Pokémon Smile*, and it's an augmented reality toothbrushing game designed to encourage kids to brush their teeth better.

In *Pokémon Smile*, players help "rescue other Pokémon from cavity-causing bacteria" by

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PP $359.99
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Quantity
1
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eTypodont
AR
Augmented Reality
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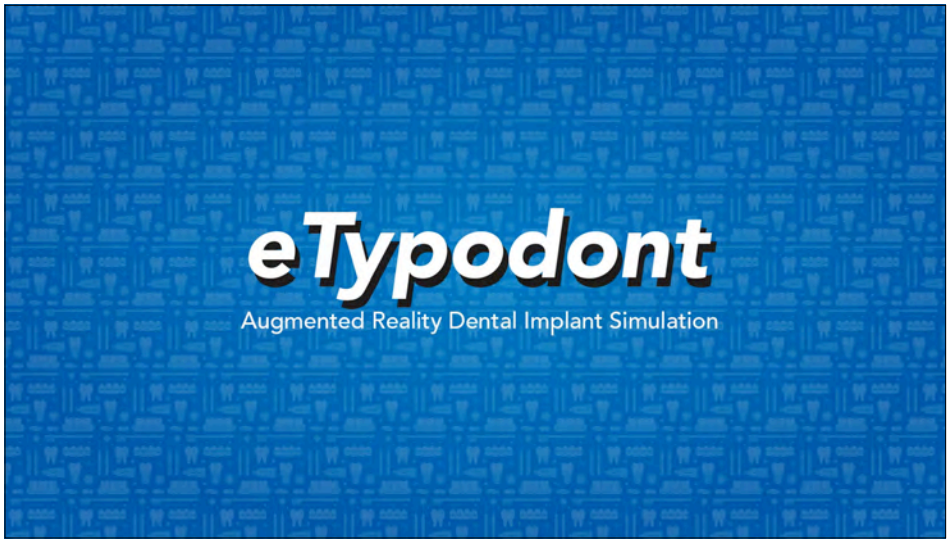
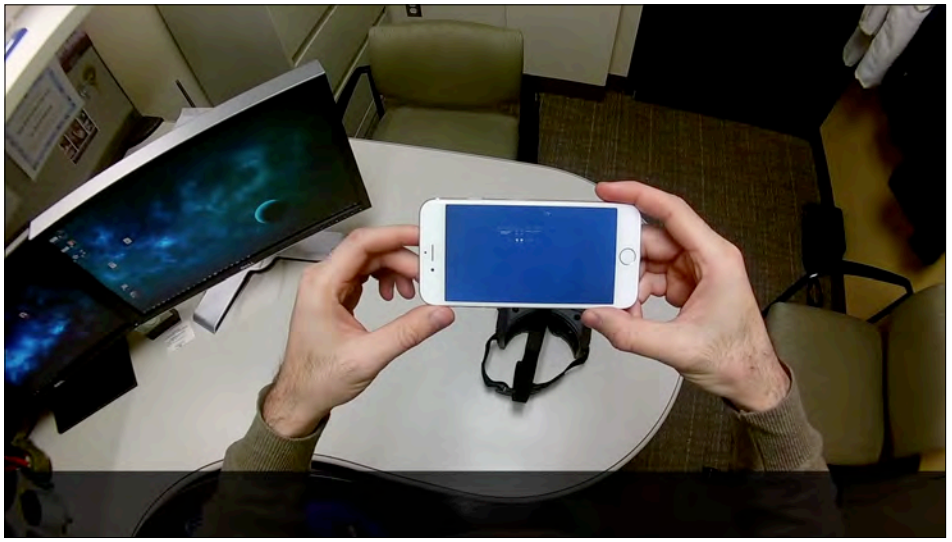

eTypodont
Augmented Reality Dental Implant Simulation

The use of Augmented Reality e-typodont to enhance patient's oral health literacy regarding dental Implant parts and treatment, a Randomized Controlled Study.

No	How would you rate your understanding of:	Typodont Increase (Mean ± SD)	Web Increase (Mean ± SD)	e-Typodont Increase (Mean ± SD)	p-Values
1	Your implant treatment?	0.6 ± 1.0[a]	1.0 ± 1.0[a,b]	1.3 ± 0.9[b]	0.021
2	Implant components?	0.8 ± 1.2	1.2 ± 1.0	1.6 ± 1.3	0.055
3	Implant treatment sequences?	0.8 ± 1.1[a]	1.1 ± 1.1[a,b]	1.5 ± 0.9[b]	0.028



VSP

Virtual Dental Standardized Patient

UIC

Cortino Sukotjo and Markus Santoso

VIRTUAL STANDARDIZED PATIENT

- **Standardized patients** are independent specialists trained to portray patient scenarios for the instruction and assessment of clinical skills of medical students, residents, fellows, and other diverse professionals.
  - Actors who receive rigorous training to maintain a consistent highly realistic portrayal
  - Give feedback to trainees on communication and interpersonal skills
  - Their use facilitates practice in critical thinking, patient safety, crisis management, team interaction, decision making and communication

CONVENTIONAL TRAINING METHODS

FACE-TO-FACE

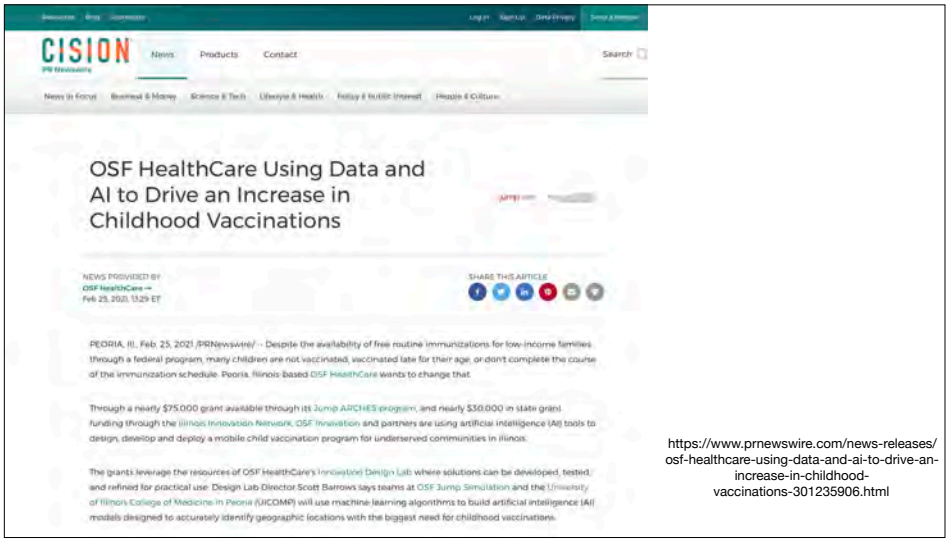
Required in person interactions between student dentist and patient

SITE DEPENDANT

Sessions take place on-site (usually in a laboratory or office)

Expensive

Money and time to train



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OSF HealthCare Using Data and AI to Drive an Increase in Childhood Vaccinations

NEWS PROVIDED BY
OSF HealthCare
Feb 25, 2021, 13:29 ET

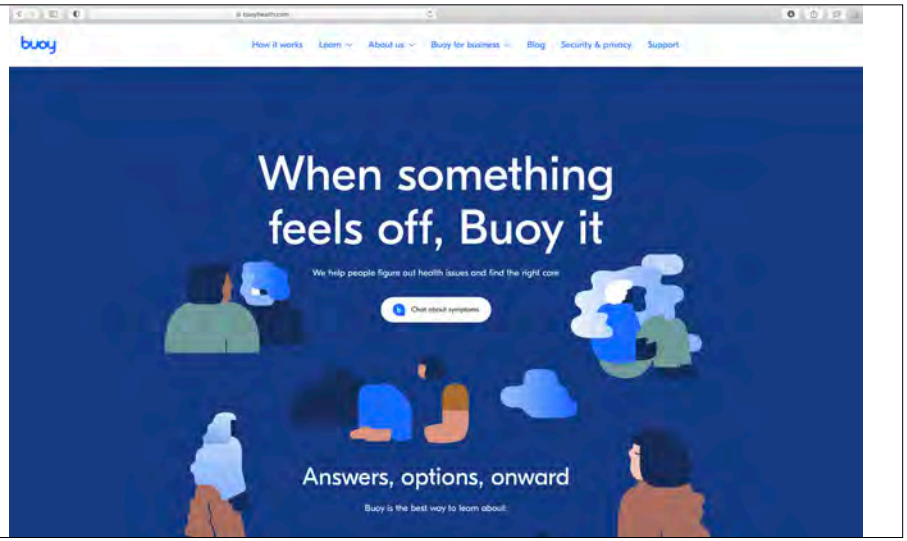
SHARE THIS ARTICLE

PEORIA, Ill., Feb. 25, 2021 /PRNewswire/ -- Despite the availability of free routine immunizations for low-income families through a federal program, many children are not vaccinated, vaccinated late for their age, or don't complete the course of the immunization schedule. Peoria, Illinois-based OSF HealthCare wants to change that.

Through a nearly $75,000 grant available through its Jump ARCHES program, and nearly $30,000 in state grant funding through the Illinois Innovation Network, OSF Innovation and partners are using artificial intelligence (AI) tools to design, develop and deploy a mobile child vaccination program for underserved communities in Illinois.

The grants leverage the resources of OSF HealthCare's Innovation Design Lab where solutions can be developed, tested, and refined for practical use. Design Lab Director Scott Barrows says teams at OSF Jump Simulation and the University of Illinois College of Medicine in Peoria (UICOMP) will use machine-learning algorithms to build artificial intelligence (AI) models designed to accurately identify geographic locations with the biggest need for childhood vaccinations.

https://www.prnewswire.com/news-releases/osf-healthcare-using-data-and-ai-to-drive-an-increase-in-childhood-vaccinations-301235906.html



buoy

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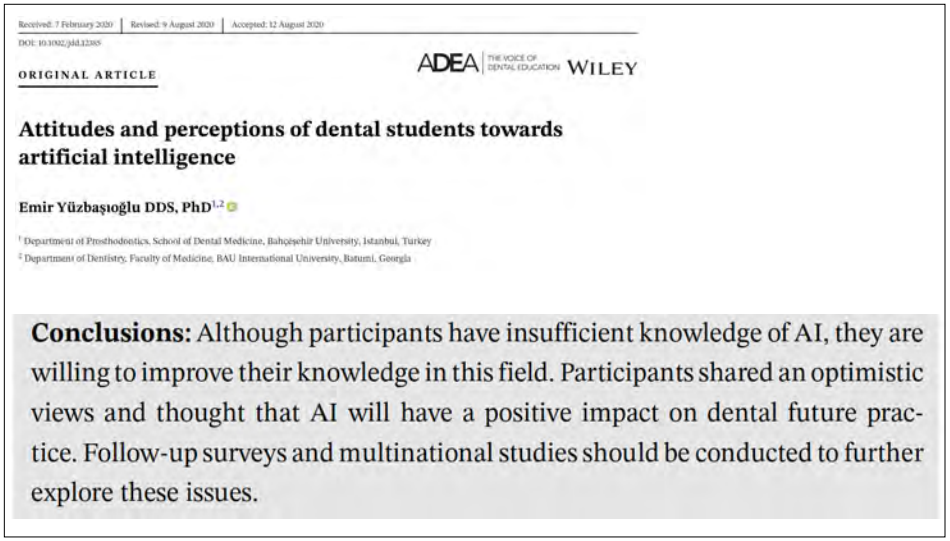
When something feels off, Buoy it

We help people figure out health issues and find the right care

Chat about symptoms

Answers, options, onward

Buoy is the best way to learn about:



Received: 7 February 2020 | Revised: 9 August 2020 | Accepted: 12 August 2020

DOI: 10.1002/jdd.12385

ORIGINAL ARTICLE

ADEA | THE VOICE OF DENTAL EDUCATION WILEY

Attitudes and perceptions of dental students towards artificial intelligence

Emir Yüzbaşıoğlu DDS, PhD[1,2]

[1] Department of Prosthodontics, School of Dental Medicine, Bahçeşehir University, Istanbul, Türkey

[2] Department of Dentistry, Faculty of Medicine, BAU International University, Batumi, Georgia

Conclusions: Although participants have insufficient knowledge of AI, they are willing to improve their knowledge in this field. Participants shared an optimistic views and thought that AI will have a positive impact on dental future practice. Follow-up surveys and multinational studies should be conducted to further explore these issues.

SCIENT

OPEN Deep Lea to Autom Periodont Periodont

OPEN Deep l predic

scientific reports

OPEN Artificial int in detecting joint osteoa on orthopan

PLOS ONE

RESEARCH ARTICLE

Predictors of tooth loss: A machine learning approach

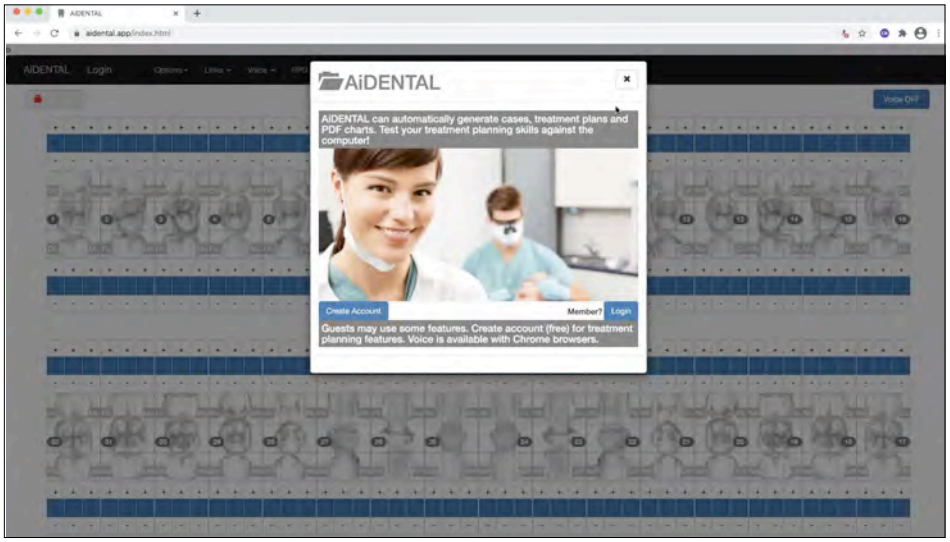
Abstract

Introduction

Methods

Results

Conclusions



Prediction of Teeth Central Width based on Facial Measurements using Machine Learning Algorithms

Cortino Sukotjo

Chandra Prasetyo Utomo

Merve Koseoglu

Funda Bayindir

Hatice Özdemir

Problem Statement

$Output\ y = CW$ $Input\ X = IAW, ICW, IPW, LCW, MCW$

Figure 1. Using mouth retractors to visualize entire width of maxillary central incisors.

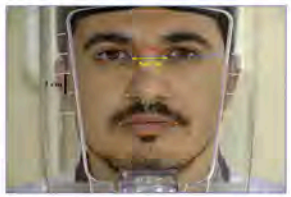


Figure 2. Immobilization of participant's head for photography using radiograph device. IAW, interalar width; ICW, intercommissural width; IPW, interpupillary width; LCW, interlateral canthus width; MCW, intermedial canthus width.

Given facial measurements X and teeth central width y, create a prediction model $f(X) = y$.

[Image Source] Özdemir H, Köseoğlu M. Relationship between different points on the face and the width of maxillary central teeth in a Turkish population. J Prosthet Dent. 2019 Jul;122(1):63-68.

Machine Learning Flow

IAW, ICW, IPW, LCW, MCW

Input → Feature Extractor → Features → Traditional ML Algorithm → Output → CW

Traditional Machine Learning Flow

Input → Deep Learning Algorithm → Output → CW

Deep Learning Flow

[Image Source] https://metacoder.ai/blog/2020/05/22/how-automation-changing-data-science-and-machine-learning/

ARTIFICIAL INTELLIGENCE

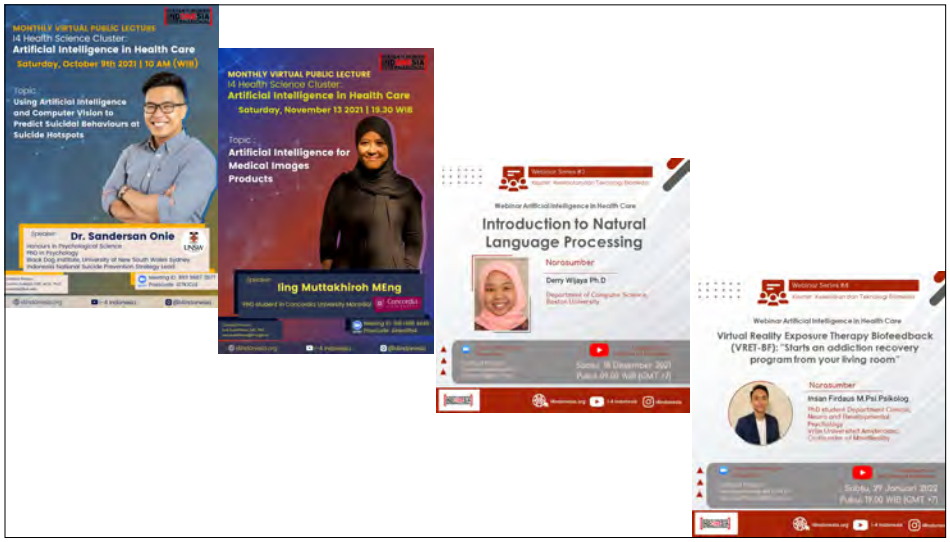
TO PREDICT DENTAL STUDENT ACADEMIC PERFORMANCE BASED ON PRE-UNIVERSITY RESULTS

BY: ADILAH SYAHIRAH BINTI ABDULLAH
AFIFAH MUNIRAH BINTI AHMAD AMIN

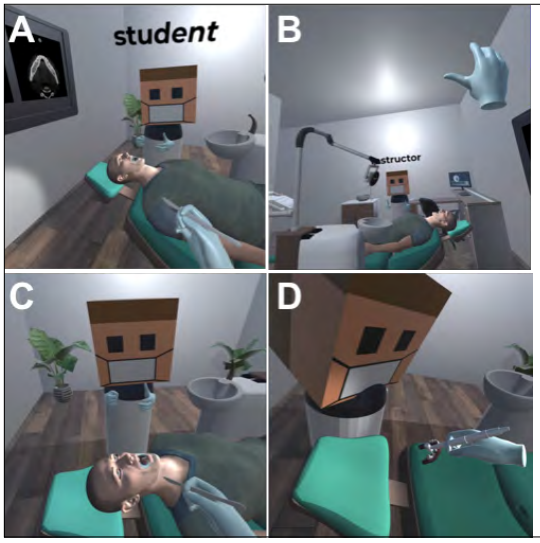
MAIN SUPERVISOR: **Assoc. Prof. Dr. Widya Lestari** (Oral Biology/ IDP)

CO-SUPERVISORS:

1. **Assoc. Prof. Cortino Sukotjo** (University Illinois at Chicago, College of Dentistry, US) (Prosthodontics / Dental Education)
2. **Chandra Prasetyo Utomo, M.S., PhD (Candidate)** (Universitas YARSI and The University of Queensland, Australia) (Fakultas Teknologi Informasi)
3. **Asst. Prof. Dr. Azlini Ismail** (Fundamental Dental and Medical Sciences (BMS))



NEXT?



V2 Features:

- *Web Browser*
- *PDF*
- *Meeting room*
- *White board*

"Comics as an educational tool to increase oral health literacy for children and caregiver"

Komikgigiku

"Comic + Augmented Reality"

Komikgigiku

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Komikgigiku

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Komikgigiku

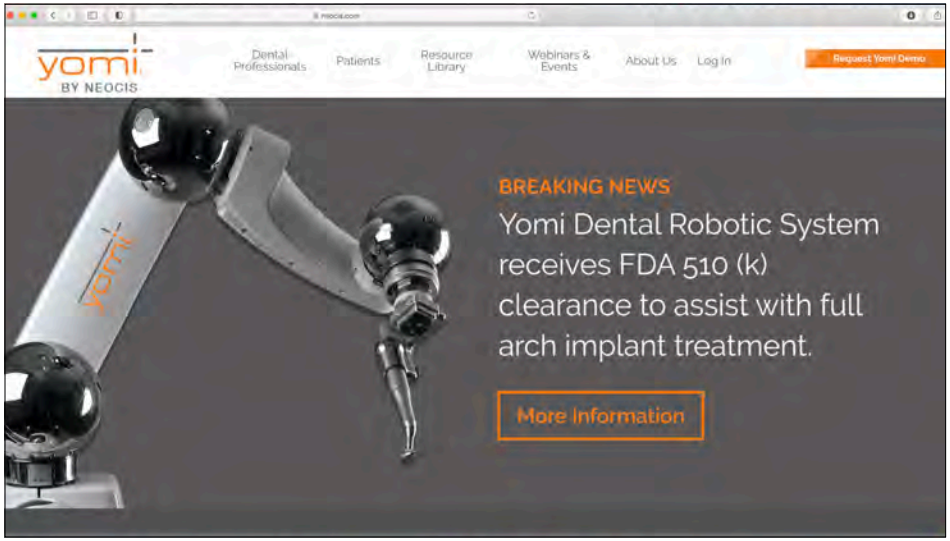

Figure 1. A, Robotic system. B, Robotic system draped and in use.

Figure 4. A, Preoperative scan with plan and B, postoperative scan of final implant positions. Combining these 2 images allows calculation of deviatio between plan and final position in 3D.

UIC

Stephanie Schreiber
Dominique Bertucci
Steven Steiner
Jeanne Le
Betty Shahin
Judy Yuan

Jingyao Li,
Menghan Zhan
Adithya Gowthaman
Austin Stanbury
Bingyu Li
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Linda Kirova
Patrick Molen
Jordan Smith

Markus Santoso Ph.D