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Training optimization and correction of painting techniques of professional painters using a virtual reality simulator



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Project No. 2020-1-HR01-KA226-VET-094650



Project description

Abstract

SIMSPRAY is a virtual spray paint learning system that helps students to acquire technical skills and train fundamental motor skills required for performing car or industrial painting and blasting works. The VR training solution speeds up the initial learning steps of students and improves the quality of professionals' performance.

The use of SIMSPRAY in vocational training is supplemented by VULCAN, a learning tracking platform that supports instructors in tracking and evaluating the learning progress of students and create customized exercises.

The deployment of the VR training solution SIMSPRAY in Morocco was realized in collaboration with the national Office of Vocational Training and Employment (OFPPT).

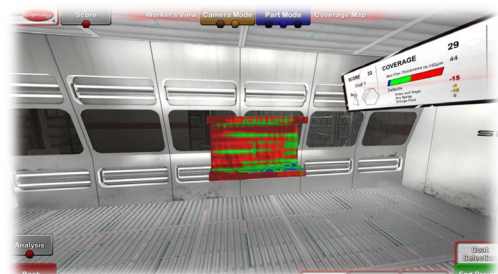
Basic Information

- **Purpose of immersive technology use in TVET:**
 - Motor skills training
 - Provide support with assistance systems
 - Use authoring tools to create learning content
- **Sector:** Paint and coatings industry
- **Course / subject area:** Car and industrial painting
- **Type of training:** Post-secondary and adults training
- **Partners:** Office of Vocational Training and Employment Promotion (OFPPT), Morocco
- **Start date:** 2020 (ongoing)





Educational concept



Learning contents & outcomes

SIMSPRAY by MIMBUS offers progressive training for learners to acquire and improve **professional competencies and manual dexterity** required in the area of car and industrial painting.

The VR training solution helps to achieve the following **learning goals**:

- Enhance understanding of industrial paint applications;
- Train and improve students' concentration, body position and hand motions required for spray painting;
- Speed up the learning process through performance analysis and feedback

OFPPT integrated the VR-based training in their curriculum. After an initial pilot phase, the VR training solution will be deployed to all OFPPT campuses by early 2022.



Educational setting

The VR training solution is designed for learners to **train repetitively** on SIMSPRAY:

- The learning approach combines experiential learning, blended learning and gamification elements: SIMSPRAY is used during the **initial learning period** and then used regularly to further improve learners' motor skills during **practical sessions** in school. VR training can also be combined with and/or precede **in-company training** to prepare learners for the workplace.
- The **target group** of this project are TVET students at post-secondary level or unemployed people who attend training courses at OFPPT to become professionals in the paint and coating industry.
- VR training is usually organized as **individual training**, but can also take place in a group.
- **Trainers** use VULCAN as **virtual assistant** to keep track of individual learning, provide feedback and create exercises that are aligned to learners' skills development and the respective curriculum.



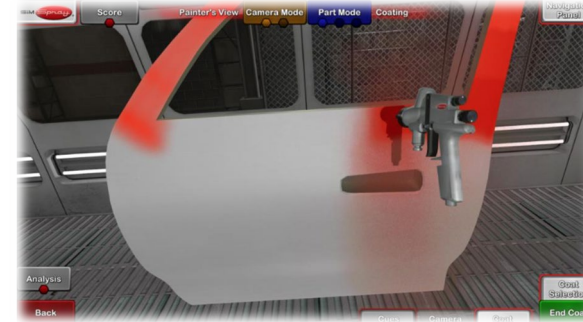
Technical setup of the virtual reality simulator

Hardware

- Computer
- Tracking system
- Head-mounted display
- Painting guns and accessories

Motion tracking

- **Room-scale VR** allows users to move around the objects displayed in the virtual space
- The **painting gun** can be set-up the same way as in real life. Painting quality such as the quantity of pain used and wasted, defects in the applied paint as well as motion speed and orientation (e.g. angle, distance) are closely **tracked**.
- SIMSPRAY also has also offers various **assistant tools** such as guides, information and visual feedbacks to support learners' training.





Benefits of Use in TVET

Reduction in training costs and waste

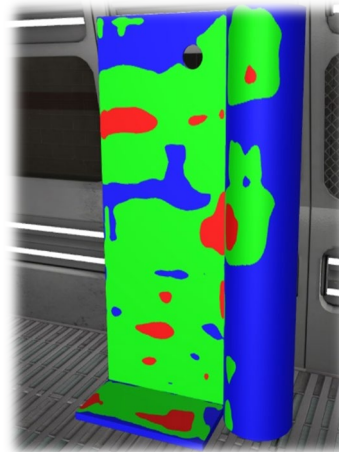
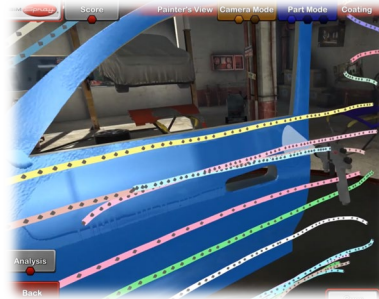
While learners can spend more time for practical training, training costs can be significantly reduced by saving painting material. This also reduces the impact of training on the environment.

VR-based training of motor skills increases training efficiency

Integrated performance analysis and feedback speeds up the learning process and significantly reduces training duration as the VR applications allows learners to repeat exercises numerous times at no extra costs. The efficiency of SIMSPRAY has been validated worldwide by various customers.

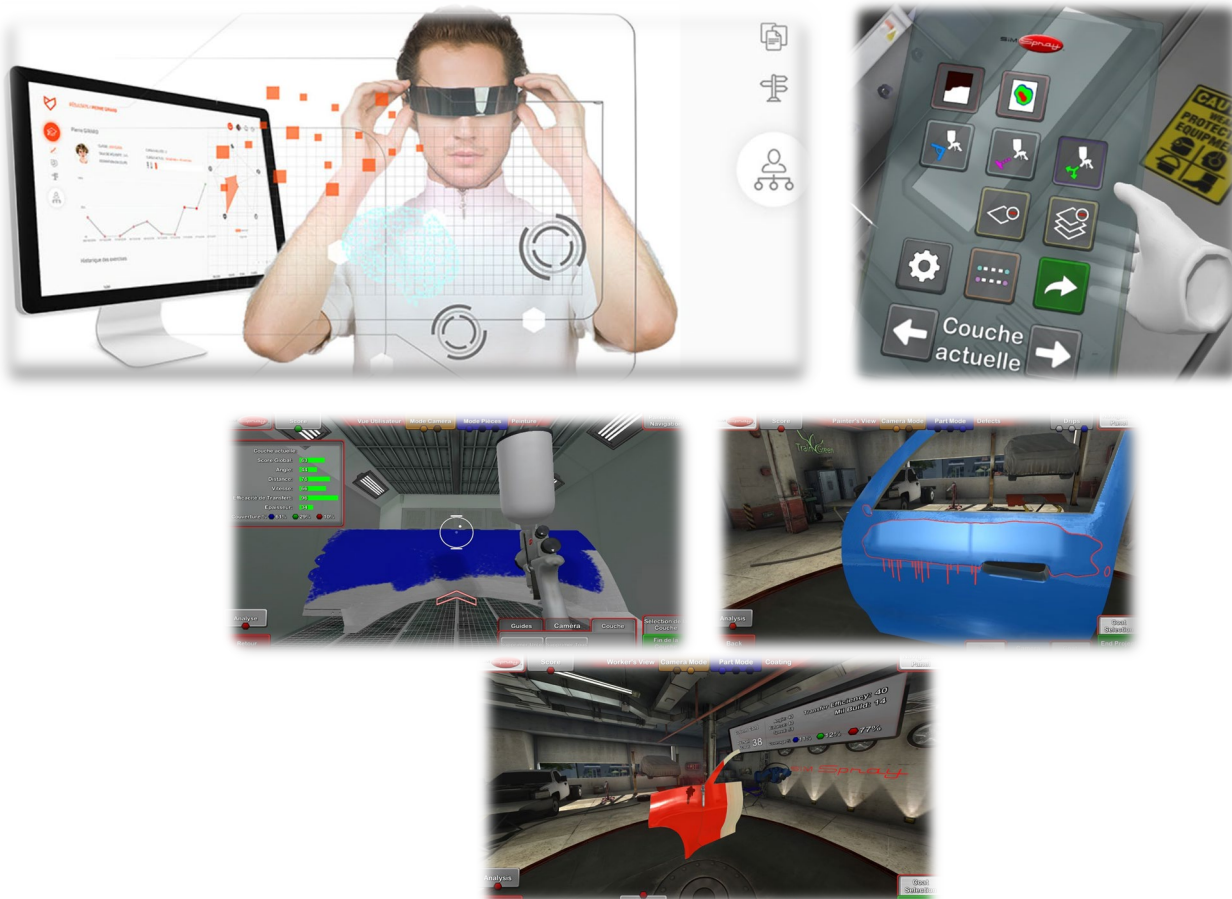
Performance tracking supports achievement of learning goals

Thanks to VULCAN, each student's learning progress is tracked and trainers can ensure that they advance accordingly. Trainers can adapt the curriculum for each student to make sure the group is making progress, and no one is left behind. The data provided by VULCAN aligns with the necessary data to validate the final achievements.





Lessons Learned



Design of XR solutions must support competency development

Immersive training solutions should not be just a virtual copy of reality. Rather, they should be designed in such a way that they support competency development and therefore may differ widely from the “real experience”. For this purpose, it is crucial to include pedagogical staff and experienced practitioners in the development process.

Flexible adaptation of virtual training content is essential

To ensure the benefits of VR-based training, it is essential to align virtual training with local standards. Integrated training management systems such as VULCAN allow instructors to flexibly adapt exercises and modify learning paths in alignment with local curricula and learners’ needs.

Provide targeted support to instructors

Teachers and trainers are essential for ensuring the acceptance and successful integration of immersive technologies in TVET. The MIMBUS ACADEMY was founded to provide guidance and training for instructors to implement technology-enhanced learning approaches into their practice.



Valuable outcomes of the project



The Bridging Innovation and Learning in TVET (BILT) project provides TVET stakeholders with a platform for exchange and supports them to address current challenges in TVET systems, which arise due to technological, social, environmental, and workplace changes. Within BILT, the overarching theme is New Qualifications and Competencies in TVET, which is supported by four focus themes in the context of TVET:

- Digitalization
- Greening
- Entrepreneurship
- Migration

Through regular knowledge exchange, thematic project activities, and expert working groups BILT leverages the existing mechanism of the UNEVOC Network to offer opportunities for collaboration and peer learning in

Europe, Africa, and Asia and the Pacific. The project complements national developments to explore and support innovative, market-oriented and attractive modes of learning and cooperation in TVET.

The results of ongoing activities are accessible on BILT's web page.

The BILT project is carried out in collaboration with UNEVOC Network members, coordinated by UNESCO-UNEVOC with support of the German Federal Institute for Vocational Education and Training (BIBB), and sponsored by the German Federal Ministry of Education and Research (BMBF).

For more information, please visit

www.unevoc.unesco.org/bilt

or contact us at unevoc.bilt@unesco.org



Digital media support in TVET

Initiated by the Federal Institute for Vocational Education and Training in Germany (BIBB), the Roadshow aims to show the potential of digital applications and technologies for teaching and learning in Technical Vocational Education and Training to make learning more flexible and enhance the quality and attractiveness of TVET.

The format builds on the German Roadshow 'Digital Media in TVET', which has been successfully implemented and conducted by the Federal Ministry of Education and Research in Germany (BMBWF) in cooperation with BIBB since 2016.

More information:

<https://www.bibb.de/de/105326.php>





Hungarian continuation of the story...

Company: PAINT TECH GROUP Kft., Hungary

Year: 2022. ongoing



The problem:

It is used by the specialists in the production during the spray painting process. Your movement dynamics need refinement, you have the right routine due to poor conditioning scrap became significant.

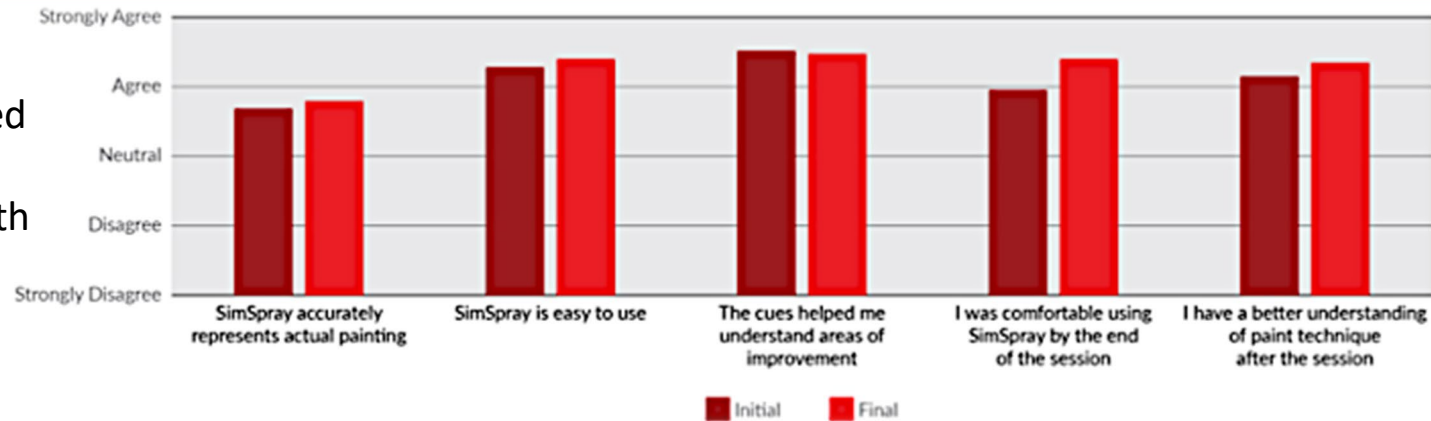


Solution to the problem: [Correction of the painter painting technique with the SimSpray simulator.](#)



Trial usage outcomes

Summary: Study consisted of 19 participants involved in manual paint processes, with varied experience (beginner to expert). Participants spent 6-8 hours across 3-4 2-hour sessions with SimSpray. Sessions included an expert painter/instructor per 1-4 participants.



Paint & Materials	Operating Costs	Training Time
35% decrease in overall material costs	20% reduction in program operating costs	60% increase in practice time, per student

Study Note: SimSpray projects are used to establish and test students' basic skill proficiency before their participation in live training (e.g. Students are required to score a minimum of 85 out of 100 before participating in live spray training).

Study Takeaways:

- **Quick, out of the box implementation**
- **A valuable tool to use for training paint associates** for manual painting technique practice
 - Allows the student to practice basic technique to promote more advanced topics while in OJT/live training
 - Increased practice 15x more than live painting
- **Engages students** in the learning process
 - Students can use the system themselves
 - Provides a 'safe, non-production' environment to learn/practice
- **Will be incorporated into a training program** consisting of classroom training and on-the-job/live training



Customer comments

I took my students to Atlanta, GA to the PPG Paint Training Center for training and certification. The instructors from PPG and other certified, experienced painters attending the center all commented on how exact my students' technique was... including gun angle, speed, distance, and overlap... Everyone asked me how they got to be so good. My answer is SimSpray forces them to do that. [Billy Huneycutt](#), Program Head of Autobody Repair/Restoration at Stanly Community College

You push a button, and you have a clean part to start with. It gives you a lot of repetitions in a pretty short period of time, which you can't get in a production environment today. [Tod Gray](#), New Model Paint Project Lead at East Liberty Auto Plant

After training on SimSpray it is a lot less stressful when it comes to live spray. [The students] reason was they learned the skills to become successful using SimSpray. [Kerry Coggins](#), AutoBody at Van Buren Intermediate School District

Before VR technology, we had to have actual physical assets. We would have to have students actually operate that equipment. Now, it allows a student to learn those skills, but in a virtual way. [Scot McLemore](#), Manager of Talent Acquisition and Deployment at Honda North America

This machine gives students a stepping stone to the reality. It's something you can practice with, and when you get to the real spray gun, panel, and paint, students will go back and retrieve that information from the training and put in practice on the real project." [Efrain Villarreal](#), Career and Technical Education Automotive Collision Teacher at San Benito Consolidated Independent School District

Most of our students don't have any experience painting. We get people straight out of high school, from (local grocery stores), or coming from a different trade. Using the simulator is the best way to help them build their skills. [Travis McGregor](#), Training Instructor at Shop 71, Puget Sound Naval Shipyard & Intermediate Maintenance Facility

The simulator tracks exactly how students hold and move the sprayer. The software provides real-time feedback to the instructor as well. We can pause what they are doing and show them where they've moved the sprayer too quickly or too slowly. We can show them where they overlapped their paint layers too much or too little. [Travis McGregor](#), Training Instructor at Shop 71, Puget Sound Naval Shipyard & Intermediate Maintenance Facility





Virtual Reality Training Tool for training spray painting, SimSpray, VRSim USA

Technology: VR Virtual Reality

Painter process: HVLP, HVLP Edge-Blending, Airless, Air-Assisted Airless, Powder Coating, Abrasive Blasting

Material: plastic, steel and wood

Content Features: Automotive, Aerospace, Building Trades, Furniture & Cabinetry, Structural

Languages: English, Spanish, French, German, Polish, Turkish, Czech, Russian, Hungarian...etc.





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This best practice example provided by the MIMBUS, our valuable partner in digitalization...

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