Vocational Innovation Renewing Tourism Advanced Learning
V.I.R.TU.A.L.
ERASMUS-EDU-2022-CB-VET
ERASMUS Lump Sum Grants
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WP 3 Interactive augmented and virtual reality didactic toolkit

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"VR/AR IN EDUCATION - HOSPITALITY AND TOURISM SECTOR"
A guide for teachers and students.

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Project fiche

V.I.R.TU.A.L (Vocational Innovation Renewing Tourism Advanced Learning) falls within the framework of the Erasmus Capacity Building VET.
Its main objective is to enhance vocational education and training (VET) in the tourism sector by applying innovative approaches and advanced technologies such as virtual reality (VR) and augmented reality (AR). The project aims to create a collaborative bridge between VET institutions and the tourism industry to ensure more effective learning, enhanced skills, and improved employability.

Objectives and aims:

- Develop teaching methodologies based on technology and ICT tools to assist teachers in integrating digital technologies into their teaching practices.
- Equip students with the necessary skills to utilise and access digital tools, software, and platforms.
- Improve the skills, abilities, and employment opportunities of VET students through innovative VET educational programs and the application of advanced technologies.
- Increase interaction between teachers and students to create a collaborative learning environment.
- Enhance understanding and learning efficiency by utilising 3D concepts instead of 2D ones.
- Provide high-quality learning, including the handling of complex topics, using AR/VR techniques.
- Foster cooperation between VET institutions and the tourism industry, including the design of digital teaching materials.
- Strengthen networks between education and the tourism industry to ensure the proper implementation of the Education 4.0 approach, with particular attention to VET actions in the Western Balkans.
- Engage businesses and stakeholders in the tourism market in the creation of innovative teaching materials, ensuring products are more functional for education and vocational training.
- Promote collaboration between the labor market and vocational training, such as dual learning and the development of curricula in collaboration with the private sector and secondary schools**.**

PARTNERSHIP	**TUCEP –** TIBER UMBRIA COMETT EUROPEAN PROGRAMME (Italia) **ARTeS** – Azione Ricerca Territorio e Sviluppo (Italia) **ASSOCIATION OF CITIZENS CEFE MACEDONIA** (N. Macedonia), **EUROPEAN EDUCATION INITIATIVE** (UET), Albania **KPT SHPK** (Kolegji Profesional i Tiranes) Albania **UBT SHPK** (UNIVERSITETI NDERKOMBETAR PER BIZNES DHE TEKNOLOGJI) Kosovo

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WORK PACKAGE OVERVIEW

Introduction

General objective: implement teaching technologies that virtualize practical experience (such as simulators, VR and AR) to facilitate practical learning in the classroom environment, obviating the difficulties of carrying out alternating activities especially in the pandemic phase and identifying, updating and integrating user-based insights into designing and developing the Project's digital materials.

Specific objectives:

- Enable students to develop professional skills by performing very specific tasks, in safe environments where students can learn at their own pace.
- Use new technologies that can be integrated into online learning platforms and face-to-face contexts to develop key competences for students participating in VET programs but also extensible in other training contexts
- Increase students' engagement via interactivity
- Equip students with competencies to use/access tools, software and platforms
- Increase interaction between teachers and students
- Increase the level of understanding and reduce the grasping time and the effort that students need to learn information by using 3D concepts instead of 2D ones
- Offer a better delivery of basic knowledge even for complex issues, higher learning efficiency and better learning experience by AR/VR techniques
- Transform the role of the teacher to be more as a co-learner, coach and development collaborator
- Transform the role of the student to be a "junior collaborator" with the teacher and be part of the learning process
- Build teachers/trainers knowledge capacity on using innovative and technological didactic materials
- Develop institutional capacities and modernize them by introducing VT and AR in teaching and learning processes
- Respond to the needs of the business, tourism and catering world, through its participation in the phase of detection of needs (WP2) and, directly, in the design of didactic materials
- Build capacities for VET trainers to incorporate Digital Technologies in teaching
- Develop teaching methodologies availing of technology and/or ICT tools
- Foster the perception that virtual technologies can be used beyond games and entertainment
- Promote VR/AR as an instrument for improving education in learning multifaceted perceptions.

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Abbreviations

AR – Augmented Reality

MR – Mixed Reality

QR Code – Quick response code

T&H – Tourism

VR - Virtual Reality

XR - Extended Reality

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I- INTRODUCTION

A Brief History of AR & VR

Augmented Reality, Virtual Reality and Extended Reality originated in 1838 with Charles Wheatstone's stereoscope, which used an image for each eye to create a 3D image. (Donovan-Stevens, 2021)

The next chipping away from reality was sparked by a filmmaker in the 1950s. Ironically, Morton Heilig was neither an engineer nor a computer scientist. He was a cinematographer in the Hollywood motion picture industry who dreamed of finding a way for people to feel as though they were inside a movie. Tinkering, as inventors do, he fashioned together a viewing apparatus that displayed 3-D video, which back then entailed mounting multiple 35 mm cameras onto a cameraman.

Heilig plugged away at his vision and ultimately created an immersive, multi-sensory experience in a large mechanical device known as the *Sensorama*. A viewer could hop in and feel as though they are riding a motorcycle through the city, complete with a vibrating seat, and the scent of gasoline. Through his efforts, Morton Heilig would later become, "The Father of Virtual Reality." (DeAnne Canieso, 2021)

In 1965 Ivan Sutherland, a student at the University of Utah mimicked the physical world with the use of his invention – Ultimate Display. This tool included interactive graphics and force-feedback devices to look like the world the person lived in. (State)

We then see the concepts of VR and AR to gain momentum in military applications during the early 1980s. Motion pictures such as "Tron", "The Matrix" and "Minority Report" all offered futuristic riffs on how these technologies would evolve in the years to come.

The first mainstream attempt at releasing a VR headset was the Sega VR in 1993, an add-on to the Sega Genesis gaming system. While it never made it to market, it did stoke consumer interest in technology. It would not be until the Oculus Rift in 2010 that a VR headset would be successful with a consumer audience — though today these devices remain expensive and largely of interest to niche, gaming-focused users.

Augmented reality splintered from virtual reality around 1990, and was brought to the public's attention in 1998, when TV broadcasters began overlaying a yellow line on the football field to better indicate the distance to a first down. Over the next decade, various apps around AR technology were designed for both military use (such as in fighter jet cockpits) and consumer use, when print magazines and packaged goods began embedding QR codes that could be scanned with a consumer's cell phone, making the product "come alive" with a short 3D video.

In 2014, Google rolled out Google Glass, with an eye toward equipping everyone with a head-mounted display AR device. The AR headset, which was controlled via voice and touch gestures, was met with skepticism and criticism, attributed to the new reality that people were recording video 24/7 in public. Privacy suddenly became a major talking point in consumer AR. Google ultimately suspended the project and relaunched it a few years later with enterprise users in mind. (Watts, 2023)

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An overview of Virtual Reality (VR) and Augmented Reality (AR)

Extended Reality (XR)
XR, is a term used to encompass the spectrum of immersive technologies that go beyond traditional boundaries of reality, combining elements of virtual reality (VR), augmented reality (AR), and mixed reality (MR). XR serves as an umbrella term that encompasses the entire range of experiences, from fully virtual to fully real, with various degrees of digital augmentation. (Kuipers, 2023)

Virtual Reality (VR):

Definition: Virtual Reality (VR) refers to a computer-generated simulation of a three-dimensional environment that users can interact with, using special equipment, such as a VR headset or VR glasses.
In VR, users are completely immersed in a virtual world, shutting out the physical surroundings.

Key Characteristics:

1. **Immersive Environment:** Users are isolated from the real world and fully immersed in a computer-generated environment.
2. **Complete Simulation:** VR aims to replicate a complete and independent virtual space where users can interact with objects and environments.

Applications:
1. **Gaming:** VR is widely used in the gaming industry to provide users with immersive gaming experiences.
2. **Training Simulations:** Industries use VR for training simulations, such as pilot training, medical procedures, military exercises etc.
3. **Virtual Tours:** VR allows users to take virtual tours of places, museums, or architectural structures directly from your home without moving at all. Just to recall how much we made use of it during the pandemic.

Augmented Reality (AR):

Definition: Augmented Reality (AR) overlays digital information (such as images, text, or 3D models) onto the real-world environment, enhancing the user's perception of the surroundings. **AR does not replace the real world but augments it with additional information.**

Key Characteristics:
1. **Integration with Real World:** AR supplements the real world by overlaying digital content onto physical objects or environments.
2. **Semi-Immersive:** Users can still see and interact with the real world while simultaneously viewing digital information.

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Applications:

1. **Mobile Apps:** AR is commonly used in mobile apps for activities like gaming, navigation, and education.
2. **Retail:** AR is used in retail applications, allowing customers to try virtual products before purchasing.
3. **Education:** AR enhances educational experiences by providing additional information or interactive elements related to textbooks or physical objects.

Differences between VR and AR:

1. **Immersiveness:**
   - **VR:** Fully immersive, blocking out the real world.
   - **AR:** Semi-immersive, enhancing the real-world environment with digital overlays.
2. **Interaction:**
   - **VR:** Users can interact with a completely virtual environment.
   - **AR:** Users interact with both the physical and digital elements simultaneously.
3. **Equipment:**
   - **VR:** Requires specialized hardware, such as VR headsets.
   - **AR:** Can be experienced on various devices, including smartphones, tablets, and AR glasses.
4. **Use Cases:**
   - **VR:** Often used for simulations, gaming, and experiences that require complete immersion.
   - **AR:** Applied in areas where real-world information is augmented with digital content, like navigation, education, and retail.
5. **Degree of Realism:**
   - **VR:** Aims for a high level of realism within the virtual environment.
   - **AR:** Enhances the real world with digital information, typically focused on providing context or additional details.

In conclusion, VR creates a fully immersive virtual environment, while AR overlays digital content onto the real world. Both technologies have distinct use cases and contribute to a range of applications across industries. (Sephy, 2018)

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Specific relevance to the Hospitality and Tourism sector

In recent years, tourism and hospitality (T&H) have witnessed an exponential growth of high technology adoption, including applications of augmented (AR) and virtual reality (VR). VR has, in particular, impacted T&H (Virtual reality, presence and attitude change; empirical evidence from tourism , 2018) with an increased supply and demand for these experiences (Virtual reality presence as a preamble of tourism experience, 2019).

One of the reasons for extended reality gaining momentum in hospitality is the amount of information guests expect to receive before they book the place. Technology helps the hotel staff simplify the booking process by allowing the customer to experience an augmented model of the room. Once the guests arrive at the location, they can be provided with the needed information in a contactless manner at any convenient time. (Pavlov, 2022) Immersive digital environments based on AR/VR technologies are currently used to enhance travelers' experience not only before, but also during, and after their trip.
These technologies are also generating a new model of tourism (S.N. Zhang, 2022) that of virtual tourism (VT), which is based on real tourism landscapes but in an immersive online environment (V. Bogicevic, Virtual reality presence as a preamble of tourism experience, 2019).

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PURPOSE OF THE HANDBOOK

The purpose of the handbook "VR/AR in Education: Transforming Hospitality and Tourism" is to serve as a comprehensive guide and resource for educators, students, industry professionals, and stakeholders interested in leveraging Virtual Reality (VR) and Augmented Reality (AR) technologies to revolutionize education and practices within the hospitality and tourism sector.

General objective: to facilitate practical learning in the classroom environment, obviating the difficulties of carrying out alternating activities especially in the pandemic phase and identifying, updating and integrating user-based insights into designing and developing the Project's digital materials (rendering them to be highly useful, usable, desirable and pleasurable).

Key purposes of the handbook include:

1. **Education and Awareness:** To introduce readers to new technologies, with a special focus on VR and AR, their benefits, advantages, similarities and differences; to educate readers about the potential of VR/AR technologies in reshaping learning experiences, guest interactions, and operational processes within the hospitality and tourism industry.
2. **Guidance and Best Practices:** To provide practical guidance, strategies, and best practices for integrating VR/AR into hospitality and tourism education programs, curriculum development, and training initiatives; Offer a better delivery of basic knowledge even for complex issues.
3. **Inspiration and Innovation:** To inspire creativity and innovation by showcasing case studies, examples, and success stories of VR/AR implementations in hospitality management, guest services, marketing, and destination promotion; Foster the perception that virtual technologies can be used beyond games and entertainment. **Skill Development:** To facilitate the development of essential skills and competencies among students and professionals, including immersive experience design, digital storytelling, technology integration, and guest engagement strategies; Enable students to develop professional; Equip students with competencies to use/access tools, software and platforms; Use new technologies that can be integrated into online learning platforms and face-to-face contexts to develop key competences for VET students and training contexts; Build teachers/trainers knowledge capacity on using innovative and technological didactic materials
4. **Industry Collaboration:** To foster collaboration and knowledge exchange between academia and the hospitality and tourism industry, facilitating partnerships, research opportunities, and the co-creation of immersive learning solutions in the frame of the Triple Helix Model.
5. **Future Readiness:** To prepare stakeholders for the future of hospitality and tourism by exploring emerging trends, advancements in XR technologies, and potential applications in areas such as sustainable tourism, experiential marketing, and crisis management.
6. **Inclusivity and Accessibility:** To promote inclusivity and accessibility in hospitality and tourism education by discussing ways to design and implement XR-based learning experiences that cater to diverse learner needs, preferences, and abilities, thus to make the academic process more qualitative and easily accessed.
7. **Ethical Considerations:** To address ethical considerations and challenges associated with the use of VR/AR in education and industry contexts, such as privacy concerns, digital equity, and responsible technology adoption.

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8. **Resource and Reference Hub:** To serve as a valuable resource hub by compiling essential information, tools, resources, and references, including academic literature, online platforms, software applications, and industry reports relevant to VR/AR in hospitality and tourism education.
9. **Advocacy and Advocacy:** To advocate for the adoption and integration of VR/AR technologies in hospitality and tourism education to enhance learning outcomes, improve guest experiences, drive innovation, and foster sustainable growth in the industry.

Overall, the handbook aims to build capacities, to develop teaching methodologies availing of technology in such a dynamic context we are living in, to empower readers with the knowledge, skills, and insights needed to embrace the transformative potential of VR/AR technologies in reshaping education, training, and practices within the dynamic and evolving landscape of hospitality and tourism.

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II- FOUNDATIONS OF VR/AR IN HOSPITALITY AND TOURISM

Definition and explanation of VR and AR in the context of the sector

As mentioned above, new technologies that include XR are creating a new model of tourism which goes by the name of Virtual Tourism.

What is Virtual Tourism (VT)?

The concept of VT lacks a generally accepted definition. According to (S.N. Zhang, 2022) VT may be defined broadly or strictly. In the first case, VT refers to “any process of obtaining information and knowledge about tourist attractions using a non-immersive way”. In this broader sense, VT may not even use advanced technology. Historically, it encompassed storytelling and panoramic paintings, providing a 360-degree view. In the stricter sense, “virtual tourism is a process of experiencing super-real scenes in a three-dimensional virtual environment through various visualization technologies, including virtual reality (VR) and augmented reality (AR)”. One of the most significant advantages of AR and VR in tourism is the ability to create a personalized experience for travelers. By using these technologies, travel companies can create customized itineraries and tours for each individual traveler, based on their interests and preferences. For example, a traveler interested in history can take a virtual tour of ancient ruins or explore a museum exhibit, while a foodie can take a virtual cooking class or a culinary tour. (Tourism and AR/VR: Revolutionizing the Travel Industry, 2023)

Examples of using AR & VR in the tourism and hospitality industry are as follows:

- **Virtual Travel Experiences**

The joy of the VR experience is doubled by the opportunity to explore the travel destination before they purchase the tickets. Imagine testing out the Bahamas before you go there. Chances of a visit may grow immediately, right? And finally, VR journeys can also provide a priceless opportunity to explore the world for people who are unable to travel. Disabled people have more possibilities to discover new locations than ever before.

- **Virtual Hotel and Room Tours**

Many hotels use virtual reality hotel tours as an opportunity to showcase their hotel rooms via interactive elements. The tours can be placed on hotels’ websites and are a great way to show customers around the property before they book or before they arrive.

- **Standby Customer Experience**

Virtual reality can also be used to showcase event spaces. For example, a hotel can create a virtual tour of its ballroom to help event planners visualize the space and plan their event. This can save time and money by allowing event planners to get a feel for the space without having to physically visit the hotel.
Augmented reality can be used to allow guests to customize their room before they arrive. Guests can use their smartphones to see how different furniture arrangements would look, or change the color of the walls, bedding, or decor. This can help guests feel more in control of their stay and create a more personalized experience.

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- **Interactive Tips**

To improve customer experiences and memories, hotels can use augmented reality technology to create interactive elements for their guests to interact with during their stay.
For instance, the elements can include gripping information about some interior items, like paintings on the walls and the room where guests stay (info on celebrities who stayed there before them, etc.).
Besides, AR/VR solutions will serve well to create an interactive map of the surrounding area or city center to highlight local landmarks or attractions. Guests can use them to map routes to the places of interest of their choice.
For example, guests can use their smartphones to scan a code and see directions to their room or hotel amenities. This can be particularly useful for large properties where guests may find it difficult to navigate without assistance. (Pavlov, 2022)

And the least but not the least, the main scope of this handbook is:

- **Training hotel/restaurant actual and future staff.**

Virtual reality can be a valuable tool for dual learning and employee training, especially for complex tasks such as room cleaning or food preparation. VR can simulate different scenarios, allowing them to practice and develop their skills without risk. This can be especially useful for new employees or those learning a new skill. Virtual reality experience can help teach someone a new tool or allow remain productive while serving more customers visiting the restaurant. Another point is that extended reality can help staff and students learn to operate complex machines that they have never experienced before.

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III- ADVANTAGES AND BENEFITS IN HOSPITALITY AND TOURISM

In the hospitality industry, the experience economy is king. Travelers seek more than a place to rest their heads—they want unforgettable experiences. Hotels are responding to this demand by transforming themselves into gateways to adventure. Hotels are creating unique, immersive guest experiences like themed rooms designed to transport guests to different worlds, surprise and delight pop-up events or collaborations with local artists to create a sense of place.
What really sets these experiences apart, however, is the technology powering them. More and more, the hospitality industry has turned to augmented reality (AR), virtual reality (VR) and digital signage to create interactive, engaging, and unforgettable experiences. This industry's goal? Using this technology to redefine and elevate hospitality to exceed even the most discerning guest's expectations. The rapid evolution of IoT technologies, including VR and AR, has the potential to revolutionize the guest experience, and hotels have taken note, seizing the opportunity to reimagine how guests interact with their properties from the time they confirm a reservation until the moment they check out.
The rising demand for data-driven personalization is reshaping hotel services. Leadership has recognized data's value and is using it to proactively address guest needs, analyze customer data for targeted marketing and recommend tailor-made, in-room amenities, and services. VR's data collection capabilities are driving these nuanced adjustments.

AR Use Cases

Sitting at the forefront of personalized guest interactions, AR technology facilitates stress-free wayfinding and satisfying experiences and can help hotels provide more interesting, impactful stays with elements like:

1. Augmented environments, including conference and guest rooms, hallways, lobbies, restaurants, and workout facilities with dynamic information overlays to enrich and deepen guests' insight into their current surroundings.
2. Beacon technology, which uses a Bluetooth-based interface and allows users to receive information when they're in specific areas. The hotel industry also uses this technology to enable wireless smartphone connectivity for its guests.
3. Gamification, like treasure hunts or magic quests for younger visitors who can use a smart device to visit a virtual platform and participate in an adventure.
4. Interactive hotel rooms where guests can learn more about the hotel's history, artwork, artists and more.
5. Maintenance updates, informing guests via an app to find out about areas, like pools or gyms, temporarily closed for maintenance and when they'll reopen. The apps can use beacon technology to send updates to guests within proximity, too.
6. Translation assistance, especially in areas frequented by visitors unfamiliar with the local language. Guests can point smartphones at different texts, guides and even the hotel menu to access the information they need in their language.

Digital innovations create convenient, personalized, and visually appealing spaces for all travelers. Other benefits of this technology include:

1. Improved guest communication, as operations can quickly update digital displays to share real-time information about conference room changes, traffic conditions, future events and even weather updates.

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2. Personalized service, with guests accessing these maps to make restaurant reservations, book spa treatments or schedule a cab.
3. Enhanced aesthetics, with hotel properties offering more visually appealing and inviting spaces to provide a world-class “home away from home” guest experience, like changing video display walls featuring breathtaking area landscapes or local must-see attractions.

The hospitality industry is undergoing a paradigm shift as hotels embrace and leverage technology to deliver more immersive, unforgettable guest experiences. The previous hospitality tradition focused on providing guests with basic amenities and services. This new era, however, creates experiences that aren’t merely functional but engaging, memorable and transformative. (Bettencourt, 2023).

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IV- TYPES OF VR/AR TECHNOLOGIES IN HOSPITALITY AND TOURISM

While the world was in lockdown from 2020-2021, the hospitality industry began to reevaluate its place in travelers' lives. The drop in travel gave travel organizations the ability to refocus their priorities and think about how they could still connect with people even if they weren't able to physically serve them. For this reason, hospitality technology development accelerated during the pandemic, especially in the areas of virtual reality (VR) and augmented reality (AR).
Hotels have employed these technologies in several ways:

- Digital check-in and check-out, where patrons can use their smartphones for either process, thus eliminating the need to wait in line at the front desk.
- Smart room amenities, with IoT-enabled devices controlling the room's temperature, lighting, and other features, helping guests personalize their stay and save energy.
- Personalized recommendations allowing hotels to use data gathered by VR or AR to track guests' preferences and make personalized recommendations for restaurants, activities, or other amenities.
- Staff training enables hotels to educate team members on new procedures or provide a better understanding of the hotel's facilities, which deepens employees' knowledge and facilitates their ability to deliver a higher-quality guest experience.

Hyatt Hotels uses VR to invite guests to remotely tour properties, explore rooms and check out amenities. The company also uses a gamified VR app to give potential employees an idea of what a career in the hotel industry might involve. Hyatt has used VR and gaming to attract young people potentially looking for career opportunities in the hospitality industry, through its community-hiring *programme RiseHY*. To give them a sense of what it would be like working in a hotel, Hyatt worked with a vendor to build a VR app, called *YouVisit*, where potential employees take virtual guided tours of a hotel, see what workers do, and learn what may be required of different roles. *Hilton* uses its new VR training program, *Hotel Immersion*, to teach empathy to its corporate, financial and marketing team members. Customer complaints dropped more than 70 percent—and customer satisfaction increased—after Best Western incorporated VR into its employee training program.

Space-as-a-Service

While not a new concept, *SPaaS* hasn't been a major strategy the hotel industry used until recently. This approach weaves AR, curated music playlists, digital displays, scent marketing and VR to tell dynamic stories, enhance brand experiences and redefine best-in-class guest experiences.
Digital signage and responsive maps have transformed how hotels communicate with their guests by replacing or complementing traditional signage, providing guests with real-time information and personalized services. In short, these customizable interactive maps have made it easier for guests to explore their surroundings and find what they need more efficiently, as well as allowing guests to explore local attractions, find nearby dining options and easily navigate the surrounding area.
For example, the *Cambria Hotel in Washington*, D.C. has transformed its elevator bay from a vast, open space into an immersive, LED experience. The W Hotel in New York City uses digital signage to display dynamic content like weather forecasts, news headlines and upcoming events, keeping guests informed and entertained. Singapore's hotel operator, Accor, uses

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elegant digital displays in lounge and café areas to showcase menu items, see prepared dishes and access ingredient information.
Also elevating the SPaaS experience? Scent marketing and curated music playlists. Smell influences our emotions 75 percent more than any other sense, and studies have shown that appealing scents improve our moods by as much as 40 percent. Hotels pump signature scents in shared spaces like their lobbies. The goal of these scents is to subtly manipulate the environment, whether to create a sense of safety or relaxation—or even inspiration.
Meanwhile, music creates ambiance—whether it's the dulcet sounds in the hotel spa, toe-tapping tunes in its vibrant restaurant or lively melodies welcoming guests in the lobby. The right music can capture guests' attention, evoke positive emotions, and create lasting memories. Its subtle power influences customer behavior, making guests feel more relaxed and comfortable, which can lead to more positive interactions between guests and staff.
Music is not just reserved for guests, either. It can have a profound impact on the wellbeing and motivation of employees. Uplifting, energizing music played in staff areas—like breakrooms or locker rooms—can create a positive work environment, boosting morale and productivity.
(Leading lodging companies in the virtual reality theme, 2023) (Bettencourt, 2023)

VIRTUAL REALITY TRAINING IN HOTEL AND RESTAURANT INDUSTRY

VR and AR simulators are revolutionizing hospitality training by providing immersive learning experiences. They allow employees to practice real-life scenarios in a virtual environment, whether it's front desk interactions, culinary techniques, or emergency procedures. These tools enhance retention and build confidence.

VR simulations offer a unique and immersive training experience for hotel staff and are often used for this target and not for students or people seeking for employment in tourism sector.

By creating virtual scenarios that mirror real-life situations, employees can practice their skills, learn how to handle challenging situations, and refine their performance in a safe and controlled environment. For example, front desk staff can be trained on handling difficult customer interactions or managing high-pressure situations with confidence. VR simulations also provide an opportunity for staff to familiarize themselves with different areas of the hotel, allowing them to become more proficient in their roles.

That's why hotels are rebooting traditional employee training programs and using VR as a powerful learning tool. In a simulated world, employees can test out interactions with lifelike guests, hone housekeeping skills and even make critical mistakes without suffering real-world consequences. The result? Hotel staff with better skills, more confidence, and an improved ability to improve guest satisfaction survey scores.

Some cases of training using VR/AR tools are interesting some big hotel chains.

Best Western reported a 71% decrease in customer complaints after implementing virtual reality training for front-desk employees. The training program has front desk agents accommodate a virtual guest who, aside from being represented by an avatar, sounds and acts like the real thing. For instance, during the dialogue, the guest may ask the agent to offer a parking discount, provide a list of the best local restaurants or schedule a wake-up call. Although it's a simulated lobby, the dialogue is real, and the virtual guest reacts to everything the agent says. In addition to the

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reduction in complaints, Best Western saw a 20-point2 rise in customer satisfaction thanks to the virtual training.

HILTON too uses virtual reality training for corporate. The leading hotel brand has developed a virtual reality training experience for their corporate employees, challenging them to perform tasks that front and back of the house staff do daily. Fitted with a VR head-mount, employees are immersed in a virtual hotel environment where they attempt common tasks such as cleaning a room, creating a food service tray, and checking in guests at the front desk. Hilton designed the virtual training to give corporate offices a real-world experience of the challenges hospitality workers faces so they can support them better. The program has been a success with 87% of participating employees saying it increased their empathy and appreciation for hotel staff.

The empathy-focused learning experience gives hotel employees an opportunity to see what it feels like when interactions are managed poorly or handled correctly by members of staff.

While VR/AR won't replace conventional training methods, it will be a key component of blended learning environments. It is not surprising that, when polled, 70% of hotel operators believe that virtual reality training will become mainstream in under 5 years.

This kind of training give different benefits to sector training, especially considering training addressed to workers:

- Reduced training times and costs. Training hotel employees across multiple properties and locations pose challenges. Travel costs, securing training facilities, and scheduling problems can cannibalize budgets and delay rollouts. Virtual environments will solve these challenges by making hands-on training available to anyone, anytime, anywhere.
- Improved employee performance. Airline pilots use flight simulators to perfect their skills in real-world situations. Similarly, hotel staff will sharpen their skills at a virtual hotel that feels like the real thing. Invaluable on-the-job training will even take place before onboarding the employee.
- Better training and operations intelligence. A good training program does more than improve knowledge and skills, it identifies weaknesses. Because virtual training involves employees performing tasks in a computer-generated environment, hotels will use software to better analyse processes. This could range from placing a fork on a table to how long it takes housekeeping to vacuum a room. As a result, management can determine if training needs improvement or if the processes themselves need tweaking.

Below we provide some examples of hotel simulation software and programs for training.

We would like to point out that the products we have listed and presented below were created mainly with reference to the training of staff already operating in tourist facilities. These are therefore products that aim to safely train staff while creating engagement and a sense of belonging to the company.

Furthermore, some of these products are functional not only for training and talent retention objectives but also aim to:

- **Customer Engagement.** The VR Cooking Simulator goes beyond exploring recipes and offers an advanced and interactive experience. Customers can enjoy intellectually

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stimulating games or quizzes while looking forward to their meals, **adding an entertaining aspect** that sets your establishment apart.

- **Customer Service Excellence.** Take customer service to new heights by providing **virtual tours of company (hotel or restaurant)**. Share detailed information about menu items, including intricate insights into ingredients and preparation methods. This immersive dining experience helps distinguish an establishment from its competitors.
- **Marketing and Advertising.** Enhance marketing strategy by leveraging the potential of VR through the implementation of **virtual coupons and discounts**, redeemable at establishment. This innovative approach provides a unique advantage in the competitive market, setting business apart from the rest.
- **Sales through Visual Menu.** Introduce a virtual menu that **highlights the visual appeal of each dish**. Allowing customers to visually preview their choices not only creates an inviting experience but also holds the potential to significantly boost sales. This interactive presentation provides a tasteful and effective way for customers to engage with the menu, making informed and visually appealing decisions.

Specifically, aims relatives to training are:

- **Training Protocols for Cost-Efficient Efficiency.** VR transcends traditional training modalities. Immerse new personnel in **realistic simulations** to augment the quality of training while concurrently curbing costs. This contemporary approach ensures the cultivation of a proficient and cost-effective workforce.
- **Skill Development with Real-world Implications.** The benefits of the VR Simulator transcend technical skills. Participants can develop crucial attributes like spatial awareness, precise timing, and improved multitasking capabilities. Users acquire essential competencies that contribute to their overall effectiveness and success in a work activity setting, making the VR Simulator a comprehensive and practical training tool.

SIMULATION FOR HOTELS

VR and XR simulated hotel of Blue Mountains International Hotel Management School

Due to the success of VR training in developing soft skills, VR is now moving into hotel management training curriculums. The Blue Mountains International Hotel Management School (BMIHMS), part of Torrens University Australia, has their own cutting-edge VR hotel simulation training program for hotel management students.

In the 2022 launch of the school's innovative Virtual Reality (VR) and Extended Reality (XR) training hotel, taking educating the next generation of hotel leaders to a new frontier. It's innovations like these that makes BMIHMS the no.1 hotel management school in Australia and Asia Pacific.

The VR and XR simulated hotel provides a vital training ground for students to practise and develop their soft skills that supplements their face-to-face learning. According to industry research, a full 14 of the 16 skills identified as essential for hospitality management are classified as soft skills, including skills such as leadership, professional demeanour, working with a team, and developing positive customer relations. Soft skills are fundamental to hospitality careers, and

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yet hotel management students rarely get the chance to practise these skills in a controlled environment before entering a workplace. That's where the potential of VR and XR training comes in. BMIHMS' Virtual Reality training environments allow learners to engage in structured role-play where they get real-time feedback as they move through different scenarios. Students learn by doing and then reapply their learning in different and unexpected scenarios, while practising critical thinking and judgement.

This model of VR training is particularly effective for teaching soft skills to employees and it's now being adopted by companies all over the world for that purpose.

The BMIHMS virtual training hotel can be accessed in a VR form using goggles to interact in life-like environments, or via a desktop version with 3D Scenarios. The VR hotel takes BMIHMS' simulated hotel, experience-based learning into the virtual space. Now, even students completing studies online can benefit from this immersive experience and best of all, they can come back to replay lessons anytime, anywhere. The BMIHMS VR Hotel provides an environment where students can make mistakes, work through different scenarios and test different approaches to guest interaction before they are required to do it in a real workplace. They develop their confidence and practise soft skills in a safe environment, before testing themselves under pressure. Students must complete tasks and activities as they wander around the virtual hotel space; serving digital guests, inspecting rooms, and making key decisions for the running of each department; just as they would in a regular hotel management role.

Unlike a regular hotel, however, students can test their learning multiple times across varied or repeat scenarios within this safe virtual space.

Here's a breakdown of what this world of Extended Reality (XR) looks like.

- Just like a video game, users move around the 3D digital environment via their laptop or desktop.
- Learners engage with objects, surfaces, and items as they move around the different hotel spaces, practising their skills of observation.
- Students interact with virtual staff and guests, practising different management styles, customer service approaches and soft skills.
- Learners encounter different issues and unexpected role-playing scenarios and must respond with problem solving and judgement.

The tool allows to:

- Make a 360 Tour in a Google Maps-style digital, navigable map of the hotel space.
- Make a 360 Tour map loaded with links and tags to videos, learning resources and information.
- Hear feedback from virtual staff and guests.
- Take interactive quizzes to track progress.
- Use a guided tour by expert academics thanks to embedded instructional videos.

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- Use body and controllers to interact with objects, characters, data points and items in the digital space.

For more information look at https://www.youtube.com/watch?v=utwQYpJPSbA

Hotrain Hospitality VR Training by XR Masters

It is a comprehensive product as it serves the training needs of hotel staff across various departments, including the food and beverage sector.

For more information look at https://www.youtube.com/watch?v=roSKcDd7cJo

SweetRush

Since many of the corporate team members throughout the Hilton business have never actually worked within a hotel, it's common for them to come up with new ideas for customer experience that can accidentally make life more challenging for the front-line staff. To ensure that Hilton's executives know what life in the hotel is about, Hilton partnered with Sweet Rush to create a virtual hotel experience for corporate team members.

The SweetRush learning and development team also created VR scenarios that would help Hilton to guide their hotel team towards handling more challenging interactions with guests in the best way possible.

Here some examples of products addressed to Hilton chain:

- With access to Oculus headsets, team members can take on the role of guests in common scenarios. This could include interacting with people at a front desk, requesting room service, organizing a meeting room, or just checking out. This allows them to observe how they react to interactions handled inadequately, appropriately resolved, or even exceeded expectations https://xr.sweetrush.com/?hsCtaTracking=5c9e9339-4ac2-47a6-84d2-cffd5ef1ebfd%7C844ee37b-bce3-4856-8574-18feb206df71
- In the hospitality sector, empathy is the key to driving memorable experiences. People rely on their hospitality companies to give them comfort and support during times when they may feel nervous or vulnerable – such as when they're exploring a new environment. Hilton believes that using VR to develop empathy in employees can help them to offer a better level of customer service. According to Hilton, creating an experience that increases empathy for team members is a game-changing process for the company. If team members can understand what guests feel, then they'll be better equipped to deliver the experiences that they expect. In the same way, if executives understand the issues that employees deal with every day, they'll know how to interact better with staff. A major initiative of Hilton's is to empower team members to always exceed expectations, not just meet them. To help encourage this connection, SweetRush partnered with Hilton on Exceed with Empathy, an engaging, immersive virtual world that lets Hilton team members not only fully experience the problems that guests can encounter at a Hilton property but also hone their own empathy skills. This virtual reality experience is realistic, authentic, user friendly, and scalable across Hilton locations and brandshttps://xr.sweetrush.com/?hsCtaTracking=5c9e9339-4ac2-47a6-84d2-cffd5ef1ebfd%7C844ee37b-bce3-4856-8574-18feb206df71.

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SIMULATION FOR RESTAURANTS

The examples provided for the restaurants are all related to the kitchen area.

Some of the examples of AR/VR cooking simulators that we have reported below present typical game features that make the training value more effective.

Such systems are highly developed in the restaurant industry, especially in the USA.

KFC's VR game for training

At KFC (Kentucky Fried Chicken), for instance, newly hired employees receive an Oculus Rift VR headset to wear. What do they have to do? Engage in a simple game described as a wild virtual reality escape room where they can progress towards the exit only by reproducing the five steps of the KFC cooking process. The Hard Way - a KFC Virtual Training Escape Room is designed as an escape room where Colonel Sanders gives his trainees hints and clues along the way to make sure they are making fried chicken the Hard Way - the way he invented more than 70 years ago. After successfully completing the five main steps - inspecting, rinsing, breading, racking, and pressure frying - participants exit the kitchen with an understanding of what it takes to cook Original Recipe chicken like a professional. The new system might seem like a truly odd publicity stunt, but KFC claims it takes an average of 10 minutes to complete the game, whereas the previous teaching method required 25 minutes.

No one at KFC expects the game to replace reality: "The game is designed to complement the existing Chicken Mastery program, not replace it" said a KFC spokesperson in a press release (https://www.youtube.com/watch?v=jiWohsFvX9E).

While KFC's methods may seem quirky, they are part of the growing trend of incorporating gamification into e-learning. KFC is not the only fast-food chain training its employees with "playful" e-learning modules: McDonald's also guides new employees through an online game, attempting to make the learning process as engaging as possible. Interestingly, the company has not made the game mandatory for new employees, yet 85% of new McDonald's employees not only played the game but also reported that it helped them learn their tasks.

GameBoom

Another Game software for cooking was developed by GameBoom (cooking game). Big Cheese Studio and PayWay are the publishers of this game. The game includes a realistic kitchen with the most common utensils. Offering gameplay modes including career and sandbox, there are 140+ ingredients to slice and dice way through, from meat and fish, through to fruit, veg, dairy products, and various liquids, as well as herbs and spices. With realistic physics and advanced cooking mechanics, it’s possible cook the perfect steak or learn how to multitask and bring a whole meal together.

This game is a good way to understand the mechanics of cooking and learn how to improve your cooking without making a mess. The game is available at https://store.steampowered.com/app/1358140/Cooking_Simulator_VR/ (https://www.youtube.com/watch?v=NiC6Q2a4pgM&t=9s)

HoReCa & Retail training platform

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It's a platform that enables workers to train and retrain within the virtual experience at no supplementary cost or time investment from their colleagues or company.

The Platform: https://www.youtube.com/watch?v=wk8pxcwRJ18&t=168s

PIXO's Patented End-to-End VR Training Platform

The platform contemplates a specific module about bagging in fast-food restaurants. Platform allows to:

- Manage content permissions to specific orgs, groups, and users.
- Wirelessly deploy VR content to any headset in the world.
- Track progress of training including status, completion, and scoring.
- Integrate data with Learning Management Systems with Pixo API.

https://www.youtube.com/watch?v=N6UT8vX5tD8&t=20s

1. **Pilot experiences**

Here pilot cases or modules are developed, in an Erasmus Project, to demonstrate how Digital Learning Spaces (VR/AR) can be effectively integrated into education. These modules will be centered around embedding these spaces within various courses, using Design-Oriented Research methods to provide faculty and students with a deeper understanding of the scientific paradigm behind them.

The pilot projects are as follows:

- AR Pilot: The Hotel Room – Students will use AR technology to explore different augmented reality hotel room scenarios, assessing how changes impact the room experience.
- AR Pilot: Holographic Chef/avatar – Used to provide step-by-step instructions for recipes and information on educational content. Allows the learner to project an instructor/lecturer into their personal space through the camera view of their phone. Assists in building a personal connection with the lecturer during remote learning.
- VR Pilot: The Outlet – 360 videos will be used to provide information to students on how to use kitchen equipment and provide an understanding of context through immersion in an environment.
- VR Pilot: Difficult Customer – 360 videos will be used to expose students to situations where they must take decisions when dealing with a difficult customer in a restaurant.
- Additional Pilot: Matterport virtual tour of hotel training room and room assessment

For more information: https://theta-project.eu/ar-vr-learning-materials/

In conclusion, VR is considered as a tool for managing workplace stress in hotels, demonstrating that VR interventions can mitigate the daily emotional fluctuations experienced by frontline hotel staff. Furthermore, hotel metaverse technology engagement seems to enhance organizational performance and value co-creation for stakeholders, influences customer relationship management, and changes how managers communicate. The new immersive technology applications are changing host-guest relationships in hotel settings.

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Implementing VR/AR in hospitality and tourism education

- Integration into hospitality and tourism curriculum
- Training programs for industry professionals
- Infrastructure and technology requirements for educational institutions

The extant literature on usage of VR/AR in tourism education is outlined below classified into three main topics/issues. First, students' perceptions about using VR and virtual environments as educational platform and learning tool. Previous studies found that students had positive perceptions of using them as teaching platforms. It was found that the perceived usefulness, playfulness, attitude toward, and behavioral intention to use virtual environment were significant among students (Singh & Lee, 2009). Flow experiences had a significant and positive impact on students' attitudes toward virtual learning (Huang, Backman, & Backman, 2010), students had supportive attitudes toward virtual environments in providing training related to tourism knowledge as well as communicational and interpersonal skills (Hsu, 2012). Likewise, virtual learning provides interesting learning opportunities and allows students to work together on group projects in online hospitality education (Deale, 2013). Moreover, Schaffer (2017) explored the use of immersive visualization in tourism education, and found that students believed that the experience contributed to a better understanding and engagement.
Training programs to use Virtual Reality (VR) and Augmented Reality (AR) can be tailored to specific roles. Here is a general outline that can be adapted based on the needs of the participants and the industry:

Module 1: Introduction to VR/AR Technology

- **Overview of VR and AR:** Understanding the basic concepts, differences, and applications.
- **History and Evolution:** Tracing the development of VR/AR technologies and their impact on various industries.

Module 2: Hardware and Software Basics

- **VR Hardware:** Introduction to VR headsets, controllers, and sensors.
- **AR Devices:** Overview of AR glasses, mobile AR devices, and spatial computing.
- **Software Platforms:** Understanding the software ecosystems for VR/AR development.

Module 3: VR/AR Development Basics

- **Programming Fundamentals:** Basics of programming languages commonly used in VR/AR development.
- **Development Environments:** Introduction to VR/AR development platforms and tools.
- **Creating 3D Models:** Basic concepts of 3D modeling for VR/AR applications.

Module 4: Design Principles for VR/AR

- **User Experience (UX) Design:** Principles for creating immersive and user-friendly experiences.
- **Interaction Design:** How users will interact with VR/AR environments.
- **Spatial Design:** Designing virtual and augmented spaces.

Module 5: Industry-specific Applications. Practical Applications.

Module 6: VR/AR Project Management

- **Project Planning:** Developing a VR/AR project plan, including timelines and milestones.
- **Team Collaboration:** Coordinating efforts among developers, designers, and content creators.
- **Testing and Quality Assurance:** Ensuring the functionality and user experience of VR/AR applications.

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Module 7: Ethical and Legal Considerations

- **Privacy Issues:** Understanding data protection and privacy concerns.
- **Ethical Design:** Ensuring inclusivity and accessibility in VR/AR applications.
- **Intellectual Property:** Navigating copyright and patent considerations in VR/AR development.

Module 8: Future Trends and Emerging Technologies

- **The Future of VR/AR:** Exploring upcoming advancements and trends.
- **Integration with Other Technologies:** AI, IoT, and blockchain in conjunction with VR/AR.

Implementing Virtual Reality (VR) and Augmented Reality (AR) in educational institutions requires careful planning and consideration of various infrastructure and technology requirements. Here is a comprehensive list of key elements to consider, which in any case is not exhaustive:

1. **Hardware:**
   - **VR/AR Headsets:** Choose headsets that are suitable for educational purposes, considering factors like comfort, durability, and ease of use. Popular options include Oculus Rift, HTC Vive, Microsoft HoloLens, and standalone devices like Oculus Quest.
   - **Computing Devices:** Powerful computers are needed to run VR applications. Ensure that the institution has the necessary hardware specifications for smooth VR experiences.
2. **Network Infrastructure:**
   - **High-Speed Internet:** A reliable and high-speed internet connection is crucial for downloading VR/AR content and ensuring smooth online experiences.
   - **Wi-Fi Connectivity:** Ensure that the institution has a robust Wi-Fi network to support multiple devices simultaneously.
3. **Software and Content:**
   - **Educational VR/AR Applications:** Select or develop content that aligns with the curriculum and educational objectives. Platforms like Google Expeditions, AltspaceVR, and others offer educational content.
   - **Content Management Systems (CMS):** Implement a system to organize and manage VR/AR content efficiently, allowing teachers to easily access and distribute materials.
4. **Learning Management System (LMS):**
   - **Integration with LMS:** Integrate VR/AR capabilities with the existing Learning Management System for streamlined content delivery, tracking, and assessment.
5. **Training and Support:**
   - **Teacher Training:** Provide comprehensive training for educators to effectively use VR/AR technology in the classroom.
   - **Technical Support:** Establish a support system to address technical issues promptly and efficiently.
6. **Space Design:**
   - **Designated VR/AR Spaces:** Create dedicated spaces within the institution for VR/AR experiences, ensuring safety and minimizing distractions.
   - **Furniture and Layout:** Arrange furniture and equipment to optimize the learning environment, considering the physical space required for VR experiences.

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Examples among the group on AR/VR use in higher education:

1. *Bowie State University,* an HBCU, where immersive collaborative virtual environments (CVE) are simulating active shooter events at the university's science building. The programs are supported by two grants from the National Science Foundation (NSF) for Minority-Serving Institutions and are helping professors collect data on how emergencies unfold. The active shooter response training is just one of the on-going projects at Bowie State University's Virtual Reality Lab, which also uses VR environments to simulate COVID-19 testing sites, fire or bomb threat emergencies in a large city, and evacuation methods using Microsoft HoloLens. The Virtual Reality Lab allows students in the computer science department to get tangible experience designing, building, and testing VR spaces.
2. *Morehouse College*, an HBCU, created four VR programs to transform classes into a virtual format during the pandemic called Morehouse in the Metaverse. As part of the program, four professors taught three courses in VR on a digital twin campus created in partnership with VictoryXR, with funding from Southern Company and Qualcomm. As of Fall 2022, Morehouse College has ten courses taught by nine professors in VR, in addition to 500 MetaQuest 2 in use by students, faculty, staff, and community members. Beyond the classroom, Morehouse is using an NSF e-fellows grant to prep computer science students for technical interviews using simulated experiences.
3. *Northern Virginia Community College (NOVA)* has also implemented AR/VR in its education curriculum: their first project for health sciences students involved a simulation targeting delivering radiation in a VR environment. They also used some of their Higher Education Emergency Relief Fund (HEERF) to use VR simulations at the start of the pandemic to help students continue their studies during remote learning. Without continued federal funding, NOVA has looked to private partnerships but also hopes that other higher education institutions that develop these VR simulations will partner with community colleges that cannot create or support their own administration and integration of these technologies.
4. *Arizona State University (ASU)*, an HSI, has partnered with Dreamscape, an LA-based immersive VR company, which creates location-based entertainment. Through this partnership, ASU is creating a nine-module VR series for biology lab students which simulates a zoo. It was noted by ASU that after a year with half of students using VR and the other half using the traditional in-person curriculum, students who used VR had a higher engagement – 15% earned higher grades, and all letter grades for AR students were approximately one letter higher than students taught the traditional curriculum. While these programs started in STEM education, students from all over ASU are increasingly involved in creating new modules. For example, students in the engineering school and artists and 3D modelers in the art school are learning how to use the Unity engine to design and build new immersive environments. Besides just collaborating in the school, ASU also partners with local community colleges. ASU benefits from its large endowment and has more capacity to fund projects than other smaller schools with similar funding, but is also active in pursuing large corporate partnerships, such as with technology companies like Verizon.
5. *Los Angeles City Community College,* an HSI, has launched the MetaCity program to promote the use of AR/VR in teaching a range of subjects, from Chemistry to Anatomy and Physiology to English. Faculty members reported back improved student engagement, with 79% of faculty indicating that AR/ VR increased students' successful completion of learning outcomes. (Nicol Turner Lee, 2022)

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V- CASE STUDIES AND EXAMPLES IN HOSPITALITY AND TOURISM

Successful implementations in hotels, resorts, and tourist destinations
Although VR has many applications in T&H (e.g., in management, marketing, and heritage preservation, to name a few; (D.A., 2010) recent studies stress the potential of VR as a marketing communication tool (M.J. Kim C. L., 2020) , (X.Y. Leung) (S. Skard, 2021) and to enhancing tourists' experience (S. Skard, 2021)
Many hotels, attractions, and destinations offer virtual tours on their websites, although often not genuine VR, because they are frequently panoramic photographs that do not permit free navigation (Guttentag, 2010) However, VR possibilities are being offered in a growing number of cases. Hospitality brands, such as Airbnb, Best Western, Carlson, Hilton, Hyatt Regency, and Marriot, as well as airline companies (e.g., Emirates and Virgin), utilize VR.

Other areas where VR is used are tourist attractions such as theme parks (e.g., Disney) and other entertainment facilities, offering, for instance, simulated motorcycle or car rides. One may also find VR in Zoo exhibits (e.g., Edinburgh Zoo) and aquariums (e.g., Georgia Aquarium).

VR may also be used to enhance learning. For instance, many museums, such as the Louvre Museum, Guggenheim Museum, the British Museum, the Museum of Modern Art, the Rijksmuseum, and the Van Gogh Museum, have adopted VR so anyone can experience their collections anywhere in the world. NASA, too, offers digital space experiences.

Natural sites (e.g., Hawaii Volcanoes National Park) and city destinations (e.g., Central Park, NY), too, are increasingly offering VR experiences. World-famous attractions, like the Great Wall of China and the Great Pyramid of Gize, may also be explored virtually. VR is even being used to recreate sites that no longer exist - such as the destroyed Buddha figure in Afghanistan (G. Toubekis, 2017), or are inaccessible – such as that created by the Arvia'juaq National Historic Site in Nunavut, Canada (A. Bec, 2021) VR also generates opportunities for new business models and jobs, such as VT-based tour guides ((Ramachandran, 2020)

Beyond its current applications, VR can potentially be a disruptive technology for T&H. Newer technologies must be incorporated into the process to achieve that. Drones, 3D printing, robotics, and other technologies are already employed to record and construct virtual experiences (Kidd, 2015) VR also requires synchronous connectivity and a large transmission capability (for instance, using 5G). Big data, AI, and IoT are indispensable to enabling VR to become a disruptive technology (M. Abdel-Basset, 2021) . As this review will reveal, extant research suggests that tourism managers must consider VR's disruptive potential and its potential impact on their businesses, attractions, or destinations.

Demonstrations of positive outcomes in education and training
The maturity of VR technology and AR technology, as well as the learner-centered, emphasis on teaching experience and the urgent need for adaptive learning, have driven the appearance of the VR/AR teaching experience system. VR achieved a brand-new state of human-computer interaction. It can obtain intuitive and real perceptions such as sight, hearing, and touch by operating objects in the virtual world. By combining virtual objects and the real world, AR can simultaneously display the information of the real world and the virtual world, enabling learners to use 3D models to enhance the visual perception ability of real-world situations. VR enhances sensory interactivity by constructing a simulated virtual world. The main features are immersion,

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interactivity, and imagination. Immersion allows learners to eliminate external disturbances and immerse themselves in virtual reality to gain an immersive feeling. Interactivity is based on the learner's head, hands, eyes, language, and body movements to adjust the image and sound presented by the system. Imagination is to acquire visual, auditory, tactile, kinesthesia and other perceptions simultaneously in the virtual environment, enhance the learner's perception of the learning content, the high sensitivity and rational understanding of the cognitive content, so that to make the user to deepen the concept and sprouts new association, and motivate the learner's creative thinking. AR is a bridge connecting virtual world and real world. It is characterized by superposition and openness. It superimposes virtual information in the real world, enhances visual, auditory, and tactile sense, and enables learners to experience the combination of real world and virtual world in the senses. The VR/AR teaching experience system compensates for the problems that appeared in traditional teaching.

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VI- FUTURE TRENDS AND DEVELOPMENTS IN HOSPITALITY AND TOURISM

Predictions for the future of VR/AR in the sector

Tourism destinations are a vital source for influencing the tourist behavior, specifically, trend and quantum of visits, the extent of the stay, tourist footprint, and the behavior before, during, and after service consumption. Technology promotes smart destination management for creating an intelligent tourism ecosystem. The inherent networking structure, perceived risk, tourist outlook, and destination attractiveness are the antecedents to tourist engagement (Alexandris et al., 2006; Gursoy & Gavcar, 2003). Proper destination management leads to enhanced destination knowledge, faster knowledge diffusion, innovation, and tourist loyalty.
some potential trends and developments to watch for:

- **Virtual Travel Experiences:** VR could enable users to virtually explore destinations before making travel decisions. This immersive experience could include virtual city tours, hotel room previews, and even virtual walkthroughs of attractions.
- **Enhanced Booking Processes:** AR could be used to enhance the booking process by allowing users to visualize hotel rooms, amenities, and nearby attractions in real-time through their mobile devices. This can provide a more personalized and interactive booking experience.
- **Virtual Concierge Services:** VR and AR could be integrated into hospitality services to offer virtual concierge assistance. Guests could use AR devices to access information about the hotel, local attractions, and services, creating a more convenient and efficient guest experience.
- **Training and Skill Development:** VR could be employed for training hospitality staff. Virtual simulations can be created to train employees in various scenarios, including customer service, emergency procedures, and language skills, improving overall service quality.
- **Virtual Events and Conferences:** VR could facilitate virtual attendance at conferences and events, providing an immersive experience for remote participants. This can be especially relevant in the post-pandemic era, where hybrid events may become more common.
- **AR Navigation for Tourists:** AR applications can assist tourists in navigating unfamiliar environments. For example, AR overlays on smartphones or smart glasses could provide real-time information about points of interest, historical facts, and directions.
- **Cultural and Historical Immersion:** VR can be used to recreate historical or cultural experiences, allowing tourists to virtually step into the past or experience cultural events. This could enhance the educational and entertainment aspects of travel.
- **AR Translation Services:** AR could assist travelers by providing real-time language translation through smart glasses or mobile devices. This would be particularly useful for overcoming language barriers in foreign countries.
- **Virtual Meetings and Collaboration:** In the hospitality industry, VR can be utilized for virtual meetings, collaborative planning sessions, and team-building activities, reducing the need for physical travel for business purposes.
- **Health and Safety Training:** VR can be employed for health and safety training in the hospitality sector. Simulations can help staff members practice proper safety protocols and emergency procedures. (R. Ahas, 2008)

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These predictions are based on the trajectory of technology as of my last update, and it's essential to stay informed about the latest developments in VR and AR for the most accurate insights into the future of these technologies in hospitality and tourism.
The present study endeavors to coalesce and analyze literature related to virtual tourism and strives to elevate its perception from a technologically disruptive intervention to a transformative conceptualization. This study emerges as vital owing to changing tourism needs in lieu of exposure and access to technology. COVID19 has exacerbated the need to solve human problems through technology, and tourism is no exception. Systematic and scientific review protocols discern the past, present and future of virtual tourism. Review methodology entails both quantitative science mapping and qualitative intellectual structure mapping. Science mapping covered scientific actors like source, author, and document analysis culminating into an exhaustive bibliographic coupling-cluster analysis. Cluster analysis guided the transformative conceptualization of virtual tourism through key drivers, stakeholders, and activating levers that triggered interactional dynamics. The antecedent, intermediary, and outcome factors elucidate the intricacies of interactional dynamics within and between primary stakeholders. The paper finally offers the future agenda for virtual tourism. The above review positions virtual tourism as a potential turnstile for the massive transition towards tech-based sustainable tourism. Our framework gives a bird's eye view of nested, complex, and interactive dynamics between stakeholders, phenomena, and elements. It provides a starting point to curate more holistic studies on the contributions of tech-based tourism services. (Sanjeev Verma, 2022).

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VII- BEST PRACTICES AND GUIDELINES FOR HOSPITALITY AND TOURISM

Recommendations for creating immersive guest experiences.

By adhering to these best practices and guidelines, hospitality and tourism businesses can create positive and memorable experiences for guests, contributing to long-term success and positive industry reputation.
In the hospitality and tourism industry, key best practices include prioritizing customer service excellence, training staff in effective communication and problem-solving, and responding promptly to guest inquiries. Personalization is emphasized through the collection of guest preferences and the use of technology to anticipate their needs. Maintaining an updated online presence and actively managing reviews contribute to a positive reputation. Health and safety standards are paramount, with adherence to protocols and ongoing staff training. Sustainable practices, employee development, and community engagement are also crucial. Technology integration, crisis management preparedness, accessibility, and quality control further enhance the overall guest experience. Flexible booking policies and clear communication help address unexpected circumstances, fostering positive relationships with guests and ensuring long-term success.

Designing effective virtual tours involves creating a compelling and immersive experience for users who are exploring a location remotely. Here are some tips to enhance the design of virtual tours:

1. **High-Quality Visuals:**
   - Use high-resolution images and videos to provide a clear and detailed view.
   - Optimize loading times to ensure a smooth experience without delays.
2. **User-Friendly Navigation:**
   - Implement an intuitive and user-friendly navigation system.
   - Include interactive elements like clickable arrows or maps for seamless transitions between locations.
3. **360-Degree Views:**
   - Provide 360-degree panoramic views to offer a comprehensive look at the surroundings.
   - Enable users to explore the space from different angles for a more immersive experience.
4. **Informative Descriptions:**
   - Include informative and concise descriptions for each point of interest.
   - Highlight key features, historical facts, or interesting details about the location.
5. **Interactive Hotspots:**
   - Add interactive hotspots that users can click on for additional information.
   - Incorporate multimedia content such as videos, audio guides, or image galleries within these hotspots.
6. **Virtual Reality (VR) Integration:**
   - Consider offering VR compatibility for users with VR headsets.
   - VR can enhance the sense of presence and immersion for a more realistic experience.
7. **Responsive Design:**
   - Ensure the virtual tour is accessible on various devices, including desktops, tablets, and smartphones.
   - Optimize the design for different screen sizes and resolutions.
8. **Engaging Storytelling:**

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- Develop a narrative or storyline that guides users through the virtual tour.
- Use storytelling techniques to create a more engaging and memorable experience.

9. **Include Points of Interest:**
   - Identify and showcase interesting points of interest within the location.
   - Highlight landmarks, historical sites, or unique features that make the tour captivating.
10. **Interactive Floor Plans:**
    - Include interactive floor plans to help users navigate through larger spaces.
    - Users can click on specific areas on the floor plan to jump to different locations within the virtual tour.
11. **Social Media Integration:**
    - Allow users to share their virtual tour experiences on social media platforms.
    - Incorporate social sharing buttons to encourage users to share the tour with their networks.
12. **Real-Time Interactivity:**
    - Consider incorporating live elements such as live streaming or real-time chat for guided tours.
    - This can create a sense of immediacy and connection with users.
13. **Feedback and Analytics:**
    - Collect user feedback to understand their experience and identify areas for improvement.
    - Use analytics to track user engagement, popular points of interest, and overall tour performance.
14. **Brand Consistency:**
    - Maintain consistency with your brand in terms of colors, fonts, and overall design.
    - Ensure the virtual tour aligns with the brand identity of the location or business.

By incorporating these tips, you can design virtual tours that not only showcase locations effectively but also provide users with a captivating and memorable digital experience. Designing effective virtual tours involves creating a visually appealing and immersive experience for users exploring a location remotely. Use high-quality visuals, including 360-degree panoramic views, and ensure user-friendly navigation. Provide informative descriptions, incorporate interactive hotspots with multimedia content, and consider VR integration for added realism. Develop engaging storytelling and showcase points of interest. Include interactive elements like floor plans and make the virtual tour accessible across various devices. Encourage social sharing, incorporate real-time interactivity, and gather user feedback for continuous improvement. Maintain brand consistency throughout the design.
Training hospitality and tourism professionals is essential for ensuring high-quality service and enhancing guest experiences.

Here are strategies to effectively train professionals in the hospitality and tourism industry:

1. **Onboarding Programs:**
   - Develop comprehensive onboarding programs for new employees.
   - Cover organizational culture, values, and standard operating procedures.
2. **Role-Specific Training:**
   - Tailor training programs to specific roles within the industry (e.g., front desk, housekeeping, catering).
   - Focus on the unique skills and knowledge required for each position.
3. **Hands-on Training:**

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- Provide practical, hands-on training experience.
- Simulate real-world scenarios to allow employees to practice skills in a controlled environment.

4. **Customer Service Workshops:**
   - Conduct regular workshops on customer service excellence.
   - Include role-playing exercises to enhance communication and problem-solving skills.
5. **Technology Training:**
   - Stay updated on industry-specific technologies.
   - Provide training on reservation systems, point-of-sale systems, and other relevant software.
6. **Cross-Training Opportunities:**
   - Encourage cross-training to broaden employees' skill sets.
   - This helps staff understand the interconnectedness of different roles within the organization.
7. **Language and Cultural Training:**
   - Provide language training for staff dealing with international guests.
   - Offer cultural sensitivity training to ensure respectful interactions with guests from diverse backgrounds.
8. **Leadership Development Programs:**
   - Implement leadership development programs for managerial staff.
   - Focus on leadership skills, conflict resolution, and effective team management.
9. **Continuous Learning Initiatives:**
   - Encourage a culture of continuous learning.
   - Provide access to online courses, webinars, and industry conferences for ongoing professional development.
10. **Safety and Emergency Response Training:**
    - Conduct regular safety training sessions.
    - Ensure employees are well-versed in emergency response protocols and procedures.
11. **Mentorship Programs:**
    - Establish mentorship programs for new employees.
    - Pair experienced staff with newcomers to provide guidance and support.
12. **Feedback and Performance Reviews:**
    - Conduct regular performance reviews to provide constructive feedback.
    - Identify areas for improvement and offer additional training as needed.
13. **Guest Experience Training:**
    - Train staff to understand and prioritize the guest experience.
    - Emphasize the importance of anticipating and exceeding guest expectations.
14. **Gamified Training Modules:**
    - Create gamified training modules to make learning more engaging.
    - Incorporate quizzes, challenges, and rewards to keep employees motivated.
15. **Soft Skills Development:**
    - Focus on developing soft skills such as communication, empathy, and teamwork.
    - These skills are crucial for building positive guest relationships.
16. **Certification Programs:**
    - Encourage employees to pursue industry certifications.
    - Offer support and incentives for obtaining relevant certifications.
17. **Scenario-based Training:**
    - Use real-life scenarios to train employees.

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- This helps them develop problem-solving skills in situations they may encounter on the job.

18. **Incorporate Technology in Training:**
    - Leverage e-learning platforms and virtual reality for immersive training experiences.
    - Use online tools for tracking progress and completion of training modules.

By combining these strategies, hospitality and tourism professionals can be equipped with the necessary skills, knowledge, and attitudes to deliver exceptional service and contribute to the success of the industry.

Effectively training hospitality and tourism professionals involves implementing comprehensive onboarding programs, role-specific training, and hands-on experiences. Emphasize customer service excellence through workshops and role-playing exercises. Stay updated on industry technologies and provide language and cultural training for diverse interactions. Foster continuous learning with leadership development, safety training, and mentorship programs. Incorporate feedback, performance reviews, and gamified training modules to keep employees engaged. Focus on soft skills development, encourage certification programs, and use scenario-based training for practical skills. Leverage technology, including e-learning platforms and virtual reality, to create immersive training experiences. These strategies collectively contribute to a skilled and adaptable workforce in the hospitality and tourism industry.

(Making Tourism More Sustainable - A Guide for Policy Makers, UNEP and UN Tourism, 2005) (Twining, 2023) (Enhancing the Customer Experience with Virtual Tours in the Hospitality Industry, n.d.) (Liang, n.d.).

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VIII- FREE AND OPEN SOURCES SUITABLE FOR EDUCATIONAL PURPOSES.

- Virtual reality (VR)
- Augmented reality (AR)

Regarding Linkedin (Mallet, 2022) Top 10 VR Apps for Education in 2022 are listed as below:

ARTS & CULTURE

- Apollo 11 VR
- Anne Frank VR House
- Traveling While Black

SOFT SKILLS

- Bodyswaps

GEOGRAPHY & NATURE

- Wander
- Titans of Space

SOCIAL VR

- Engage
- Tiltbrush/Multibrush

DESIGN & ANATOMY

- Organon
- ShapesXR

VR *free and open sources* suitable for educational purposes:

1- OpenSimulator

OpenSimulator is an open-source multi-platform, multi-user 3D application server. It can be used to create a virtual environment (or world) which can be accessed through a variety of clients, on multiple protocols, see Connecting. Optional Hypergrid allow users to visit other OpenSimulator installations across the web from their 'home' installation or grid. In this way, it is the basis of a nascent distributed Metaverse. OpenSimulator allows virtual world developers to customize their worlds using the technologies they feel work best - we've designed the framework to be easily extensible. OpenSimulator is written in C#, running both on Windows over the .NET Framework and on Unix-like machines over the Mono framework. The source code is released under a BSD License, a commercially friendly license to embed OpenSimulator in products. If you want to know about our development history, see History.
OpenSimulator can be used to simulate virtual environments like Second Life™. However, OpenSimulator does not aim to become a clone of the Second Life server platform. Rather, the project aims to enable innovative feature development for virtual environments and the Metaverse at large. OpenSimulator is getting more stable over time but is still a highly complex software system that can suffer various bugs and quirks, handle with care!
http://opensimulator.org/wiki/Main_Page

2- JanusVR

JanusVR is an open-source web browser for virtual reality experiences. It allows users to explore and interact with virtual worlds and 3D content on the web using VR headsets or standard desktop computers. Users can navigate through virtual spaces by clicking on

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hyperlinks that lead to other VR scenes or web pages. JanusVR supports a variety of immersive features such as spatial audio, dynamic lighting, and multi-user interactions.
https://www.janusxr.org

3- Mozilla Hubs

Mozilla Hubs is a web-based platform that allows users to create and share virtual spaces for meetings, events, and educational experiences. It enables users to collaborate in real-time within customizable virtual environments. Users can access Mozilla Hubs through a web browser, without the need for additional software or downloads. They can create new virtual rooms, customize the environment, invite others to join, and interact using avatars and built-in tools.
https://hubs.mozilla.com

4- Kolibri VR

Kolibri VR is an open-source platform for creating and sharing interactive VR lessons and experiences. It enables educators to develop custom VR content for educational purposes, including virtual tours, simulations, and interactive storytelling. Kolibri VR provides a user-friendly interface for building VR experiences without coding. Educators can create scenes, add multimedia content, define interactions, and publish their projects for viewing on VR headsets or desktop computers.

AR *free and open sources* suitable for educational purposes:

1- ARToolKit+

ARToolKit+ is an open-source software that helps solve the fundamental problems in augmented reality including geometric and photometric registration. The ARToolkit+ is a collection of software tools that provides impressive results to the users. This free augmented reality software makes use of scalable AR solutions to solve real-world issues.
https://www.goodfirms.co/software/artoolkit

2- Mixare

Mixare is an open-source augmented reality browser that works as a completely autonomous application. This free AR software is available for android and the iPhone 3GS. It is published under GPLv3 and is also available for the development of its implementations.
http://www.mixare.org/static/index.html

3- Holokit

Holokit is one of the top open source software that makes use of mobile devices. The software includes the HeadKit cardboard headset and TrackKit software. HoloKit provides access to the world of mixed reality with the help of smartphones and mixed reality apps. It provides an immersive solution to the users.

4- Adobe Aero

Adobe Aero is free software that can view, build, and share immersive and interactive AR experiences. The user does not require complex coding and can effortlessly blur the lines between the physical and digital worlds. The software provides engaging AR experiences quickly and easily.
https://www.adobe.com/products/aero.html

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5- Vuforia Engine

Vuforgia Engine is free software that is used by companies of all sizes. It is considered one of the top free AR software solutions that can drive better outcomes. Across all leading platforms, Vuforia Engine supports AR devices like phones, tablets, and headsets to reach the most massive audience.
https://www.ptc.com/en/products/vuforia/vuforia-engine

6- ZapWorks Studio (30 days free trial)

ZapWorks Studio serves as the complete augmented reality toolkit for agencies and businesses. The software provides a powerful AR toolkit for companies who prefer to push the boundaries of creativity and storytelling. With this software, the user can quickly build, publish, analyze, and scale immersive AR experiences. The designers and developers can make fully customizable AR experiences across print, product, packaging, retail, and events.
https://zap.works
(Hernanadez, 2023)

TECHNOLOGIES USED BY THE PARTNERS IN THE CONSORTIUM:

EON Reality
EON Reality specializes in creating AR and VR solutions aimed at transforming education and industry training. They focus on making knowledge transfer more efficient and accessible, combining AI, IoT, AR, and VR technologies. Their offerings include software platforms and applications designed to enhance learning, training, and performance support. EON Reality's vision extends to fostering a closer human-computer collaboration, aiming to empower people through advanced digital tools. Their solutions are tailored to meet the needs of various sectors, including education, healthcare, and manufacturing, facilitating immersive and interactive learning experiences.

For a more detailed overview, please visit their website (https://eonreality.com/home/).

Some examples from the website on the topic of tourism:

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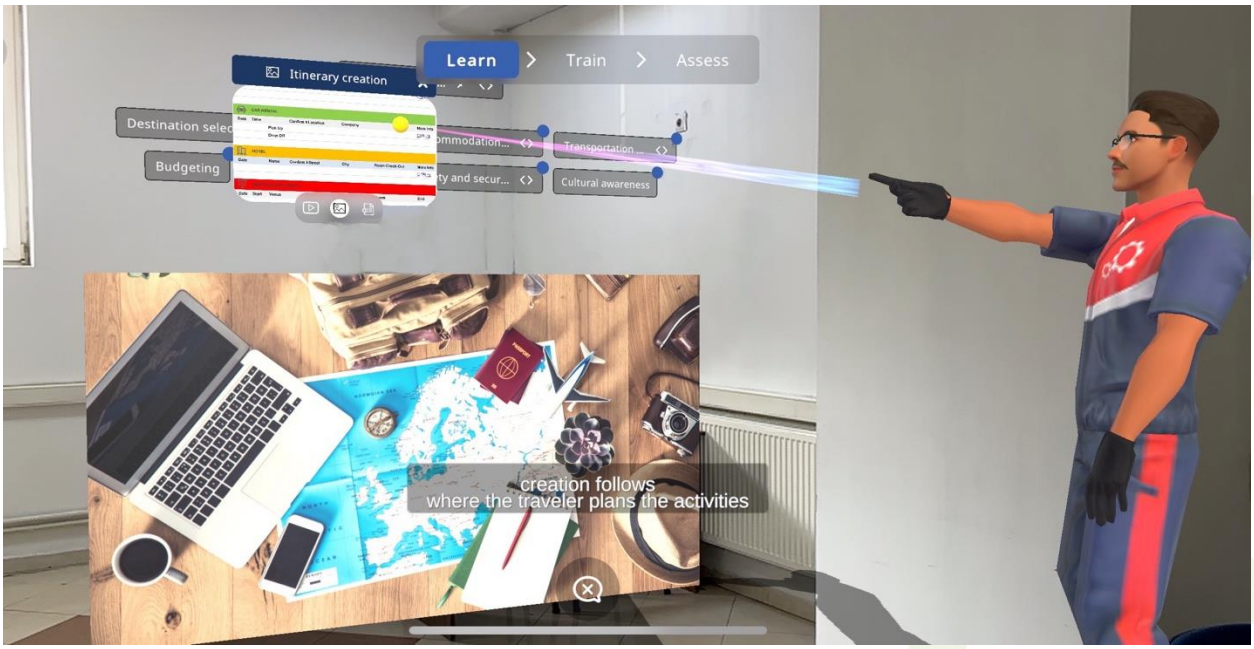

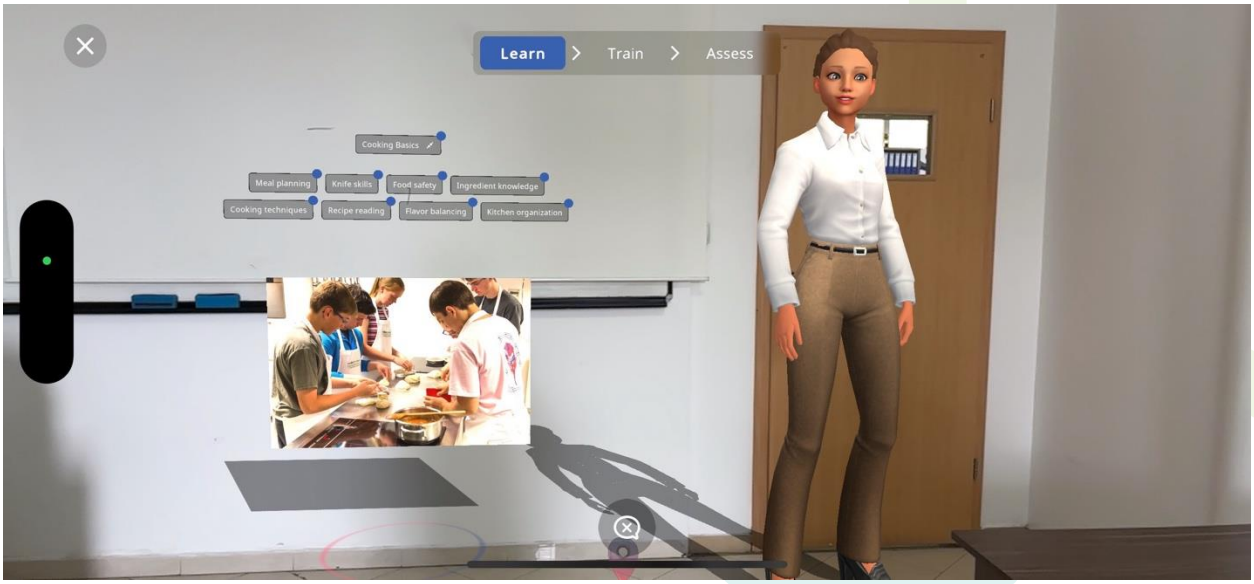

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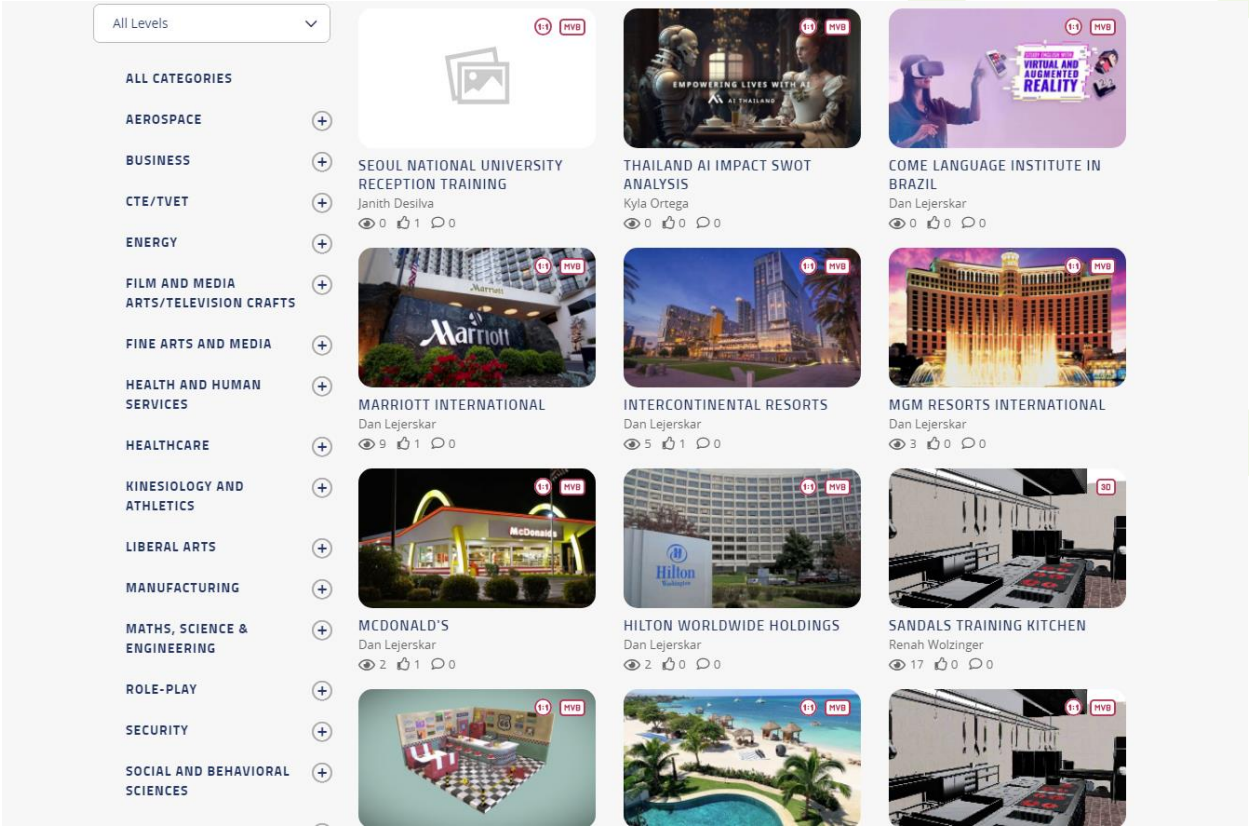

Google Earth VR through VIVE glasses

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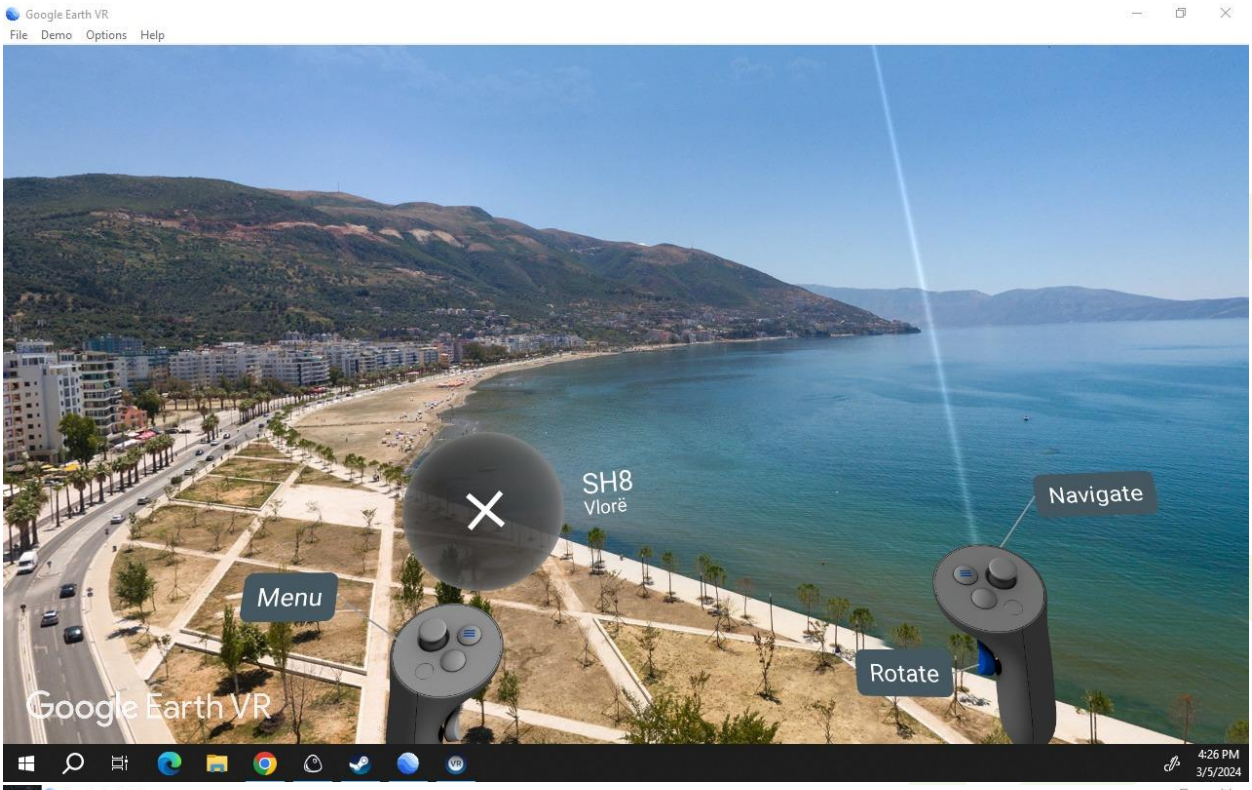

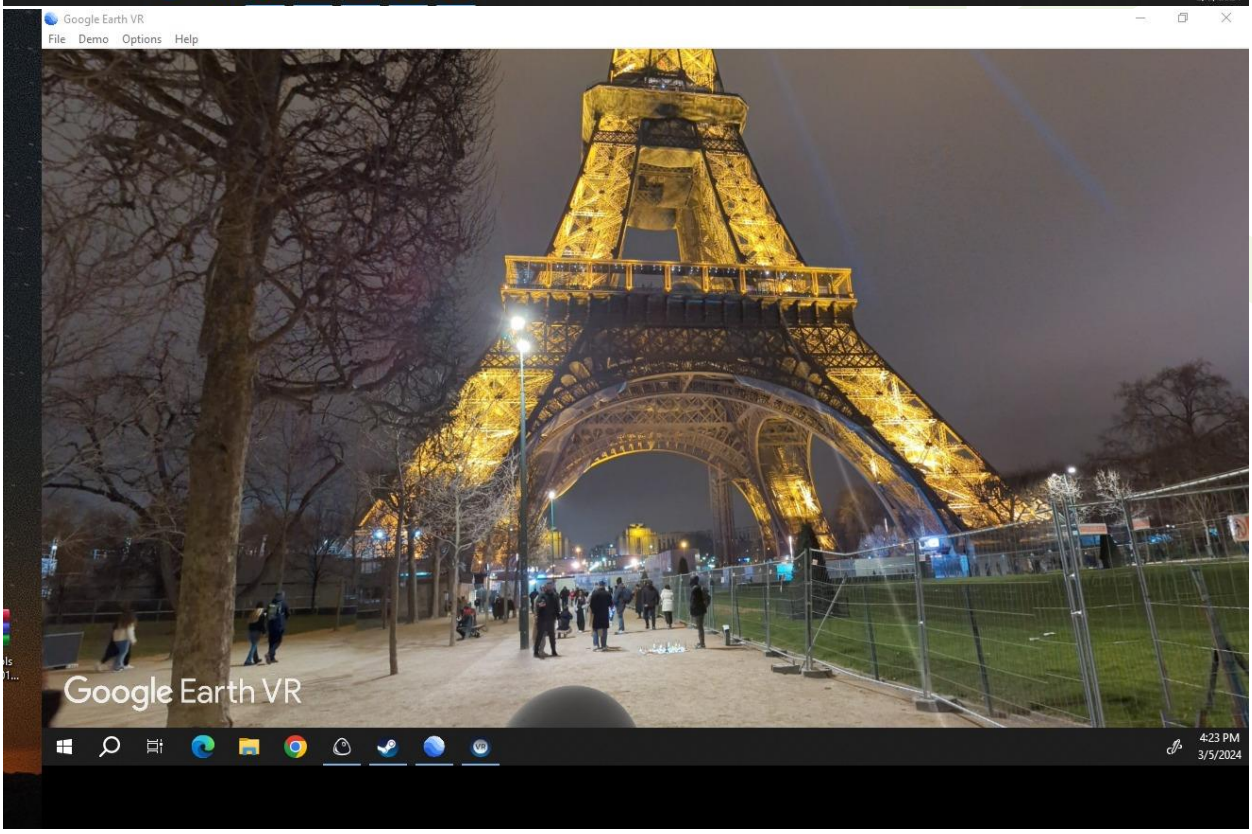

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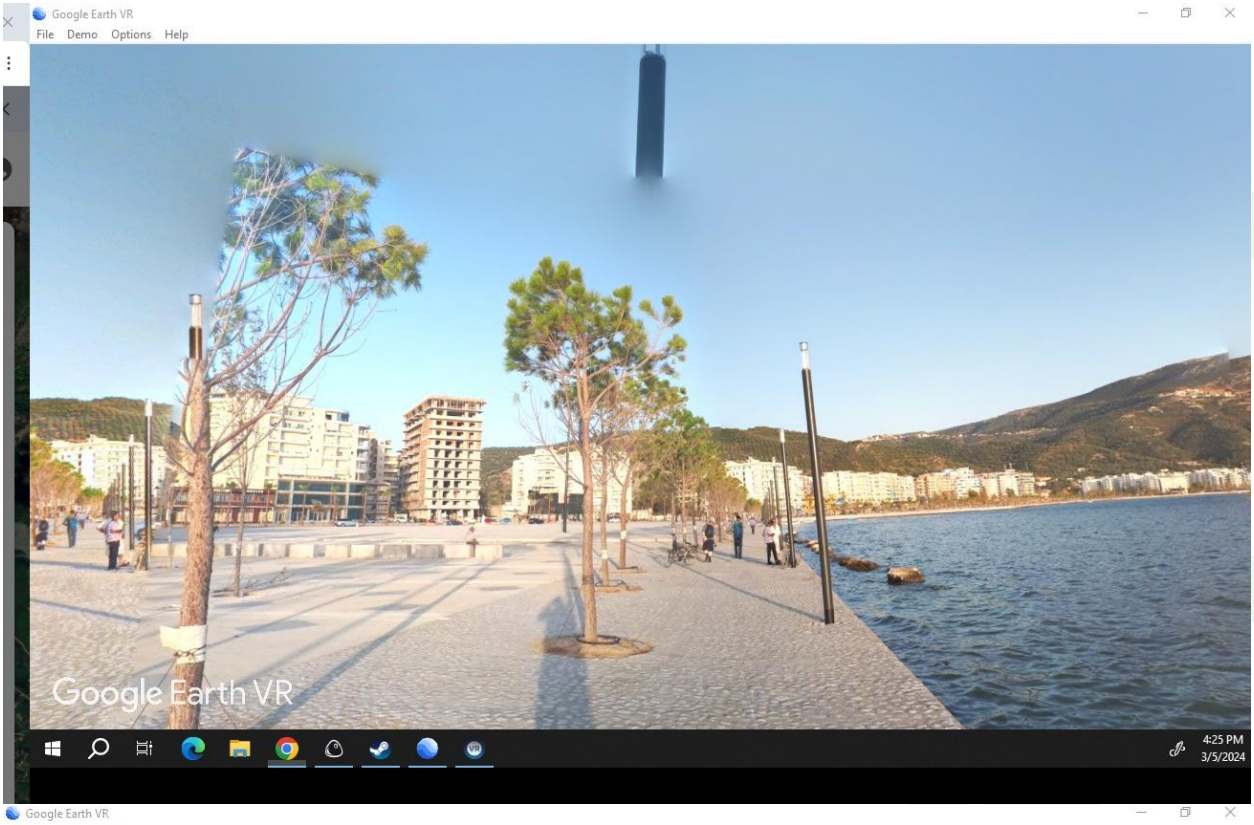

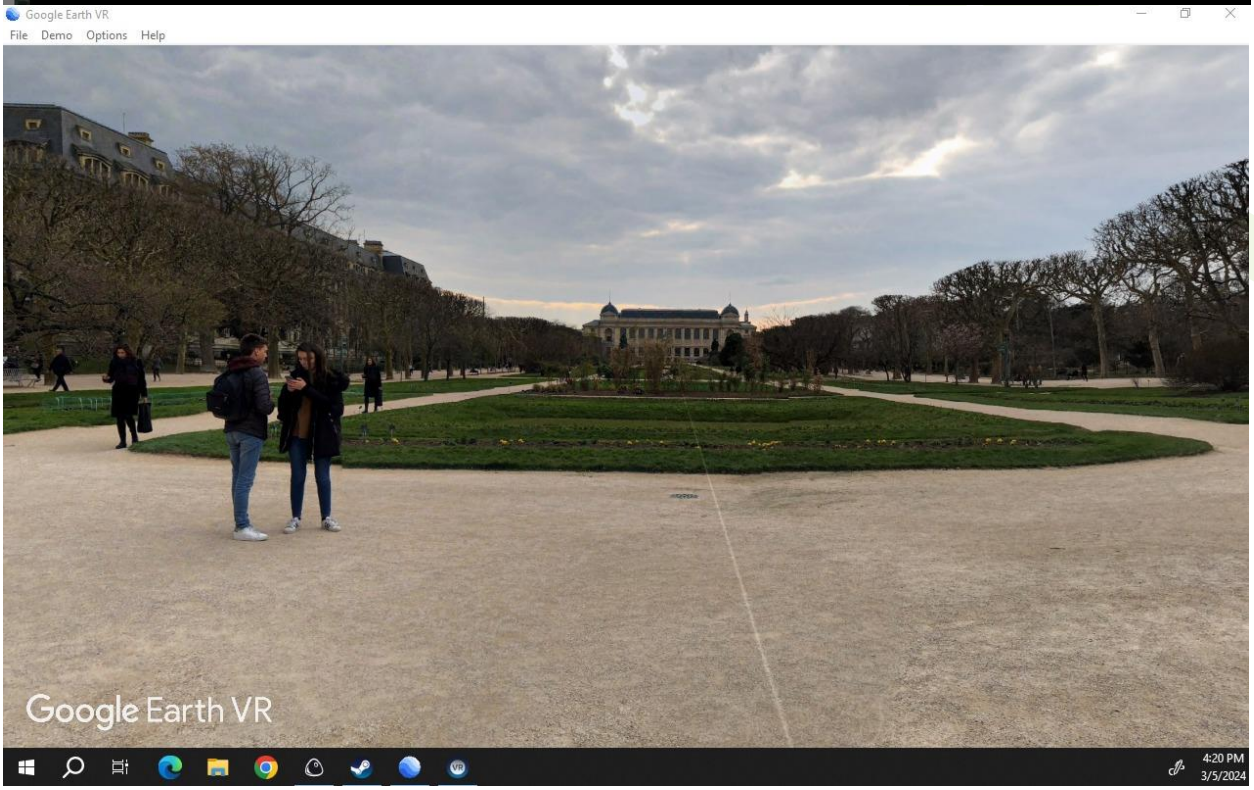

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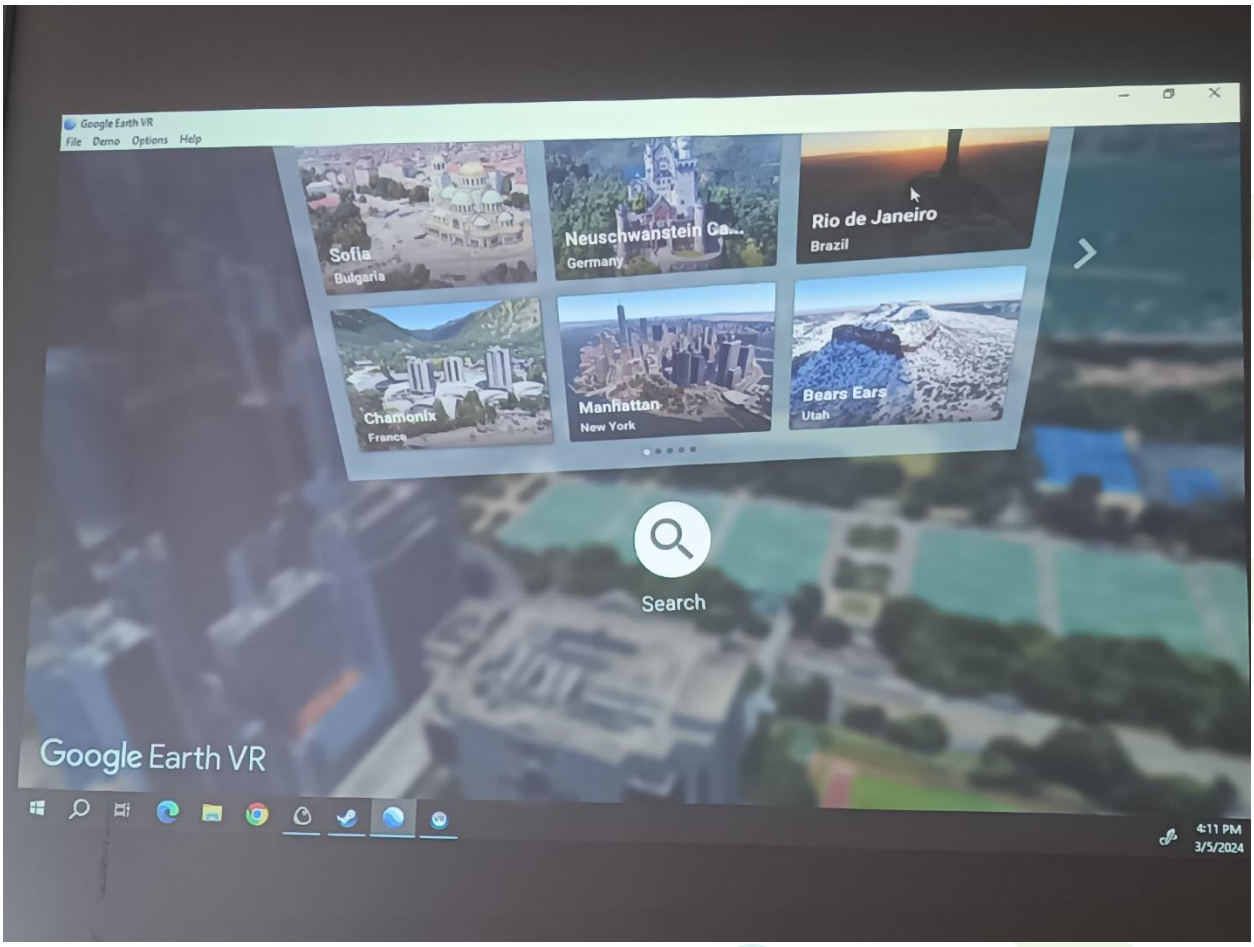

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