



Realidad Virtual,
Aumentada y Mixta en el
Entrenamiento de
Profesionales de Salud

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VT-IE/M

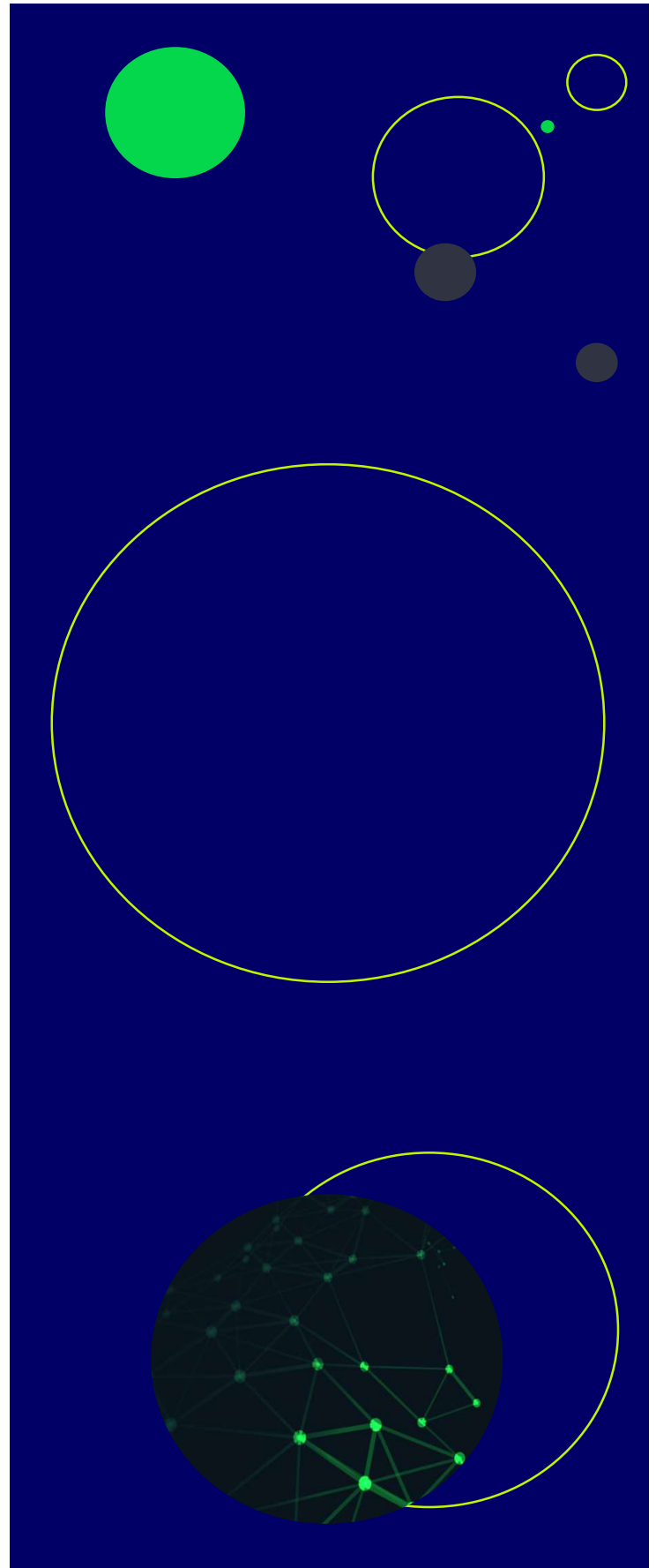
Vigilancia Tecnológica - Inteligencia Estratégica y
de Mercados

Información como herramienta competitiva e innovación

En un entorno cada vez más dinámico y competitivo, la capacidad de anticipar y responder eficazmente a los cambios en la ciencia, la tecnología y en el mercado, se ha convertido en un factor crítico para el éxito organizacional. En este contexto, la vigilancia tecnológica e inteligencia estratégica y competencia de mercado emerge como una herramienta fundamental para detectar, analizar y sintetizar información relevante y pertinente en el corto y mediano plazo que facilite la toma de decisiones estratégicas informadas.

El presente documento establece los resultados de un programa integral diseñado para fortalecer las capacidades de las organizaciones. Su propósito es brindar apoyo tanto a la industria local como al sector público, facilitando la identificación de tendencias emergentes, oportunidades de innovación o amenazas potenciales.

En resumen, se busca potenciar la capacidad de las organizaciones para generar desarrollos innovativos y crear ventajas competitivas que impulsen el crecimiento económico y social de la región.



1. Descripción del sector

La Realidad Virtual sumerge al usuario en un entorno digital generado por computadora que simula un ambiente donde se integra al usuario a través de gafas, auriculares, guantes o trajes para el cuerpo. La Realidad Aumentada permite al usuario interactuar con elementos reales del ambiente y con elementos virtuales añadidos. La Realidad Mixta combina ambos sistemas para crear un modelo 3D de la realidad y sobre este superponer información virtual, creando un ambiente único para el desarrollo de actividades que de otro modo no serían posibles.

Una de las principales aplicaciones de las realidades virtuales, aumentadas y mixtas en el sector salud es la formación de profesionales. Por medio de estas tecnologías se pueden practicar en forma segura, controlada y realista los conocimientos teóricos en los escenarios 3D elegidos según la temática a aprender y las condiciones del/la estudiante.

2. Estado de situación actual de la RV, RA y RM en formación del personal de salud

2. A. Empresas que trabajan en RV, RA y RM en Formación de personal de salud

1. Clínica El Castaño, San Juan, Argentina: la Clínica está desarrollando, junto a investigadores del INAUT (Instituto de Automática, un laboratorio de doble dependencia del CONICET y la UNSJ) y con fondos de la Fundación Dr. Manuel Sadosky, un sistema integrado de formación de personal de salud para la manipulación de la vía aérea. <https://youtu.be/lqbO-EBMpz8>
2. VIAR Inc., WA, EE.UU.: esta empresa ofrece servicio de entrenamiento general, incluyendo a trabajadores de salud, utilizando Realidad Virtual. Su sistema Viar360 permite crear e implementar escenarios basados en videos y fotos de 360° <https://www.viar360.com/>
3. Orama VR SA, Creta, Grecia: fundada en 2016, esta empresa se propone acelerar la transición hacia el entrenamiento médico con Realidad Mixta ofreciendo la plataforma de software MAGES™ SDK para crear simulaciones de realidad mixta de alta fidelidad 8 veces más rápido y por un octavo del costo de las plataformas actuales. <https://oramavr.com/>

2. B. Universidades que trabajan en el tema

1. University of Copenhagen, Copenhagen, Dinamarca: El Laboratorio de Aprendizaje Virtual (Virtual Learning Lab, VLL) investiga sobre el aprendizaje con tecnologías inmersivas tales

como realidad virtual y aumentada con el objetivo de entender cómo las personas aprenden, combinando investigaciones de laboratorio con experimentos en ambientes educativos reales. <https://psychology.ku.dk/vll/about/>

2. University of Maryland, College Park, Maryland , Estados Unidos: contiene el Maryland Blended Reality Center (MBRC) un centro multidisciplinario lanzado en 2017 para desarrollar herramientas computacionales basadas en tecnologías inmersivas para ser usadas en módulos de enseñanza y entrenamiento innovadores en medicina de emergencia y salud. <https://mbrc.umd.edu/>
3. India Institutes of Medical Sciences (AIIMS), Nueva Delhi, India: utilizan la plataforma Mission Rehearsal® VR de ImmersiveTouch para convertir los datos 2D en un gemelo digital del paciente, proporcionando a los cirujanos la posibilidad de planificar la operación previamente. Por su parte, la plataforma ImmersiveSim transporta virtualmente a los estudiantes de medicina al centro de una sala de operaciones para ensayos de procedimientos, mejora del rendimiento clínico y capacitación. <https://www.prnewswire.com/news-releases/immersivetouch-metaverse-now-available-for-surgeons-in-india-301459964.html>

2. C. Países que trabajan el tema

1. Estados Unidos de América: Un ejemplo de cuán extendido está el uso de RV, RA y RM en los Estados Unidos es el ranking de las 25 universidades públicas que investigan o utilizan esas tecnologías para enseñar: <https://www.animationcareerreview.com/articles/top-25-public-augmentedvirtual-reality-arvr-schools-us-2021-college-rankings>
2. China: es el mercado de realidad mixta y realidad virtual más importante del mundo, debido a la rápida adopción por parte de las empresas inmobiliarias y de otras industrias, gracias a que los chinos están extremadamente entusiasmados con las tecnologías emergentes. Por esto, los inversores chinos están seguros de que la mayoría de los usuarios en el futuro accederán a la realidad virtual a través de sus teléfonos inteligentes, en lugar de gafas conectadas a una computadora o consola. Para 2026 el plan de acción de China es convertirse en el líder mundial en la industria de la realidad virtual, con un ecosistema industrial próspero, con empresas chinas altamente competitivas en todo el mundo. China tiene como objetivo producir 25 millones de dispositivos de realidad virtual. <https://marketingtochina.com/virtual-reality-industry-china/>
3. Alemania: es el segundo ecosistema más grande en Europa respecto a RV/RA según la VR/AR Association (VRARA) <https://www.thevrara.com/germany>

3. Monitoreo

3. A. Palabras clave

Español	Inglés	Siglas/Acrónimos
Realidad Virtual	Virtual Reality	RV, VR
Realidad Aumentada	Augmented Reality	RA, AR
Realidad Mixta	Mixed Reality	RM, MR
Educación	Education	Ed
Aprendizaje	Learning	
Entrenamiento	Training	
Profesionales de salud	Health professionals, health workers	
Personal de salud	Health personnel	

3. B. Ecuaciones

- ("Realidad Virtual" AND "Entrenamiento") AND ("Profesionales de salud" OR "Personal de Salud")
- ("Realidad Mixta" AND "Personal de Salud") AND ("Educación" OR "Aprendizaje")
- (VR OR AR OR MR) AND ("Training" AND "Health workers")
- "Virtual Reality" AND "Training" AND "Health workers"

3. C. Hallazgos

Describir los principales hallazgos a partir de novedades encontradas como insumos para el desarrollo del trabajo (un total de 15 novedades de variedad de fuentes, países).

TÍTULO	Immersive learning laboratory in health and nursing: learning biosafety in a virtual world
RESUMEN	<p>Objectives: to develop a virtual simulation and learning laboratory in an immersive virtual world that enables students, nursing professionals as well as health professionals to experiment, reflect and contextualize biosafety actions, infection protection concepts and universal precautions.</p> <p>Methods: description of the development of the Immersive Learning Laboratory in Health and Nursing (LIASE) with a focus on biosafety, having as theoretical basis Kolb's experimental learning cycle and the OpenSimulator platform.</p>
AÑO/PAÍS	2021, Brasil

AUTOR	Karen Cardoso, Milton Antônio Zaro, Ana Maria Muller de Magalhães, Liane Margarida Rockenbach Tarouco
ENLACE	https://www.scielo.br/j/reben/a/gJTQwdFdhbvR35bnWdWmQVN/?lang=en#

TÍTULO	Pragati - A Mobile Based Virtual Reality (VR) Platform to Train and Educate Community Health Workers
RESUMEN	Accredited Social Health Activists (ASHAs) are essential link to healthy communities in resource-constrained environments. However, they are insufficiently trained to solve community health challenges. In this paper, we present Pragati - a mobile-based Virtual Reality (VR) platform to train and educate ASHAs in rural Assam, India. Mobile based VR platform was chosen due to its ability to increase focus, attention and learnability among users. We developed 3 modules on maternal and child healthcare. Modules were presented via audio-visual interface in local Assamese language. This paper presents the design of Pragati, user interactions, technology implementations and future directions of our study.
AÑO/PAÍS	2017, India
AUTOR	Keyur Sorathia, Kshipra Sharma, Shimmila Bhowmick, Preetham Kamidi
ENLACE	https://link.springer.com/chapter/10.1007/978-3-319-68059-0_51

TÍTULO	Augmented Reality for Health and Safety Training Program Among Healthcare Workers: An Attempt at a Critical Review of the Literature
RESUMEN	The aim of this research is to summarize the current knowledge regarding the application of augmented reality in occupational safety training programs, particularly in the healthcare sector. Three databases (PubMed, Scopus, Web of Science) were searched for articles published between 1992 and 2017 on health and safety training for healthcare professionals, with particular attention to the use of augmented reality; for this purpose, a search string was created. Augmented reality represents a great opportunity in the training of health workers, being able to implement the workers' knowledge and perception of the

	risks. It is therefore important to have a multidisciplinary approach that manages the opportunities and risks of these new tools in a well-defined framework, increasingly taking advantage of the former and reducing the latter, to guide health care workers in adopting correct and safe behaviours that favour the reduction of injuries and occupational diseases.
AÑO/PAÍS	2018, Italia
AUTOR	Anna Rita Corvino, Elpidio Maria Garzillo, Paola Arena, Arcangelo Cioffi, Maria Grazia Lourdes Monaco, Monica Lamberti
ENLACE	https://link.springer.com/chapter/10.1007/978-3-030-02053-8_108

TÍTULO	Feasibility of virtual reality based training for optimising COVID-19 case handling in Uganda
RESUMEN	Epidemics and pandemics are causing high morbidity and mortality on a still-evolving scale exemplified by the COVID-19 pandemic. Infection prevention and control (IPC) training for frontline health workers is thus essential. However, classroom or hospital ward-based training portends an infection risk due to the in-person interaction of participants. We explored the use of Virtual Reality (VR) simulations for frontline health worker training since it trains participants without exposing them to infections that would arise from in-person training. It does away with the requirement for expensive personal protective equipment (PPE) that has been in acute shortage and improves learning, retention, and recall. This represents the first attempt in deploying VR-based pedagogy in a Ugandan medical education context.
AÑO/PAÍS	2022, Uganda
AUTOR	Paul Buyego, Elizabeth Katwesigye, Grace Kebirungi, Mike Nsubuga, Shirley Nakyejwe, Phillip Cruz, Meghan C. McCarthy, Darrell Hurt, Andrew Kambugu, Joseph Walter Arinaitwe, Umaru Ssekabira, Daudi Jjingo
ENLACE	https://link.springer.com/article/10.1186/s12909-022-03294-x

TÍTULO	How, for Whom, and in Which Contexts or Conditions Augmented and Virtual Reality Training Works in Upskilling Health Care Workers: Realist Synthesis
RESUMEN	Using traditional simulators (eg, cadavers, animals, or actors) to upskill health workers is becoming less common because of ethical issues, commitment to patient safety, and cost and resource restrictions. Virtual reality (VR) and augmented reality (AR) may help to overcome these barriers. However, their effectiveness is often contested and poorly understood and warrants further investigation.
AÑO/PAÍS	2022, Reino Unido
AUTOR	Norina Gasteiger, Sabine N van der Veer, Paul Wilson, Dawn Dowding
ENLACE	https://games.jmir.org/2022/1/e31644

TÍTULO	Virtual reality for medical and nursing training in low- and middle-income countries
RESUMEN	This paper reviews the potential for the use of new low-cost Virtual Reality (VR) technology for conducting medical simulation training in low- and middle-income countries (LMICs). VR has been used in medical simulation training for many years but has traditionally been very expensive and requiring large machines that would be difficult to set up and maintain in LMICs. However, new advances in computer technology have enabled a new generation of consumer-focused VR hardware that offers the potential for implementation in LMICs. Our research team based in Oxford and Kenya developed a VR training scenario for the Life Saving Instruction for Emergencies (LIFE) project. We tested LIFE:VR with healthcare workers in Kenya to establish the potential feasibility and acceptability of low-cost VR for medical simulation training. We found that healthcare workers were enthusiastic about the approach but the systems we tested had a number of technical limitations such as requiring powerful laptop computers and the installation of laser tracking base-stations that would limit scale up. However, newly announced hardware from major VR manufacturers appear to address these technical issues and will continue to reduce the costs of devices increasing the potential for wider adoption in LMICs.
AÑO/PAÍS	2019, Kenia y Reino Unido

AUTOR	Naomi Muinga, Chris Paton
ENLACE	https://pathwayscommission.bsg.ox.ac.uk/sites/default/files/2019-09/virtual_reality_for_medical_and_nursing_training_.pdf

TÍTULO	Meta Touts Metaverse's Potential for Job Training and Education
RESUMEN	Meta Platforms Inc. is hoping to revive interest in the metaverse by pitching it as a tool to help train workforces, showing the social media giant isn't backing down on its virtual reality ambitions even as artificial intelligence takes center stage.
AÑO/PAÍS	2023, EE.UU.
AUTOR	Jackie Davalos
ENLACE	https://www.bloomberg.com/news/articles/2023-05-16/meta-touts-metaverse-s-potential-for-job-training-and-education#xj4y7vzkg

TÍTULO	Apple Will Take Scattershot Approach to Pitching AR/VR Headset
RESUMEN	Apple is taking a scattershot approach to the upcoming Reality headset's features, hoping that a wide variety of options will get consumers to try the product. Also: The company's Apple Card savings account finally launches, its first stores open in India, and there are new details on the headset's charging system.
AÑO/PAÍS	2023, EE.UU.
AUTOR	Mark Gurman
ENLACE	https://www.bloomberg.com/news/newsletters/2023-04-23/apple-s-ar-vr-headset-plans-ipad-apps-fitness-sports-viewing-gaming-music-lgtgopgx

TÍTULO	Virtual Reality Medical Training: Another Healthcare Revolution?
RESUMEN	Virtual reality in the healthcare industry is already being used effectively to train medical students, new surgeons and help medical professionals refresh their skills. As Virtual Reality is rocking in the field of technology and entertainment, health sectors are also finding new and innovative ways to utilize VR systems over old-school training techniques.
AÑO/PAÍS	2017, EE.UU.
AUTOR	Unimersiv.com
ENLACE	https://unimersiv.com/virtual-reality-medical-training-healthcare/

TÍTULO	Virtual Reality Training For Healthcare Professionals
RESUMEN	Emerging changes in health-care delivery are having a significant impact on the structure of health-care professionals' education. Today it is recognized that medical knowledge doubles every 6-8 years, with new medical procedures emerging every day. While the half-life of medical information is so short, the average physician practices 30 years and the average nurse 40 years. Continuing education thus represents an important challenge to face. Recent advances in educational technology are offering an increasing number of innovative learning tools. Among these, Virtual Reality represents a promising area with a high potential of enhancing the training of healthcare professionals.
AÑO/PAÍS	N/D, EE.UU.
AUTOR	Viar360.com
ENLACE	https://www.viar360.com/virtual-reality-training-for-healthcare-professionals/

TÍTULO	VR training for healthcare workers on the front line and in the classroom
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RESUMEN	In this critical time, virtual simulations offer the next best thing to real patients, helping medical professionals and students sharpen their skills and learn new ones.
AÑO/PAÍS	2020, EE.UU.
AUTOR	Stephanie Walden
ENLACE	https://garage.hp.com/us/en/innovation/covid19-vr-training-nurses-healthcare.html

TÍTULO	How VR will rewire the Indian Medical Education
RESUMEN	What's new? It's the question asked all the time by academics, researchers as well as policymakers. In a fast-moving world, the answer has to be good. Stanford University has a good reply. There was a recent report in a business publication about how Stanford University is embracing virtual technology to train doctors and surgeons. The University has set up a Neurological Simulation and Virtual Reality Centre.
AÑO/PAÍS	2019, India
AUTOR	healthcareexecutive.in
ENLACE	https://www.healthcareexecutive.in/blog/how-vr-will-rewire-the-indian-medical-education

TÍTULO	How VR is Changing Healthcare Education & Training: Latest News
RESUMEN	Scouring the web for the best medical simulation content we have come across numerous articles in the past month which focus on Virtual Reality (VR) technologies in Medicine and Healthcare that we are sharing here today. VR is a crucial technology for medical simulation in that it will help to bridge the gap between classroom experiences and high stakes high-fidelity simulation experiences which are extremely expensive to operate. In the future, VR

	headsets will enable learners to plug in from almost anywhere, to train through any scenario with an endless number of participants located all over the world. And all in real-time with the most advanced graphics and psychologically proven learning models which humans have ever seen. The sooner we understand this future reality is a given, the sooner we can grasp it and make it a reality now!
AÑO/PAÍS	2019, EE.UU.
AUTOR	Lance Baily
ENLACE	https://www.healthysimulation.com/18769/vr-healthcare-training/

TÍTULO	How VR in Healthcare Delivers Pandemic Education and Outreach
RESUMEN	Virtual reality solutions give medical schools and healthcare organizations a new way to teach clinicians, patients and the public.
AÑO/PAÍS	2020, EE.UU.
AUTOR	Calvin Hennick
ENLACE	https://healthtechmagazine.net/article/2020/10/how-vr-healthcare-delivers-pandemic-education-and-outreach

TÍTULO	A Review on Virtual Reality Skill Training Applications
RESUMEN	This study aimed to discuss the research efforts in developing virtual reality (VR) technology for different training applications. To begin with, we describe how VR training experiences are typically created and delivered using the current software and hardware. We then discuss the challenges and solutions of applying VR training to different application domains, such as first responder training, medical training, military training, workforce training, and education. Furthermore, we discuss the common assessment tests and evaluation methods used to validate VR training effectiveness. We conclude the article by discussing

	possible future directions to leverage VR technology advances for developing novel training experiences.
AÑO/PAÍS	2021, EE.UU.
AUTOR	Biao Xie, Huimin Liu, Rawan Alghofaili, Yongqi Zhang, Yeling Jiang, Flavio Destri Lobo, Changyang Li, Wanwan Li, Haikun Huang, Mesut Akdere, Christos Mousas, Lap-Fai Yu ¹
ENLACE	https://www.frontiersin.org/articles/10.3389/frvir.2021.645153/full

TÍTULO	CN107067856B - Medical simulation training system and method
RESUMEN	The invention discloses a medical simulation system and a method, wherein the system comprises: the object model building module is used for collecting three-dimensional model data of a specific part of a human body and building a corresponding three-dimensional model object based on the collected three-dimensional model data; a model database storing three-dimensional model object data; the sensor tracking module is used for acquiring operation data of a user on the three-dimensional model; the data processing module is used for processing the acquired data to obtain shape data of the three-dimensional model and operation data of the three-dimensional model by a user and outputting the shape data and the operation data; the image generation module generates a three-dimensional image comprising simulation operation result information according to shape data of the three-dimensional model and operation data of a user; and the display module is used for displaying and outputting the three-dimensional image for a user to check the simulation operation result. The system and the method of the embodiment have strong immersion, simulate real medical scenes to the maximum extent, and reduce the cost of clinical teaching and of surgical operations, intravenous injection and the like.
AÑO/PAÍS	2020, China
AUTOR	Goertek Techology Co Ltd
ENLACE	https://patents.google.com/patent/CN107067856B

TÍTULO	CN114049808A - Emergency knowledge training system based on virtual reality
RESUMEN	The embodiment of the present application provides a virtual reality-based emergency knowledge training system. In order to provide a basic understanding of some aspects of the disclosed embodiments, a brief summary is given below. This summary is not intended to be an extensive review, nor is it intended to identify key/critical elements or delineate the scope of protection of these embodiments. Its sole purpose is to present some concepts in a simplified form as a prelude to the detailed description that follows.
AÑO/PAÍS	2022, China
AUTOR	QINGDAO VIRTUAL REALITY RES INSTITUTE CO LTD
ENLACE	https://worldwide.espacenet.com/patent/search/family/080206180/publication/CN114049808A

TÍTULO	KR102532795B1 - COLLECTION SYSTEM AND METHOD FOR PERFORMANCE BEHAVIOR DATA OF DENTAL TRAINING SUBJECTS BASED ON VIRTUAL REALITY
RESUMEN	The present invention relates to a system and method for collecting performance behavior data of a subject of virtual reality-based dental practice education, and more specifically, a subject receiving dental practice education using virtual reality uses a virtual patient. It is about a method of collecting data on the performing behavior of checking the oral cavity of a person.
AÑO/PAÍS	2023, Corea del Sur
AUTOR	전남대학교산학협력단
ENLACE	https://worldwide.espacenet.com/patent/search/family/080266181/publication/KR102532795B1