

## IO3 – HOW TO ... Best practice example

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

---



Co-funded by the  
Erasmus+ Programme  
of the European Union

*The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein..*



## Table of Contents

Glossary.....	4
Abbreviations.....	6
1. Introduction.....	7
2. Selection of best practices in digital education and training .....	9
3. Education and training in IWT sector .....	16
3.1 Online Education for IWT sector using gamification .....	22
3.2 Blended Education for IWT sector using inland navigation simulator .....	24
4. Digital education in engineering.....	28
4.1 Learning about Beam Pumping Units using digital technologies .....	28
4.2 Correction of welding techniques of professional welders (tailor made).....	29
5. Virtual reality simulators for painting.....	32
5.1 Training optimization and correction of painting techniques of professional painters using a virtual reality simulator .....	32
5.2 Professional integration of autistic people thanks to MIMBUS Discover and more European good practice examples using virtual reality training tools in VET.....	40
6. Virtual and Augmented Reality in engineering and CSI training .....	45
6.1 Welding learning based in Augmented Training Methodology .....	45
6.2 Criminalistic inspection with Virtual Reality.....	46
7. Welding simulators for training and virtual tour using smartphones .....	49
7.1 Design of student curricula, training and courses connected to WPS-MAG 135 and MMA 111 on a Fronius Virtual Welding Training System .....	49
7.2 How to make a virtual tour.....	55
8. Blended teaching using different digital tools.....	61
8.1 Microsoft Teams (blended teaching / training).....	61
8.2 Kahoot (presential teaching/learning) .....	63
9. Facilitating classrooms and safety issues in virtual reality.....	65
9.1 How to use VR safely in a classroom setting .....	65
9.2 How to facilitate your first class? .....	69
10. Simulation of welding and online learning using digital tools.....	75
10.1 Introduction to MAG welding.....	75



10.2 Blended Learning (mixture of e-learning and teaching in a classroom) of visual testing of welded joints .....78

References .....80

## Glossary

Gamification	adding game mechanics into nongame environments, like a website, online community, learning management system or business' intranet to increase participation.
Simulators	devices that provides the imitation of the operation of a real-world process or system over time
Interactive Smartboard	large interactive display board in the form factor of a whiteboard. It can either be a standalone touchscreen computer used independently to perform tasks and operations, or a connectable apparatus used as a touchpad to control computers from a projector. They are used in a variety of settings, including classrooms at all levels of education, in corporate board rooms and work groups, in training rooms for professional sports coaching, in broadcasting studios, and others.
Google Classroom	a free web service developed by Google for schools that aims to simplify the creation, distribution and grading of assignments in a paperless way. The main purpose of Google Classroom is to streamline the file sharing process between teachers and students.
Microsoft Teams	A messaging app for organizations, a workspace for real-time collaboration and communication, meetings, file and app sharing, and even the occasional emoji.
VR Headset	A virtual reality headset (or VR headset) is a head-mounted device that provides virtual reality for the wearer. VR headsets are widely used with VR video games but they are also used in other applications, including simulators and trainers. VR headsets typically include a stereoscopic display (providing separate images for each eye), stereo sound, and sensors like accelerometers and gyroscopes for tracking the pose of the user's head to match the orientation of the virtual camera with the user's eye positions in the real world
Game Console	A video game console is an electronic device that outputs a video signal or image to display a video game that can be played with a game controller. These may be home consoles, which are generally placed in a permanent location connected to a television or other display devices and controlled with a separate game controller, or handheld consoles, which include their own display unit and controller functions built into the unit and which can be played anywhere. Hybrid consoles combine elements of both home and handheld consoles.
Learning Management Systems	a software application for the administration, documentation, tracking, reporting, automation, and delivery of educational courses, training programs, materials or learning and development programs. The learning management system concept emerged directly from e-Learning. Learning management systems make up the largest segment of the learning system market.



## Welding Procedure Specification

a document that serves as a guide for the effective creation of a weld that meets all applicable code requirements and production standards



## Abbreviations

WPS	Welding Procedure Specification
IWT	Inland Waterway Transport
PTSD	Post – Traumatic Stress Disorder
LMS	Learning Management System
ILIAS	Integrated Learning, Information and Work Cooperation System
CSI	Crime Scene Investigation
TVET	Technical and Vocational Education and Training

# 1. Introduction

COVID-19 crisis raised an important issue of educational systems. According to OECD (2020) report related to the impact on education systems, the COVID-19 crisis has exposed the many inadequacies and inequities in our education systems – from access to the broadband and computers needed for online education, and the supportive environments needed to focus on learning, up to the misalignment between resources and needs. Previous reports of OECD also outlined that less than 40% of educators felt ready to use digital technologies in teaching with wide differences across the EU. Moreover, although there are simulators that use technologies based on augmented reality or virtual reality, they can only be accessed by students inside the laboratories of the vocational school. No European country has been prepared for the transition from traditional face-to-face learning to online or blended learning, much less in the case of practical activities absolutely necessary for qualification in special trades such as welding. Therefore, the need to present the best practices in the activity of teaching / theoretical and practical learning is absolutely necessary for the improvement of the educational process in vocational schools that have not used digital tools so far. On the other hand the digital skills of teachers and students are very important for the succes of uptaking of virtual learning environment in education process. According to JRC Technical Report of EU (2020) related to the impact of COVID-19 on education, the need for profesional development in the are of ICT skills for teaching is also higher in schools with high concetration of disadvantaged students. The tasks assumed according to the application were:

- Digital Learning Management Systems
- Best practices in education and training using digital tools
- Exchange information using European platforms

DRinVET main goal is to create tools in Digital Reality (DR) to help teachers and trainers, who have been struggling to adapt to this new digital environment, in overcoming their difficulties, especially in terms of practical training delivery and assessment. The reason behind this project comes from the current reality we have been facing regarding COVID-19. The Intellectual Output 3 (IO3) aims to develop best practice examples for VET digital classroom using current digital tools for distance and blended learning such as Microsoft Teams, Google Classroom, Zoom, Webex, etc. The work performed by DRinVET partners can be summarized as follows:

- STEP 1: Selection of two best practices that you are using in teaching and assessment activity
- STEP 2: Describing the best practices:
  - Preparation for teaching/learning/assessment: describing the interaction with students in classroom:
    - Is it used specific digital tool like Google Classroom, Microsoft Teams or any other tools for creation the virtual classroom?
    - Is it use blended learning tools like teaching face-to-face and the assessment of practical training is done on a simulator or any other digital

- tool?
  - Is it used other methods for teaching that include digital tools for theoretical and practical training?
- Describing in detail the methodology:
  - Teaching methodology (online, blended, etc.)
  - Providing the educational materials to the students
  - Giving assignments to the students
  - Procedure for assessment of the students
- STEP 3: preparing a document related to your the practices developed according to an agreed template
- STEP 4: preparing two presentations with information from the document. The presentations will be used by teachers in training activity of other teachers
- STEP 5: Recording videos for each best practice that are developed in DRinVET project.

The development of IO3 – How To ... has been focused on presenting best practices in teaching, learning and assessment during COVID-19 pandemia. Based on their expertise in the field of education and digital tools for teaching, learning and the assessment, the partners developed documentation for teachers and students. The best practices developed in the scope of DRinVET project cover various specializations for VET, as follows:

- Inland and maritime navigation
- Electrical and mechanical engineering
- Welding technology
- Judicial and police investigation
- Spray painting
- Photography and virtual tours



## 2. Selection of best practices in digital education and training

The development of new approaches in the digital era has been focused on presenting best practices in teaching, learning and assessment during COVID-19 pandemia. Based on their expertise in the field of education and digital tools for teaching, learning and the assessment, the contributors developed documentation for teachers and students. The best practices here presented were developed with scope of improving digital education and cover various specializations for VET, as follows:

- Online and Blended Learning using inland navigation simulator and gamification

Table 2.1 Online Learning best practices for inland navigation using gamification

Type	Theory	Practice	Application / Technology
Online	x		Google Classroom
Blended			Ship Simulator 2006
Physically			UCV LMS
Offline@home	x	x	Computer, Laptop
N.A.			
Description	How to use online environment for teaching and assessment		

Table 2.2 Blended Learning best practices for inland navigation using simulators

Type	Theory	Practice	Application / Technology
Online	x		Google Suite Ship Simulator 2006 UCV LMS Computer, Laptop
Blended		x	Google Suite
Physically		x	Ship Simulator 2006
Offline@home		x	UCV LMS Interactive SmartBoard Inland Navigation Console or other auxilliary devices
N.A.			
Description	How to use online and face to face environment for teaching, practising and assessment		

- How to learn about beam pumping units using digital technologies and correction of welding techniques of professional welders

Table 2.3 Learning about Beam Pumping Units using digital technologies

Type	Theory	Practice	Application / Technology
Online	X		Social Media – Facebook group
Blended			
Physically		X	Flipped classroom - Debriefing
Offline@home			
N.A.			
Description	This best practice is focused on presenting how the students can learn about beam pumping units in terms of formulation of general and technical description of devices and equipment. Also, the second aspect is the presentation of the results using digital tools as well as creating and presenting technical studies using digital technologies in a virtual environment		

Table 2.4 Correction of welding techniques of professional welders

Type	Theory	Practice	Application / Technology
Online			
Blended			
Physically			
Offline@home		X	VWTS / Digital reality (VR, AR, MR, XR)
N.A.			
Description	Training is arranged according to the needs of the employer (Tailor made) WPS is sc co-developed by the employer’s welding coordinator and trainer. The trainer enters data from WPS into VWTS (Virtual Welding Training System – welding simulator). The trainer sets a pass threshold for training in percentages. The possibility is from 0% to 100%.		

- How to use SIMSPRAY virtual spray paint learning system that helps students to acquire technical skills and how to use MIMBUS for training people with disabilities.

Table 2.5 Virtual spray paint learning system

Type	Theory	Practice	Application / Technology
Online			
Blended			
Physically		x	Virtual Reality SIMSPRAY
Offline@home			
N.A.			

Description	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).
-------------	---

Table 2.6 MIMBUS solutions for people with disabilities

Type	Theory	Practice	Application / Technology
Online			
Blended			
Physically		x	Virtual Reality MIMBUS
Offline@home			
N.A.			
Description	Professional integration of autistic people thanks to MIMBUS Discover and more European good practice example using virtual reality training tools in VET		

- How to use Soldamatic learning management system for creation of virtual classroom and training in virtual environment for police officers involved in crime scene investigation

Table 2.7 Creating virtual classroom for practice on welding simulator

Type	Theory	Practice	Application / Technology
Online	x		Seabery Learning Management System
Blended		x	Soldamatic simulator and Seabery Learning Management System
Physically		x	Soldamatic Simulator
Offline@home			
N.A.			
Description	The best practice is focused on creation of virtual classroom for students that practice on welding simulator in order to assess the students performance		

Table 2.8 Virtual training for CSI agents

Type	Theory	Practice	Application / Technology
------	--------	----------	--------------------------

Online	x		Seabery Learning Management System
Blended		x	Virtual CSI environment
Physically			
Offline@home			
N.A.			
Description	The best practices is focused on presentation of new training system for guardia civil		

- Design of student curricula, training and courses connected to WPS-MAG 135 and MMA 111 and how to creat a virtual tour using a smartphone and software application

Table 2.9 Design student curricula, training and courses for WPS-MAG 135 and MMA 111

Type	Theory	Practice	Application / Technology
Online			
Blended			
Physically	x	x	Virtual Welding Simulator
Offline@home			
N.A.			
Description	How to use online and face to face environment for teaching, practising and assessment		

Table 2.10 How to create a virtual tour

Type	Theory	Practice	Application / Technology
Online			
Blended			
Physically	x	x	Smartphone Computer/Laptop with USB Kuula application
Offline@home			
N.A.			
Description	How to use a smartphone and a computer to create a virtual tour by connecting photos		

- Online and Physically learning using digital tools

Table 2.11 Blended Learning using MS Teams

Type	Theory	Practice	Application / Technology
Online			Microsoft Teams
Blended		x	

Physically			
Offline@home			
N.A.			
Description	<p>For this best practice the students/trainees and teachers/trainers need to be connected to the class/training via Microsoft Teams, and at least 50% of the class needs to be present in the classroom.</p> <p>This example starts with a PowerPoint presentation, given by the teacher/trainer to the students/trainees, with at least one Yes or No question, for each portion of the given subject. Followed by the division of the students/trainees into small groups, for an interactive activity regarding the entirety of the given subject, to self assess the knowledge acquired and identify which areas need more study.</p>		

Table 2.12 Online assessment in physical classroom

Type	Theory	Practice	Application / Technology
Online			Kahoot
Blended			
Physically		x	
Offline@home			
N.A.			
Description	<p>For this best practice the students/trainees and teachers/trainers need to be connected to computers and internet.</p> <p>This example starts with a PowerPoint presentation, given by the teacher/trainer to the students/trainees, with at least five specific questions, for each portion of the given subject, using Kahoot. Each student/trainee must connect to the platform, using the code given by the teacher, and answer the questions individually, to self assess the knowledge acquired and identify which areas need more study.</p>		

- VR applications for safety and new technologies

Table 2.13 VR applications for safety issues

Type	Theory	Practice	Application / Technology
Online			VR safety
Blended			
Physically	X	X	
Offline@home			
N.A.			

Description	<p>VR and the use of the headsets can lead to an injury. When the student/trainee wears a headset he/she can not see the real world surroundings, and after a while, his/her brain will get lost in the real world space. To ensure that everyone with VR headset on is in a safe environment, safety precautions shall be taught and shared. Also, teachers/trainers need to make sure that the person in VR might not get their pre-existing conditions triggered (such as epilepsy attack etc). There are several steps one should go through to make sure that the VR experience will be safe.</p> <ol style="list-style-type: none"> <li>1. Clear surroundings</li> <li>2. Keep an eye on the person</li> <li>3. Identify motion sickness</li> <li>4. Identify person's discomfort</li> <li>5. Pre-existing conditions and safety suggestions</li> <li>6. Kids and VR</li> <li>7. Safe handling of the VR equipment</li> <li>8. Sanitation</li> </ol>
-------------	--

Table 2.14 VR applications for introduction of new technologies

Type	Theory	Practice	Application/Technology
Online			VR first encounter
Blended			
Physically			
Offline@home			
N.A.			
Description	<p>Introducing new technology to people is always tricky. The first impression matters as well. The problem arises when a person does not have a proper onboarding to the technology which results in hesitancy and apathy towards the technology. The first use of VR can also result in dizziness and headache as the brain tries to adapt and overcome the real-world/simulated-world contradiction. Therefore it is important to have a proper onboarding following the safety procedures and trying a simple and enjoyable experience first before diving into the VR world. It is also important to understand what will happen in the VR to avoid triggers of phobias or PTSD.</p>		

- SVSXASS – teaching welding topics using MS Teams and other digital tools

Table 2.15 Welding topics using MS Teams

Type	Theory	Practice	Application / Technology
Online	X		MS Teams

Blended			
Physically		X	
Offline@home			
N.A.			
Description	In this best practice are presented, how the welding theory can be taught using the online device MS Teams, and for the transfer of the practical welding will be presented a combination of preparing the student for welding on the Simulator soldamatic and afterwards applying the learned digital movements in the real workshop.		

Table 2.16 Welding topics using Learning Management System tools

Type	Theory	Practice	Application / Technology
Online			
Blended	X		LMS (ILIAS) and presence inhouse
Physically			
Offline@home			
N.A.			
Description	<p>Visual testing of welded joints is a topic that the teacher/trainer transmits in blended learning. It is presented how the theory is transmitted via LMS (ILIAS) to the students for preparing class and studying the theory at home by themselves.</p> <p>Then the theory is discussed in the real classroom, some practice examples are done together and examples for visual testing are demonstrated in the lab.</p>		

### 3. Education and training in IWT sector

COVID-19 pandemia forced the teacher and students to move from traditional face-to-face meetings to online meetings. For some of the teaching activities, distance learning did not affect the quality of the education, but for technical sciences, the practical training has been affected due to lack of digital tools which could properly replace laboratory conditions. Digital tools can be defined as any devices and technologies of transmitting knowledge from teacher to student with computer applications, online course media or practical training through devices that use augmented reality, virtual reality, etc.

The virtual classroom represents a digital environment where the teachers and students can run educational activities in order to improve the theoretical knowledge and practical skills for better competences in the field of work. UCV uses Google Suite as main application for teaching and assessment of the students. All teachers and students have specific emails ([@edu.ucv.ro](mailto:@edu.ucv.ro) for teachers and [@student.ucv.ro](mailto:@student.ucv.ro) for students) that are connected with the University of Craiova Learning Management System.

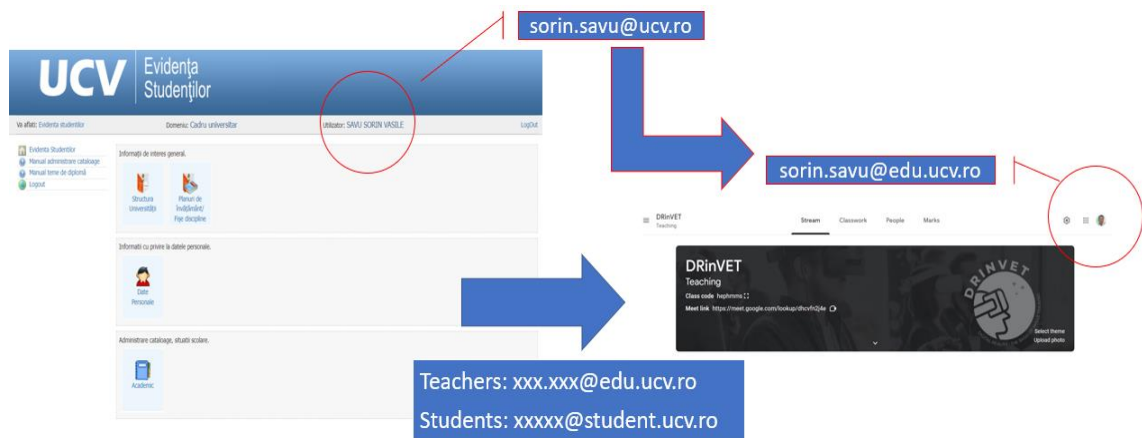


Fig. 3.1 Embedding Google Suite in UCV Learning Management System

The teacher creates the virtual classroom and invites the students to join to the course by sending individual email to each student or to a group of students. By accepting the invitation, the students can access the course support, practice, laboratory and other feeds provided by the teacher. The online education in inland and maritime specialization requires at least the following tools:

- Computer, Laptop, Tablet, Phone
- Webcam
- Headset
- Microphone
- Internet connection
- Institutional email account (ucv.ro) only for teachers. The students can access the



University of Craiova LMS by using personal code (CNP) and a password provided by university.

- Gmail domain accounts (for teachers: edu.ucv.ro and for students: student.ucv.ro)
- Joystick, mouse, keyboard or specific console for practical training at home

Before teaching, the teachers must do the following steps presented in the figure below.

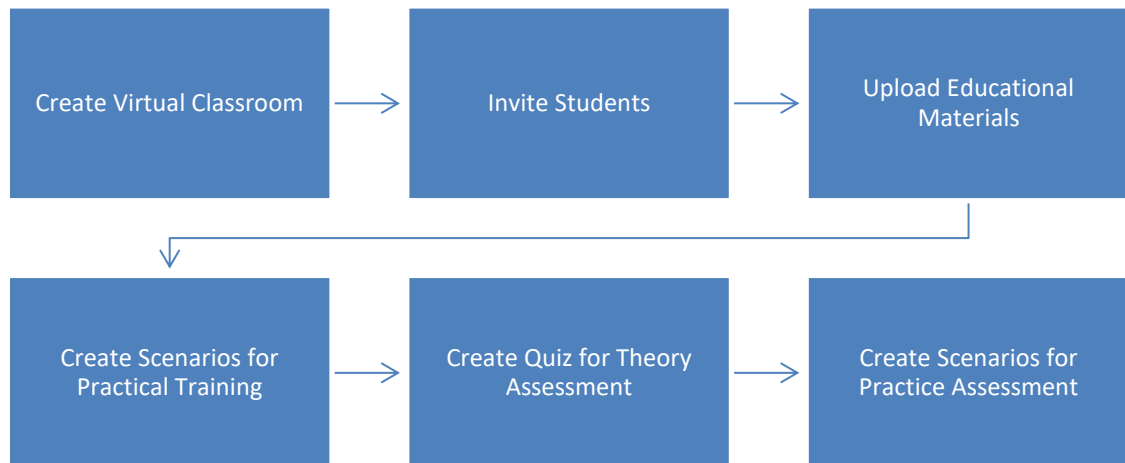


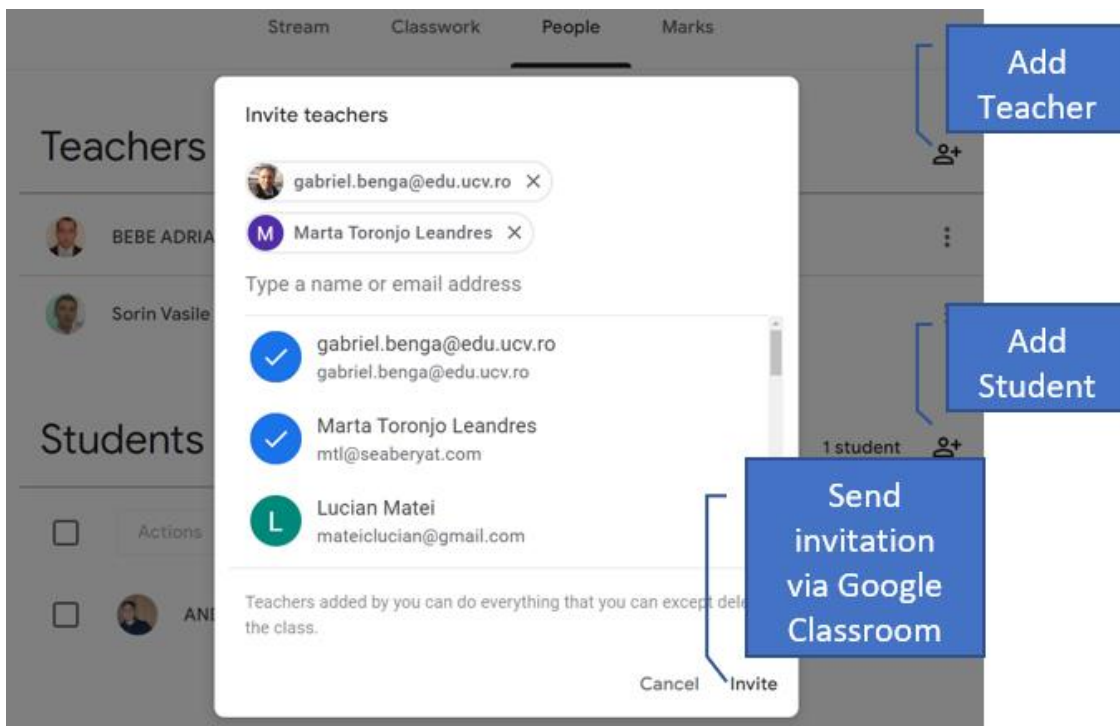
Fig. 3.2 Establishing conditions for online education

### **Create Virtual Classroom**

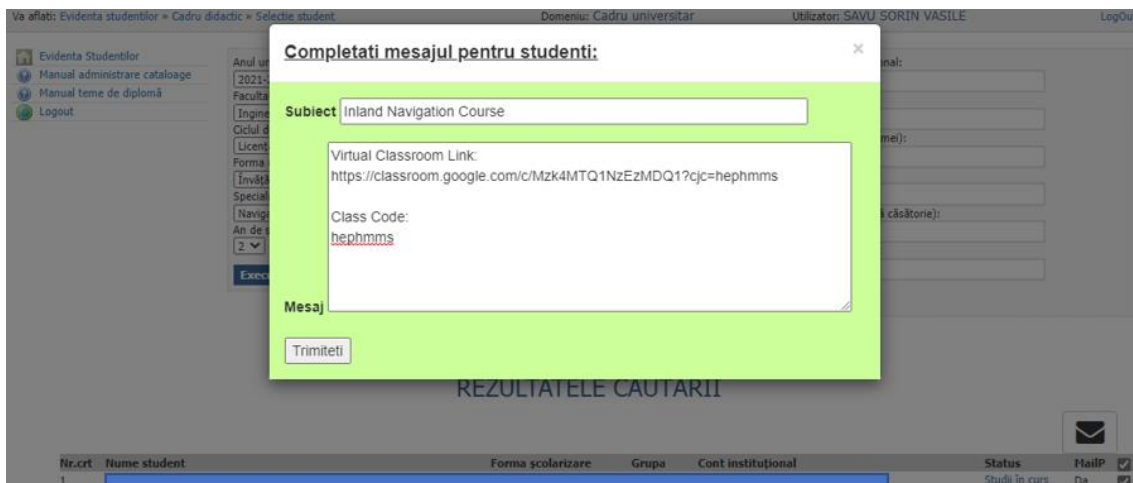
The virtual classroom can be created using the tools from Google Suite by accessing Google Classroom. After login with teacher credentials, the teacher can create a virtual classroom by introducing at least the name of the course. In addition, the teacher can generate a Google Meet link that can be visible by the students that will allow them to connect with teacher during the teaching/assessment process.

### **Invite students**

The students must be invited to join to the classroom created before. The invitation can be sent using classroom tools after adding the students to virtual classroom or by sending individual email with virtual classroom code using University of Craiova Learning Management System. The figures below present the both ways to invite students to join to virtual classroom.



a.



b.

Fig. 3.3 Methods to invite students to join virtual classroom  
 a. using Google Classroom, b. using University of Craiova LMS

### Upload Educational Materials

The educational materials should be in digital format in order to allow their upload on Google Classroom.

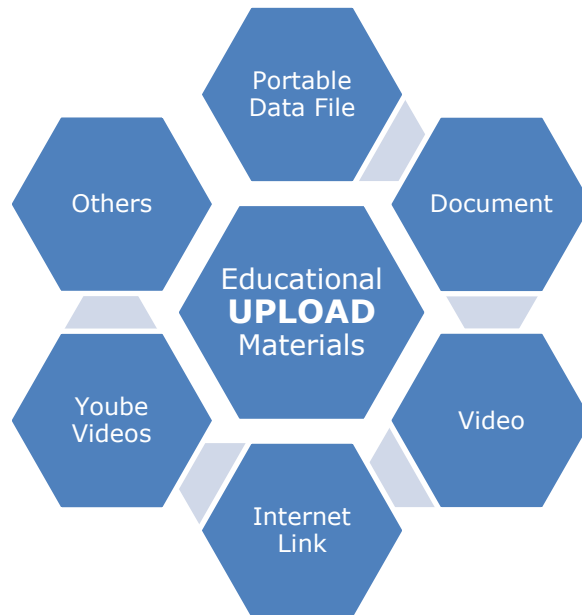


Fig. 3.4 Types of digital educational materials for virtual classroom

Each teacher can choose what kind of digital educational materials will suit better to their teaching purposes. Based on this assumption and tools provided by Google Classroom, the teachers can prepare and upload the information and content of their disciplines as follows in figure below. The platform allows to upload even stand-alone applications similar with executable program that is subject to practical training in inland and maritime navigation.

### Create Scenarios for Practical Training

Practical training on inland navigation simulator is usually performed in laboratory conditions, but in special cases imposed by COVID-19 restrictions can be done at home.

## Practice Module

⋮

Sorin Vasile Savu • Yesterday (Edited 10:16)

2 points
Due 28 Jan 2022, 23:59

---

This section contains the main coordinates regarding the missions assigned for students. Each student must solve the study case by practicing on nautical simulator. After completion the mission, the student will upload the video recorded on his simulator and then return the homework to the teacher. Each study case will be graded with 2 points / mission complete.

---

Class comments

Add class comment...

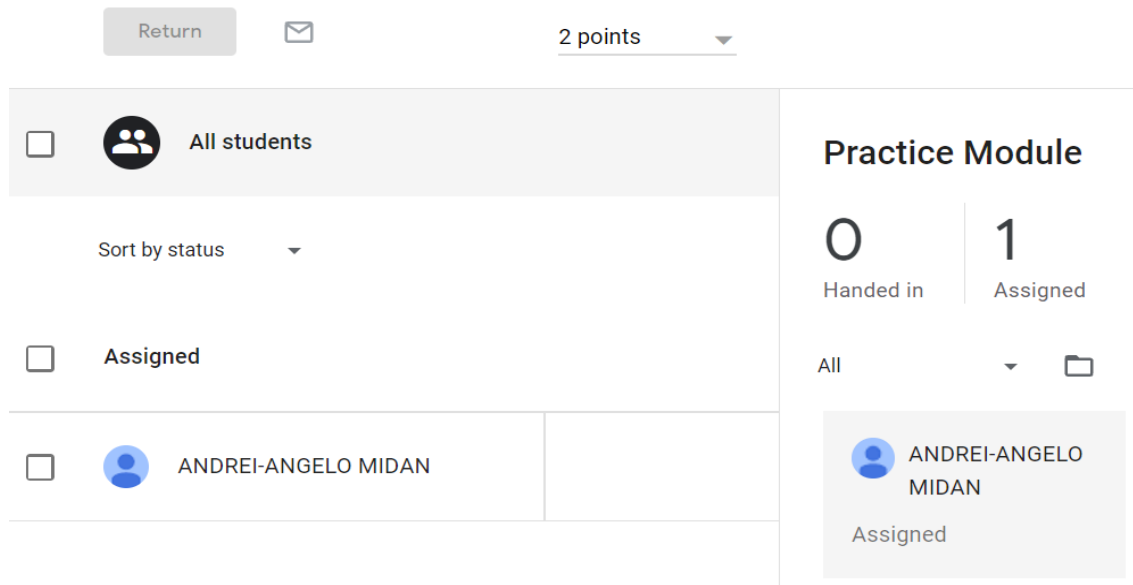


Fig. 3.5 Create practical training assignment for students

The teacher creates the scenarios for practical training using gamification tools. In the scope of DRinVET project, the scenarios for practical training were developed using Ship Simulator Software 2006 provided by VSTEP.

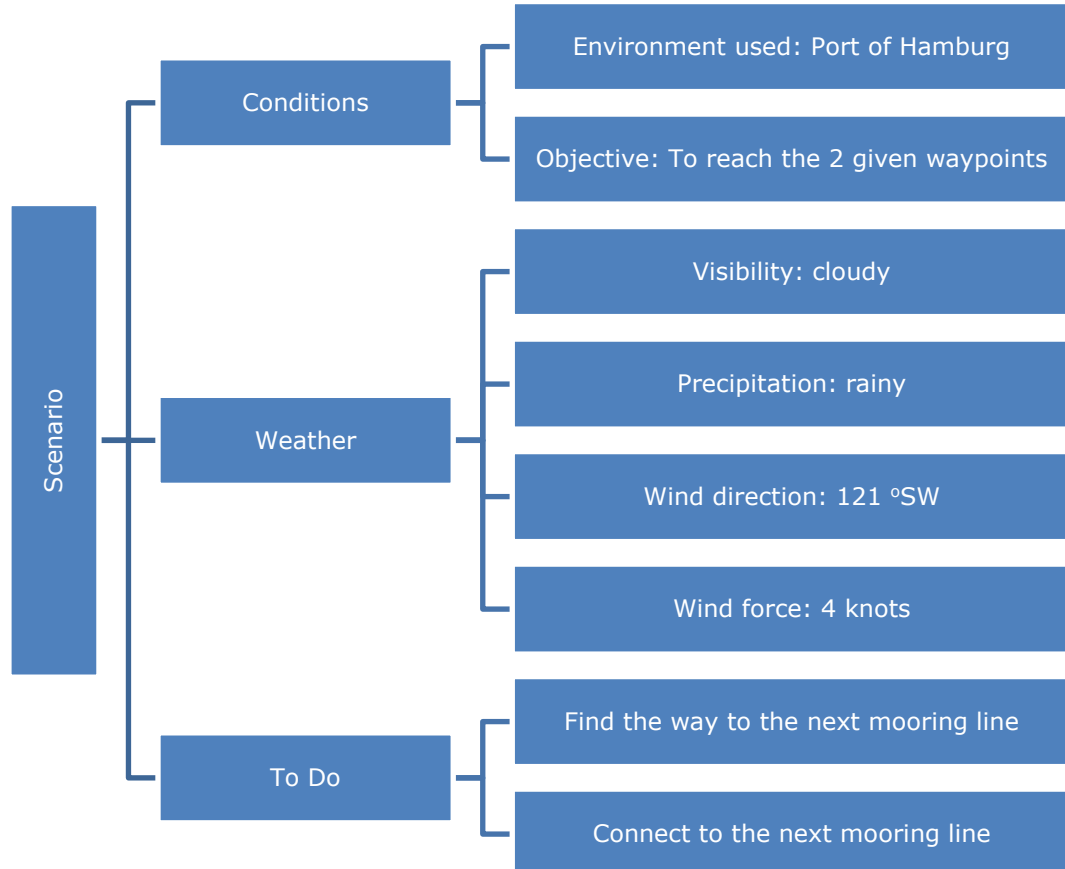


Fig. 3.6 Scenario for practical training on inland and maritime navigation simulator

### Create Quiz for Theory Assessment

The assessment of theoretical aspects presented during semester will be performed using fast quiz with questions with multiple choice answers. Each question will be graded with 1 point, but all questions will be mandatory.

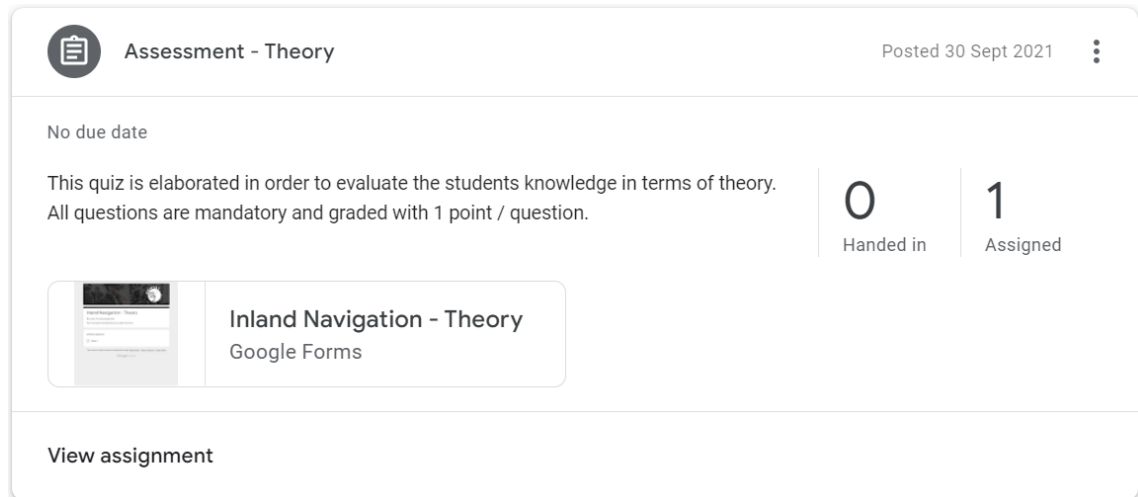


Fig. 3.7 Example of fast quiz assigned to the students

### Create Scenarios for Practical Assessment

The assessment of the work done and grading the students for practical training will be performed using the following rubric:

- The student should be able to manage leaving from the dock and out of the terminal
- The student should be able to unload and then load the containers
- The student should be able to move down the river and then to the next terminal

The rubrics related to student’s performance is well establish by the teacher in discipline fiche. For both best practices the rubrics established are:

Table 3.1 Rubrics for summative and formative evaluation

Online/Blended Practical Training	Theory Quiz	Practical Examination	Total
10	10	10	10

The Google Classroom platform allows multiple grading for different assignments and a final grade for the student performance during assessment process. However, the teacher can modify the grades if he consider that the student worth more or less.

### 3.1 Online Education for IWT sector using gamification

The online education best practice consists of elaboration a full structure in terms of theoretical course support, study case for practical training at home and assessment quiz for online evaluation. Google Meet supports the video stream for online education as permanent link attached to virtual classroom. In addition, each student receives a copy Ship Simulator 2006 software with serial number, in order to be able to install the game on his or her own personal computers, laptops or tablets. The procedure for online learning is established by the teacher and should contain at least the following steps:

- Teacher creates the virtual classroom and invite the students to join to the course
- Students receive the invitation in their institutional email and accept the invitation to join to the classroom/course
- Teacher creates the following modules in Classwork area:
  - Theory Module: this module contains course support in portable data file format, powerpoint presentation of the course and other interactive resources that are considered to be necessary for students education

✕ Material

Description (optional)  
This section contains course support for discipline Inland Navigation. The material can be used by students for their individual study in order to be able to solve the quiz and the mission assigned for practical training on nautical simulator.

**B** *I* U ☰ ✕

📎 ⬆️ 🔗 📺 +

	CABLES, ROPES AND WINCHES USED IN NAVIGATION.pdf PDF	✕
	COLREG-collision regulations.pdf PDF	✕
	Ports and inland vessels.pdf PDF	✕
	How to... Mediterranean mooring YouTube video 8 minutes	✕

?

Fig. 3.8 Snapshot from Theory Module containing course support and other educational materials

- Practice Module: this module contains at least two files related to: description

of the inland navigation missions assigned for each student and Ship Simulator 2006 software package.

- Assessment Module: this module contains a set of questions developed using Google Forms that represent the assessment of theoretical knowledge of the students. Each student will be able to access the quiz and after the completion of the questionnaire, the students have to submit online the answers. In addition, this module will be used for online assessment of practical skills of the students
- Teacher assigns to the students a practical study case that must be fulfilled during a semester.
- The students download the Ship Simulator Software 2006 and install the game on their computers
- The students consult the list with missions allocated and start practising on inland waterway transport simulator using as steering controls the keyboard and mouse. They will need to learn all controls available on board of the ship and travel from point A to point B using the navigation conditions assigned by teacher

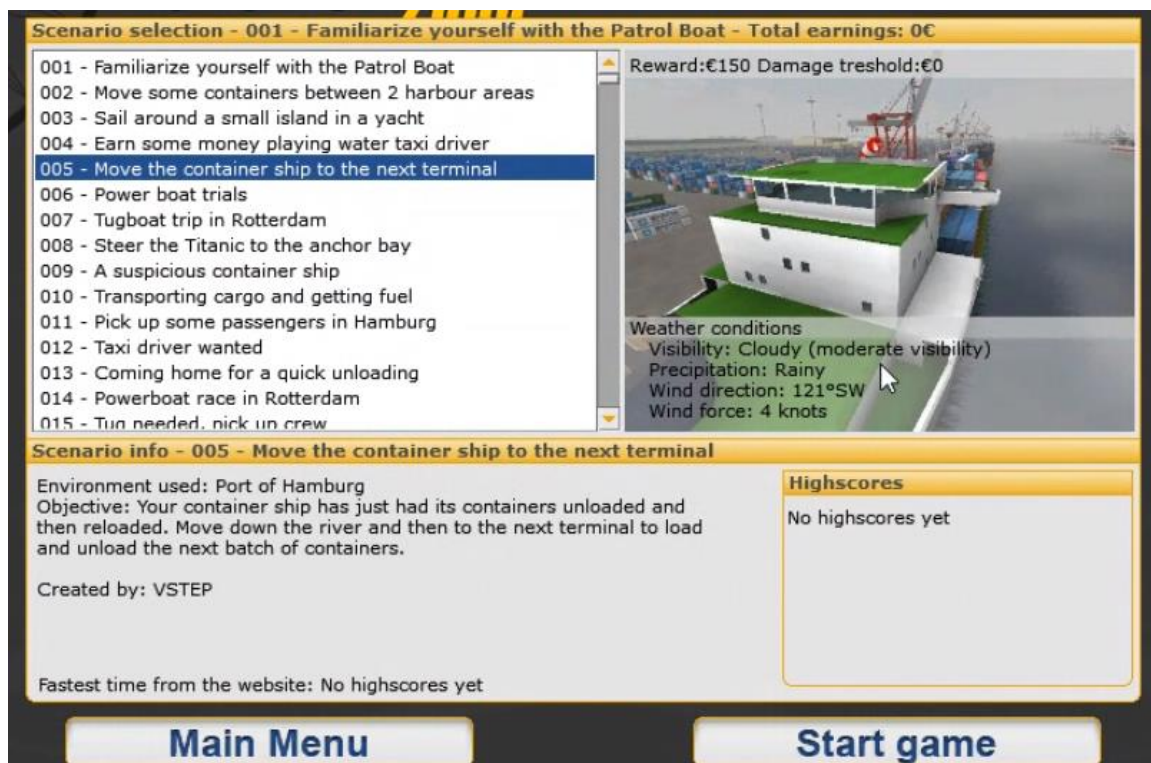


Fig. 3.9 Snapshot mission assigned to the students

- The students start to perform on inland waterway transport simulator and after the total hours of practising, they have to record the entire mission using Google Meet.
- After the completion the mission, the students have to upload the video previously recorded in *Classwork* section and to return the practical homework to the teacher

- The teacher evaluates the students' performance by viewing the recorded video and assigns grades for work done. The total points that can be graded are 2 points.
- Teacher invites the student at the end of semester to join to the examination module for both theoretical and practical skills and knowledge.
- The students accept the invitation and join to a common video session on Google Meet. The students must keep the web camera on and the microphone off. The microphone will be activated only to answer to the teacher or for specific questions related to quiz.
- The students answer to the theoretical questions and after a certain time they need to submit the answers to the teacher for evaluation and grading. The total number of points graded will not exceed 5 points.
- After the submission of the theoretical tests, the students will be evaluated for practical skills. Each student will receive specific missions and must navigate using their own simulator. The teacher will evaluate the performance of the students by viewing the shared screen of the student that performs on simulator.
- After completion of all missions, the teacher will grade the students' performance. The total points graded will not exceed 3 points.
- After the grading process, the students receives the final grades in their performance during semester and final exam. The final grade is splitted by Google Classroom platform as can be seen in the figure below

DRinVET Teaching		Stream	Classwork	People	Marks
Sort by surname ▾	No due date <b>Assessment - Theory</b> out of 5	No due date <b>Assessment - ...</b> out of 3	28 Jan 2022 <b>Practice Module</b> out of 2		
Class average					
ANDREI-ANGELO MIDAN					

Fig. 3.10 Summative grading in online learning

### 3.2 Blended Education for IWT sector using inland navigation simulator

The blended education seems to represent the most suitable method for hybrid education taking into consideration the restrictions related to COVID-19 in terms of number of persons who can attend face-to-face to courses and practical training. In hybrid education, the lectures are performed online using Google Meet and the practical training in laboratory conditions will be done using small groups of students.

Normally, a group of students has 20 participants. However, the restrictions related to



face-to-face meeting imposed performing the practical training with maximum 5 students at once. Therefore, the practical training is performed using the following rules:

- The initial group of 20 students will be divided in 2 small groups
- First group of 5 students will be trained on inland and maritime navigation simulator (50 minutes/session)
- The second group of 5 students will view the practical training using VR glasses
- Then, the students will switch places in order to give opportunity to the second group of students to practice on simulator



Fig. 3.11 Practical training on inland and maritime navigation simulator

Blended education under COVID-19 restrictions for specialization in inland and maritime navigation requires at least:

- Two teachers: one teacher for supervising the students practicing on inland and maritime simulator in laboratory conditions and the other one for supervising the second group of students
- Two locations for the first and second groups of students
- Five computers with licences for Ship Simulator Software 2006
- Five consoles for inland and maritime simulator
- Five VR glasses for the second group of students
- One stand-alone computer for teacher who supervise the practical training in laboratory conditions

The procedure of teaching, learning and assessment is similar to online learning with exception of practical training which can be done both at home and in laboratory conditions. The students have the opportunity to download the simulation software and practice missions on their own computer at home as well as to improve their skills and abilities in laboratory by using the inland navigation console. Obviously, in terms of skills, the performance of practical training in laboratory is higher than practical training at home. The procedure for blended learning is established by the teacher and should contain at least the following steps:

- The teacher follows the procedure related to creation of virtual classroom, upload educational materials, online teaching and online assessment for theoretical issues
- For practical training on simulator in laboratory, the teacher splits the students in two groups: first group will practice on simulator and the second group will observe the practical procedures using VR glasses or external monitors



Fig. 3.12 Interactive teaching using Newline Interactive Display

- For the first group, the teacher starts a broadcast using Newline Interactive Display and the students will be able to see all the information taught in an interactive way
- The teacher create a scenario for navigation from a terminal to other terminal using different navigation conditions
- The students start the Ship Simulator Software 2006 and begin to navigate using the console/mouse/keyboards. They will record their work and after that will upload the video on their Google Classroom account.



- The teacher can supervise their work on its monitor using Microsoft Remote Desktop. In addition, the teacher can send messages to the students (individually or collective) in order to help them in practical training on simulator

## 4. Digital education in engineering

The first best practice is focused on presenting how students can learn about beam pumping units in terms of formulation of general and technical description of devices and equipment, presentation of the results using digital tools as well as creating and presenting technical studies using digital technologies in a virtual environment. The second good example is related to improve the welding technique using a training programme developed according to the needs of the employer (Tailor Made)

### 4.1 Learning about Beam Pumping Units using digital technologies

Subject Title: Electromechanical Engineering

Students will learn:

- To formulate a general and technical description of devices and equipment
- To present the result using digital tools
- To communicate in a virtual environment
- To create and present a technical study using digital technologies.

Topic: Beam Pumping Units

Initial material:

Pumping unit is a kind of equipment for oil production, installed on the ground, which drives pump in and out of oil well, it is the most important lifting equipment in sucker rod pumping system.

Tasks:

1. Make a general description of the Beam pumping unit.
2. Describe where the equipment is used, for what purpose, whether it is standardized, describe the mode of operation and work in a safe manner and environmental protection.
3. Make a technical description of the device. Make a list of all parts and describe their function.
4. Describe in detail the mechanism of power transmission and equipment operation. Describe in detail the key elements of the equipment.
5. Prepare a technical study based on the previous three points.

Mode of operation:

- Virtual space: Facebook closed group.
- Students are divided into 4 groups

- First step: "bidding" tasks for each group. The group that was given the fourth task is the process flow control group and the group that prepares the final document.
- Second step: The first three groups are working on their task. After completing 35% of the task, they publish their draft in virtual space.
- Third step: All three groups participate in the evaluation of all three tasks, and the evaluation is led by the fourth group. They comment on each other's work, give suggestions for improvements, and the fourth group checks that everything is within the set limits, whether the tasks are compatible and completes the evaluation for each task.
- Fourth step: The first three groups are working on their task. After completing 70% of the task, they publish their draft in virtual space.
- Fifth step: Same as step 3.
- Sixth step: The first three groups complete their work and present it at a video conference of the whole group. The fourth group conducts the evaluation procedure according to the set criteria, and all participants participate in the evaluation.
- Seventh step: The fourth group finalizes all three papers and completes the technical study with all the necessary components and places it on the Facebook group for a final insight into the complete paper.
- Eighth step: Flipped classroom: Debriefing. This step can also be called "reverse evaluation". The complete task and work of the fourth group is discussed and evaluated according to previously known criteria, and thus the processing of the topic is completed.

The teacher participates in the whole process as an advisor and one who takes care that the topic is completed within the prescribed framework and records the final grade for all participants.

#### **4.2 Correction of welding techniques of professional welders (tailor made)**

Training is arranged according to the needs of the employer (Tailor made). WPS is co-developed by the employer's welding coordinator and trainer. The trainer enters data from WPS into VWTS (Virtual Welding Training System - welding simulator). The trainer sets a pass threshold for training in percentages. The possibility is from 0% to 100%. Two important activities can be performed on the simulator:



Fig. 4.1 Activities performed on the simulator

### Training

The training is performed with the help of a "Ghost" trainer, ie the simulator uses a pointer to direct the welder to actions: exactly - faster - slower, exactly - get closer - move away, exactly - lean left - lean right - lean forward - lean back.

The colors of the indicators are: green - actions are performed well, yellow - actions are performed a little worse than good ones (correct yourself) - red - actions are performed badly (make a correction).

3 elements can be trained:

- level 1: Welding speed,
- level 2: Welding speed + Stick out, distance of the electrode tip from the workpiece
- level 3. Tilt angle of burner or electrode holder.

The simulator scores each of the three elements and gives a summative grade. The welder can playback analyze his work.

### Simulation

The welder welds as in real conditions. The device scores all three elements.

### TRAINING (TAILOR MADE)

The training takes place in three steps:

- Step 1: Simulation - Initial test

The welder after three test welds welds the weld. The trainer analyzes both the trial welds and the final weld, and decides on a further training program. There are two possibilities. He can send it to Training (step 2) or again to Simulation (step 3).

- Step 2: Training with the virtual trainer "Ghost"

Training is performed in groups - a maximum of 5 welders.

The welder on the simulator pulls the weld with the help of the virtual teacher "Ghost". The condition to complete the training is 5 consecutive well-executed welds. All three sizes are evaluated: welding speed, distance from the workpiece and torch angle. The maximum number of welds in one training is 20. After that, the training is approached by another welder from the group.

- Step 3: Simulation - Final training

The welder on the simulator pulls the weld without the help of the virtual teacher "Ghost". The condition to complete the training is 3 consecutive well-executed welds. All three sizes are evaluated: welding speed, distance from the workpiece and torch angle. The maximum number of welds in one training is 10. After that, the training is approached by another welder from the group. A welder who does not have three consecutive good welds in 10 withdrawn welds, returns to training (Step 2).

## 5. Virtual reality simulators for painting

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

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). The purpose of immersive technology use in TVET:

- Motor skills training
- Provide support with assistance systems
- Use authoring tools to create learning content

This best practice applies to paint and coating industry and the subject of the best practice is related to car and industrial painting as teaching subject for post secondary and adults training. The best practice has been supported by Office of Vocational Training and Employment Promotion (OFPPT), Morocco and started in 2020.

#### **Learning contents and 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.





Fig. 5.1 Improving professional competences and manual dexterity for car 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.

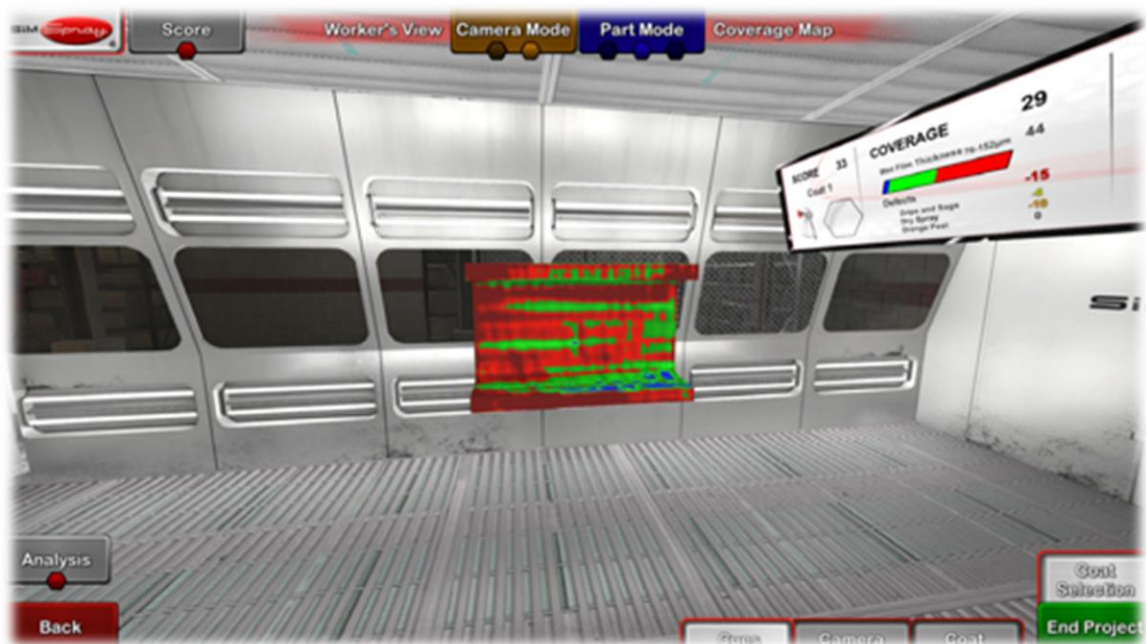


Fig. 5.2 Improving professional competences and manual dexterity for car painting

### 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 requires specific hardware and a motion tracking concept:

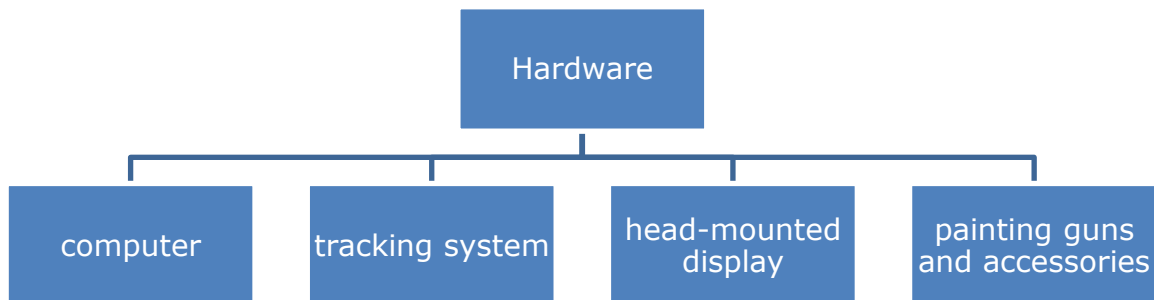


Fig. 5.3 Hardware requirements

The motion tracking concept consist of :

- 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.



#### 5.4 Technical setup of the virtual reality simulator

##### 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.



#### 5.5 Performance tracking supports achievement of learning goals

### **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 other projects**

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:



#### 5.6 Focus themes in the context of TVET

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](http://www.unevoc.unesco.org/bilt) or contact us at our email address [unevoc.bilt@unesco.org](mailto:unevoc.bilt@unesco.org).

### **Digital media support in TVET**

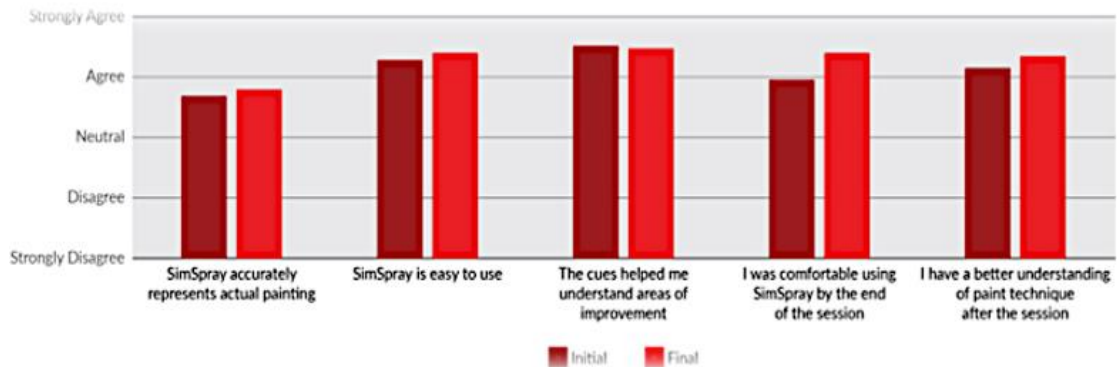
Initiated by the Federal Institute for Vocational Education and Training in Germany (BIBB), the Roadshow aims to show the potential of digital applications and technologies for teaching and learning in Technical Vocational Education and Training to make learning more flexible and enhance the quality 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 (BMBF) in cooperation with BIBB since 2016. More information: <https://www.bibb.de/de/105326.php>

An example of from Hungary is related to PAINT TECH GROUP Kft., which had the problem related to using specialists in the production during the spray painting process. Their movement dynamics need refinement and the solution to the problem was the correction of the painter painting technique with the SimSpray simulator.



#### 5.7 Improving dynamic movement

- 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
<b>35% decrease</b> in overall material costs	<b>20% reduction</b> in program operating costs	<b>60% increase</b> in practice time, per student

### 5.8 Analysis of the case study

- 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:
    - Allow the students to practice basic technique to promote more advanced topics while in OJT/live training
    - Increase practice 15 times 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 on-the-job/live training

The customer comments and the feedback was supportive:



*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

*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

*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

*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*

*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

*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

*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

## 5.9 Collected feedback from participants

## 5.2 Professional integration of autistic people thanks to MIMBUS Discover and more European good practice examples using virtual reality training tools in VET

### Testimonials

- "This workshop is really great! It should not be limited to the ULIS classes but should be extended to all classes of 4e and 3e. Young people need this type of solution to discover the possibilities open to them." Principal of a secondary school in France.
- "During a workshop, a student finished an exercise, put the helmet down before going to her teacher and saying: I want to do an internship in mechanics. It is in these moments that these workshops take all their meaning." Laurent Peytavy, head of OTEMA – TSA.

### Customer history

OTEMA - TSA presents itself as an innovative structure in the world of autism. OTEMA's mission is to accompany autistic people in their professional integration and mobility.

In addition, Laurent Peytavy, the manager, has developed a workshop of job discovery in Virtual Reality for ULIS classes in secondary schools of France. At the initiative of the OF2I project, he goes to their classes with MIMBUS Discover to make them discover trades using VR. Thus, they can discover different work environments, explore them and manipulate the tools that make them up. Laurent tells us how this workshop opens the field of possibilities for them.



5.10 Snapshot during practical training

### Challenges

- Convinced that new technologies can greatly help the disabled community, the manager wishes to contribute by proposing innovative solutions that can help this public to integrate professionally.
- Promoting the professional integration of disabled and autistic people through workshops to discover a profession. These workshops must be accessible to all by ensuring that everyone is an actor in the experience proposed. It is also important to



offer a wide range of jobs to reach all students.



#### 5.11 Challenges identified for target group

##### **Journey to find the solution**

It was during an exchange in our offices with Laurent Da Dalto, President of MIMBUS, that the two leaders had the idea of going directly to the ULIS classes to offer them these workshops. It is by going to their comfort zone that they could encourage the maximum adhesion of the students to these workshops. They are more confident and able to take part in new experiences that take them out of their daily lives.

##### **Solutions found and implemented**

The main goal of this project was to find a solution allowing to easily make discover several trades. Laurent Peytavy chose MIMBUS Discover because it allows to dive into about 15 different jobs and this number will continuously increase.

In addition to MIMBUS Discover, Laurent Peytavy has equipped himself with zSpace, a 3D computer that allows him to learn about the welding profession, as well as another Virtual Reality software that allows him to discover different professional environments.



#### 5.12 Virtual Reality software that allows the user to discover different professional environments

Having multiple headsets and different solutions keeps all the students busy at the same time. They are all active and transported into worlds they do not know. They are very quickly captivated, which leaves no room for them to drop out.

### Benefits, valuable outcomes and results

- The panel of professions to discover is wider. It opens up even more the field of possibilities while varying the formats. All the students can find the right fit!
- The learning curve is faster and more efficient. Students are less discouraged and take ownership of the material. Better conditions for talent detection.
- All students become actors. They are all involved and live the experience to the fullest.
- Students are successful in the exercises and feel able to succeed.
- The technology presented is out of the ordinary. While they are used to discovering technologies, especially through video games, this time they are the ones who are pushed and who discover. The adhesion is very strong.



### 5.13 Benefits, valuable outcomes and results

#### Future plans for the solution

Adding additional trades is Peytavy's main request. It is very important to make the experience even more complete and to meet everyone's expectations. Why not also extend this type of workshop throughout France or to all classes of 4e and 3e?



#### 5.14 Future plans for the solution

##### **Mimbus Discover references – Example 1**

Regional association for the inclusion and professional talent detection of the autistic population. Using VR, the idea is to prove the real manual capacities and dexterity of disabled population by autism spectrum disorder. The program includes a specialized trainer, Trades discovery VR contents, and Vulcan for analytics. Educational tools used for workshop: workshop in a box, Mimbus Discover The benefits of the solution are:

- +1000 disabled student from Mid-School evaluated in 2022
- 30% succeeded an integration thanks to the VR training

##### **Mimbus Discover references – Example 2**

Job attractivity program launched by Pole Emploi, the French recruitment agency. The strategy is about to bring the best career guidance and the first job discovery into a place where young people use to go with VR room, games and simulators. Educational tools used for workshop: Workshop in a box, Mimbus Discover, 360trades videos. The benefits of the solution are:

- Detect talents and reveal passions (Pilot centre installed in a Mall in Paris)
- Feed careers that suffer from shortage of workforce
- Highly efficient: deployment all over the country in 2023

##### **Mimbus Discover references – Example 3**

High skilled training center for construction and historic French patrimony heritage. The VR solutions as been integrated for efficient risks training sessions in construction and trades discovery for career guidance. Educational tools used for workshop: Workshop in a box, Mimbus discover, electrician training, scaffolding, site risk management. The benefits of the solution are:

- Safer hands-on activities : NO accident, teens can practice
- Candidates : +50%, Certifications : +70%

### **Virtual Indus Electricity references – Example 1**

Second-chance school program, using VR for trades discovery, career guidance and deep training to become electrician and construction workers. Educational tools used for workshop: Backpack VR equipment including Hp Reverb headset, Electrician training VR content and site risk management for construction. The benefits of the solution are:

- Reduce drop-out from 50% to 20%
- Improved results : from 70% to 85% qualified

### **Simspray references**

St John's College is one of the 31 colleges of the Cambridge University in the United Kingdom. Educational tools used for workshop: Simspray. The benefits of the solution are:

- Divide by 3 the training duration for the same quality
- Saving of up to 90% of the raw material
- Improved certification ratio : from 65% to 89%

### **Wave NG and Wood Ed references**

The company is the biggest adult training organization in France. Educational tools used for workshop: Deployed Virtual Welding and Virtual Woodworking in their 100+ training centers in France. The benefits of the solution are:

- More candidates (innovation attraction)
- Efficient for Open-Houses
- Better tracking of the learners
- Cost reductions from 30% to 50%
- Certifications ratio improved

### **Virtual Indus HVAC references**

Nash Community College offers academic programs that lead to a degree, diploma or a certificate that prepares learners for the workplace and provides a skilled workforce for the region. Nash Community College leverages virtual reality for immersive learning. With HP partner MIMBUS, the educational institution created an innovative, proof-of-concept model for students in the heating, ventilation and air conditioning (HVAC) continuing education course. Educational tools used for workshop: Deployed Virtual Welding and Virtual Woodworking in their 100+ training centers in France. The benefits of the solution are: cloud-based platform set up learning programs with ease.

## 6. Virtual and Augmented Reality in engineering and CSI training

This module is focused in two different educational tools based on the use of digital reality. Firstly, we will talk about the augmented training methodology, created by ATS and applied in Soldamatic; secondly, we will see a new tool, VirtualCSI, that uses virtual reality for the practice of ocular inspection at a crime scene.

### 6.1 Welding learning based in Augmented Training Methodology

The Augmented Training methodology consists of three elements: welding practices simulated with Augmented Reality, an e-Learning application and real welding practices. This methodology offers many advantages when practicing and monitoring the students' learning due to the connection between the welding simulator and the e-Learning app.

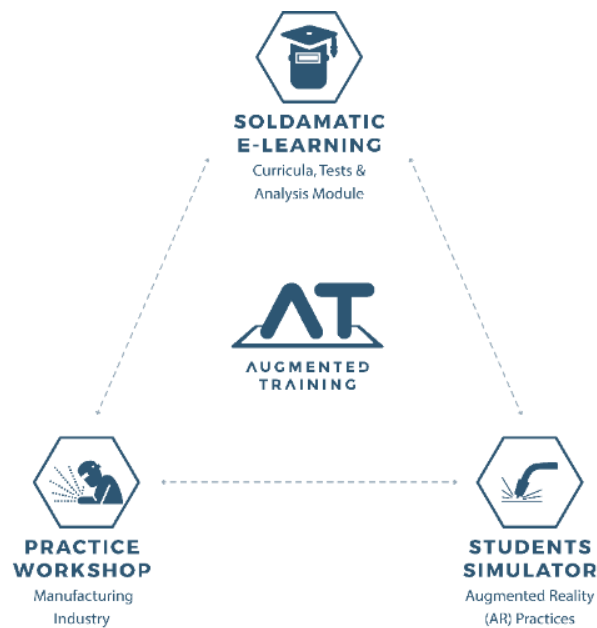


Fig. 6.1 Augmented training methodology scheme

One of the options available with this educational solution is to connect several simulators on the same server, thus creating a connected classroom where you can get the information of the practices and courses taken by students. In addition, these classroom simulators can be connected to a cloud server, which allows the instructor to visualize the information without being physically in the classroom.



Fig. 6.2 Augmented Lab scheme



Fig. 6.3 3D representation of a simulator classroom

When students are in a simulator classroom, the teacher can see in real time the practice they are developing through the e-Learning app. He/she will be able to visualize all the simulators in which a practice is being developed either through a video or a progress graph. You can also access the information of each student and their progress in the different courses in which they are enrolled, as well as each practice they perform. In addition, you can create customized courses and practices for each student according to their level.

## 6.2 Criminalistic inspection with Virtual Reality

Virtual reality can be applied to a wide range of environments and situations, allowing for an immersive educational experience that enables interaction with space and various elements. This is why it is increasingly seen as a tool for teaching. One of the areas in which it allows great progress is in crime inspection, since it enables the recreation of a multitude of different scenarios in which to practice the steps to follow in the performance of these inspections.





Fig. 6.4 Real life crime recreation scene

The virtual environment allows you to create your own scenario or reproduce real scenarios for training purposes. You can choose from our library of rooms, furniture, tests, etc. and create your own scenario using the VR Scenario Creator, save, copy or delete at any time. In addition, you can use our practice guide to increase your learning speed, you can activate or deactivate tips during your training to improve your performance.

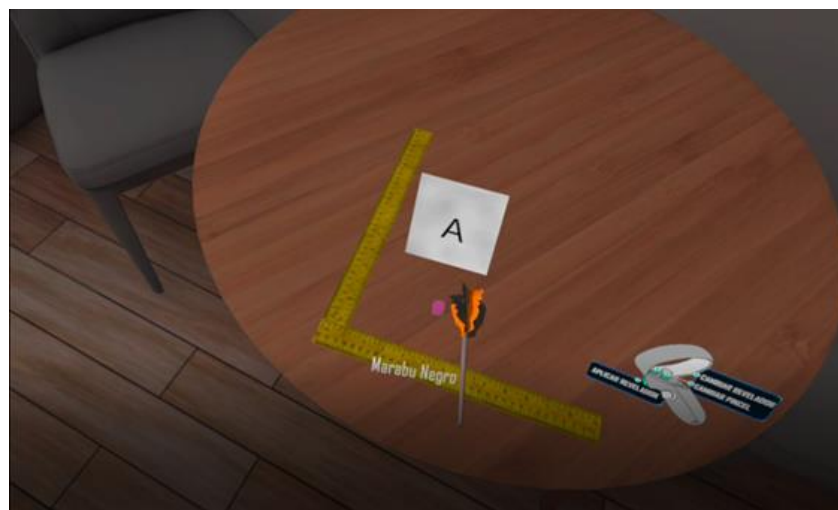


Fig. 6.5 View of evidence collection in VirtualCSI

The advantages of using Virtual Reality for Criminalistic Inspection are that it offers, mainly:

- An LMS Platform with access to students and teachers, where the teacher can design each of the practices with the indications he wants and where he wants and where both students and teachers have a space with the results of the practices.
- VR tutorial on the use of the tool.
- Practices and exams to train the use of the VR tool:

- Placement of protective equipment
- Placement of the case
- Selection of tracking tactics
- Tracking with different lights
- Delimitation of the area
- Treatment of the access point
- Creation of corridors
- Identification, analysis and collection of evidence/signs
  - Fingerprints
  - Footprints
  - Objects (phone, glass, ...)
  - Blood, fluids
- Photography and photo library
- Scene abandonment management



## 7. Welding simulators for training and virtual tour using smartphones

The goal of this subchapter is to present how the teachers and students can contribute to the digital transformation using virtual reality simulators into the educational process. There are presented two best practices related to simulation of welding as well as in virtual orientation.

### 7.1 Design of student curricula, training and courses connected to WPS-MAG 135 and MMA 111 on a Fronius Virtual Welding Training System

Integrated interactive training of welding trainees has been carried out in the Industrial and Trade School Slavonski Brod, Croatia since 2010. Integrated because it connects virtual and real welding, and interactive because the interaction of 3 elements - virtual welding, real welding and aerobic training yields a system that has several advantages over the classical training system:

- Training becomes cheaper
- Training is more modern and more acceptable to younger generations
- Training is more dynamic, and can be shortened
- This training can also be used with experienced welders to correct their welding technique
- By including the aerobic training, the level of welder's psychophysical abilities is raised and also the quality of welding

The training is based on the integrated interactive system by combining the training on the VWTS Fronius and real welding machines. Two important activities can be performed on the simulator:



Fig. 7.1 Training and Simulation on welding simulator

The training is performed with the help of a "Ghost" trainer, i.e. the simulator uses a pointer to direct the welder to actions: exactly - faster - slower, exactly - get closer - move away, exactly - lean left - lean right - lean forward - lean back. The colours of the indicators are: green - actions are performed well, yellow - actions are performed with slight mistakes (correct yourself) - red - actions are performed badly (make a big correction). For the two above-mentioned processes, the training concept consists of following steps:

- Step 1 – The trainer creates the training by designing a unique WPS for the work on both the VWTS Fronius and work on the welding machine in real conditions.
- Step 2 – The trainer enters the WPS into the VWTS Fronius and, if needed, also his own welding technique into the exercise. The trainer also sets the minimum threshold in %.
- Step 3 – The trainer determines how long one of the two processes is practised on the virtual machine, and how long the students will practice in real conditions on a real machine. In other words, the trainer determines the success criteria for going from the virtual over to real conditions.
- Step 4 – Trainees practice on the VWTS Fronius that keeps score of every single activity. The trainees practice with the help of a virtual trainer (the so called "Ghost") in the training mode and also in the simulation mode without the help of the virtual trainer.

With the virtual trainer, the "Ghost", the exercises are carried out in 3 interconnected levels:

- a) level 1: Welding speed,
- b) level 2: Welding speed + Stick out (distance of the electrode tip from the work piece)
- c) level 3: Welding speed + Stick out (distance of the electrode tip from the work piece) + Tilt angle of the burner or electrode.

In order to pass, the trainee needs to clear all 3 levels, and cannot move to the higher level until the lower level has been cleared. In the simulation mode, the weld is carried out just as it would in real conditions, and the simulator scores the activity with a total mark the same as with the level of 3 trainings. When the trainees have met all the criteria, they can move to the real welding.

- Step 5 – The trainees practice in the welding workshop in real conditions by welding according to the conditions set in the WPS. Each test piece/coupon is visually inspected. The inspection is done by both the trainer and the trainee. The coupon is evaluated according to the criteria set in the standard HRN EN ISO 5817. The passing mark is weld class C.
- Step 6 – The trainer determines after how many successfully carried out pieces the trainee is finished with the training and gets a passing mark for the effort/work.



The simulator scores each of the three elements and gives a summative grade. The trainee/welder has a playback option to analyse his work. The trainee/welder welds as in real conditions. The device scores all three elements: Welding speed, Welding speed + Stick out (distance of the electrode tip from the work piece), Welding speed + Stick out (distance of the electrode tip from the work piece) + Tilt angle of the burner or electrode.

### Training Concept: MAG 135

		WELDING PROCEDURE SPECIFICATION (WPS)				TRAINING - IOS					
		Specifikacija postupaka zavarivanja(WPS)				Date: Datum:	Rev: Rev:				
Produced by: Proizvođač:	ios	Client: Klijent:	WELDCHANCE		Ref. stand: Ref. Standard:	EN ISO 15614-1					
Project: Projekt:	WELDCHANCE		Exam body: Isp. tijelo:	ios-Bi. Bred							
Location: Mjesto:	Bi. Bred										
Welding process: Postupak zavarivanja	135		2		3						
Shielding gas type: Vrsta zaštitnog plina	1	EN ISO 14175-M21 (Ar 80%, CO <sub>2</sub> 18%)		2	3						
Weaving (Yes/No): Sprezračivanje		Yes NE	max. max.		mm	max. max.	mm	mm			
Purging gas type: Vrsta plina za čišćenje	Inert										
Welding positions: Položaj zavarivanja	PB										
Joint type: Vrsta spoja	FILLET JOINT (KUTNI)										
Joint preparation: Priprema spoja	OXY FLAME/MACHING										
Cleaning method: Postupak čišćenja	GRINDING, BRUSHING										
Backing: Podloška	NONE										
Single/side: Jednoslojno/dvoslojno	SINGLE "I"										
Back gouging: Čišćenje											
Flux designation: Oznaka praška za zavarivanje											
Flux handling: Rukovanje praškom zavarivačkom											
Tungsten electrode: Volfranova elektroda	mm										
Torch angle: Kut gorionika	8 - 12°/45°										
Stand off distance: Udaljenost	8-15 mm										
Nozzle diameter(s): Promjer mlaznice	17-22 mm										
Task, welding procedure: Posrepa specifikacije zavarivanja							Rev: Rev:				
<b>Identification of parent metal</b> Identifikacija osnovnog metala											
Part Dio	Name/grade Ime/razred	Standard	Group Grupa	Delivery conditional Stanje isporuke	Thickness range Raspon debljine mm	Diameter range Raspon promjera mm					
1	S355J2+N	EN 10025-2	1.2	-	10.00						
2	S355J2+N	EN 10025-2	1.2								
3											
<b>Identification of filler metal</b> Identifikacija dodatnog metala											
Index Indeks	Trade name Trgovačko ime	Classification/ Klasifikacija	Group Grupa	Filler handling Rukovanje dodatnim materijalom							
1	MIG-2 (Corkon)	EN ISO 14341-A:G3351	PA1								
2											
3											
<b>Welding parameters:</b> Parametri zavarivanja				<b>Equipment:</b> Oprema:							
Pass no. Brij. procesa	Index Indeks	Dist. Promjer	Welding process Postupak zavarivanja	Wire feed speed Brzina dot	Current Jakost struje A	Voltage Napon V	Current polarity Smjer polariteta	Welding speed Brzina zavarivanja mm/min	Run out length Dužina depozita 1 elektrode mm	Gas Plin l/min	Heat input Učinak topline kJ/mm
1	1	1.20	135P	6.50 -	118 - 220	27 - 28	(C2)	380 - 400	10-15	8.0 - 1.0	
2-3	1	1.20	135P	6.50 -	118 - 220	27 - 28	(C2+)	380 - 400	10-15	8.0 - 8.8	
Remarks: Napomena								Date/signature Datum/potpis			
Transfer mode-pulsating current								Approval Odobro			

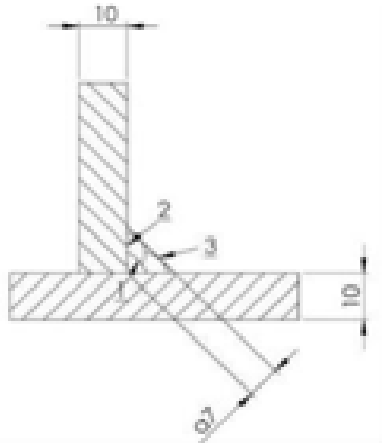


Fig. 7.2 WPS MAG 135

- Trainer designs a WPS for the trainees to practice 3-layer welding of a fillet T- joint, steel sheets, in PB position.
- Training is carried out in pairs.
- Foreseen training duration is 20 school hours.
- The first part of the training is carried out on the Fronius simulator. The foreseen training duration is 40% (8 h)
- The second part is real welding on Transsteel 3500 Synergic Fronius. The foreseen training duration is 60% (12 h)
- Visual inspection of the coupon/test piece

### Training Concept: MMA 111

		WELDING PROCEDURE SPECIFICATION (WPS)						TRAINING - IOS			
		Specifikacija postupaka zavarivanja(WPS)						Date: Datum:		Rev: Rev:	
Produced by: <b>IOŠ</b>		Client: <b>WELDCHANCE</b>		Ref. stand: <b>EN ISO 15614-1</b>		Ref. Standard: <b>IOŠ-SI. Brod</b>					
Project: <b>WELDCHANCE</b>		Klijent:		Exam body: <b>IOŠ-SI. Brod</b>		Isp. tijelo:					
Location: <b>Sl. Brod</b>		Mjesto:									
Welding process Postupak zavarivanja		111		2		3					
Shielding gas type Vrsta zaštitnog plina		1									
Weaving (Yes/No) Nijihanje(Da/Ne)		max.: max.: mm		max.: max.: mm		max.: max.: mm					
Purging gas type Vrsta plina za čišćenje				l/min							
Welding positions Položaji zavarivanja		PB									
Joint type Vrsta spoja		FILLET JOINT (KUTNI)									
Joint preparation Priprema spoja		OXY FLAME /MACHINING									
Cleaning method Postupak čišćenja		BRUSHING									
Backing Podloška		-									
Single/double Jednostruko/dvostruko		SINGLE "T"									
Back gouging Žlijebljenje											
Flux designation Oznaka praška za zavarivanje											
Flux handling Rukovanje praškom za zavarivanje											
Tungsten electrode Volframova elektroda				mm							
Torch angle Kut gorionika											
Stand.off distance Udaljenost				mm							
Nozzle diameter(s) Promjeri mlaznice				mm							
Tack, welding procedure Promjena specifikacije zavarivanja				Rev: Rev:							
<b>Identification of parent metal</b> <i>Identifikacija osnovnog metala</i>											
Part Dio	Name/grade Ime/kvaliteta	Standard Standard	Group Grupa	Delivery conditional Stanje isporuke	Thickness range Raspon debljine mm	Diameter range Raspon promjera mm					
I			1		10,00						
II			1		10,00						
III											
<b>Identification of filler metal</b> <i>Identifikacija dodatnog metala</i>											
Index Indeks	Trade name Trgovačko ime	Classification/ Klasifikacija	Group Grupa	Filler handling Rukovanje dodatnim materijalom							
1	UTP 614 KB	B Basic E 7018 EN ISO 2560 A E 42 3 B 32 H 10									
2											
3											
<b>Welding parameters:</b> <i>Parametri zavarivanja</i>											
Pass no. Broj prolaza	Index Indeks	Dia. Promjer	Welding process Postupak zavarivanja	Wire feed speed Brzina žice	Current Jakost struje, A	Voltage Napon V	Current/polarity Struja/polaritet	Welding speed Brzina zavarivanja mm/min	Run-out length Dujina depozita 1 elektrode, mm	Gas Plin l/min	Heat input Unos topline kJ/mm
1		3,2	111		133	MACHINE	DC(+)				
Equipment: Oprema:											
Remarks Primjedbe											
							Date/signature Datum/potpis				
							Approved Odobrio				

Fig. 7.3 WPS MAG 135

- Trainer designs a WPS for the trainees to practice 1-layer welding of a fillet T- joint, steel sheets, in PB position.
- Training is carried out in pairs.
- Foreseen training duration is 24 school hours.
- The first part of the training is carried out on the Fronius simulator. The foreseen training duration is 50% (12 h)
- The second part is real welding on Transpocket 180 - Fronius. The foreseen training duration is 50% (12 h)
- Visual inspection of the coupon/test piece

## 7.2 How to make a virtual tour

The scope of the best practice is focused on teaching students how to create virtual tours as complementary knowledge to the profession of photographer. The main goal is to expand photography knowledge by adding a new camera type and a new virtual tour software. To create a virtual tour, the students need to have Adobe Lightroom installed, create an account on kuula.co and download the Theta app on your smartphone

### 1. Mount camera on monopod



Fig. 7.4 Mounting camera on monopod

### 2. Connect camera and smartphone

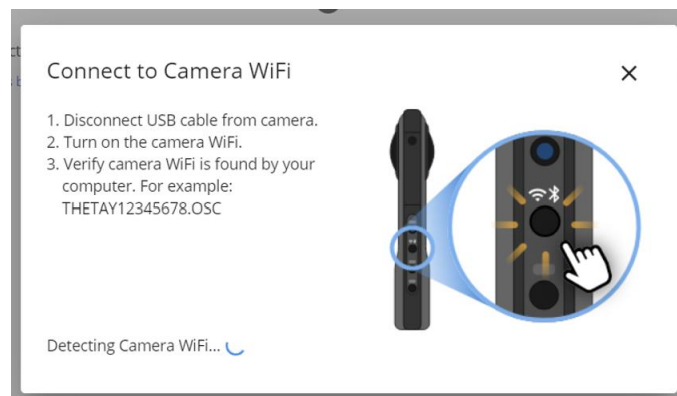


Fig. 7.5 Connecting camera to a smartphone

3. Open Theta app on smartphone and take picture

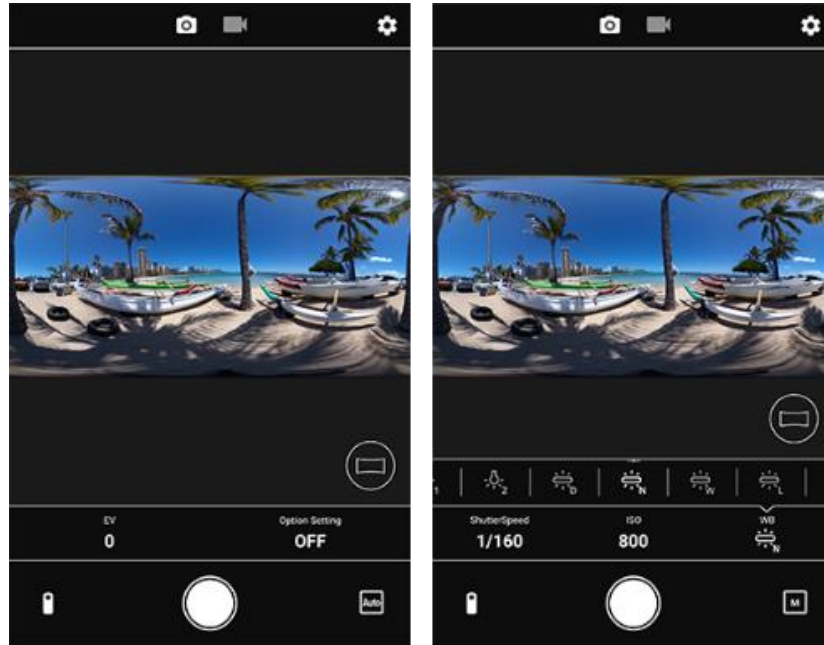


Fig. 7.6 Launch the app

4. Move to next room and take the second picture

5. Transfer pictures from camera to PC via USB cable



Fig. 7.7 Transferring the files through USB cable

6. Open Adobe Lightroom on PC and load images with IMPORT button.



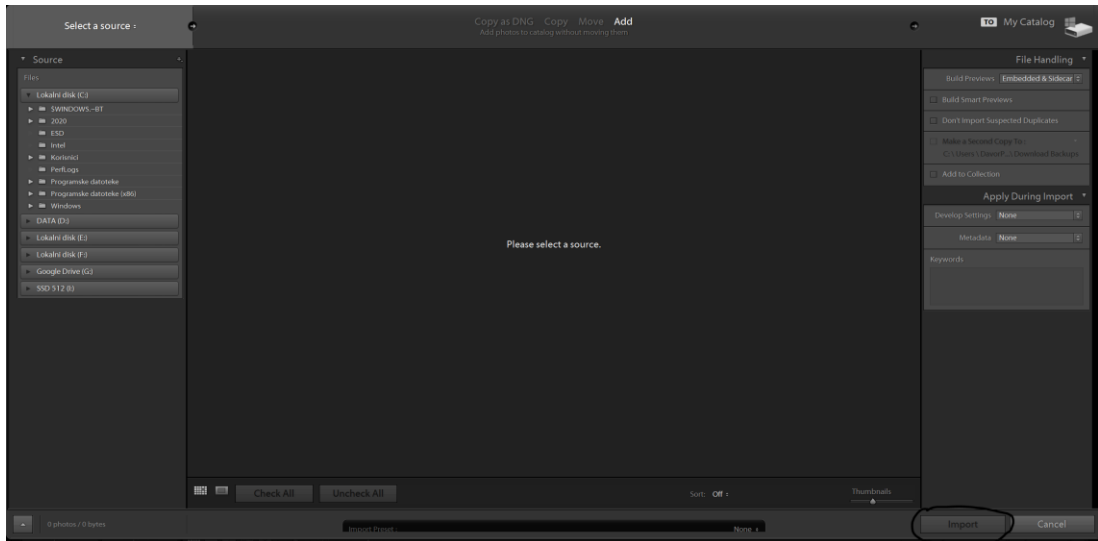


Fig. 7.8 Using specific software to import pictures

7. Correct image's attributes on the right side.

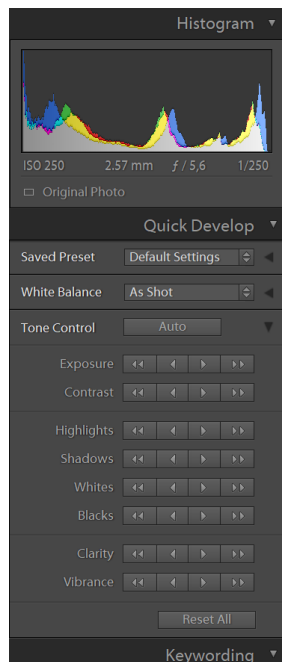


Fig. 7.9 Optimising the picture

8. Do the same for the 2nd and all other images in future.

9. Open kuula.co



Fig. 7.10 Logo of kuula.co online application

## 10. Upload New Tour

[Create tour](#)
[Add to existing tour](#)
[Batch upload](#)

Test School

*Tour description (optional)*

**SELECT IMAGES**

...or drag & drop files anywhere in the window.  
 Max file dimensions 16384 x 16384 pixels  
 JPG, PNG, WEBP, BMP  
 Panoramic or regular

Fig. 7.11 Creating virtual tour

## 11. Upload images

Test School

*Tour description (optional)*

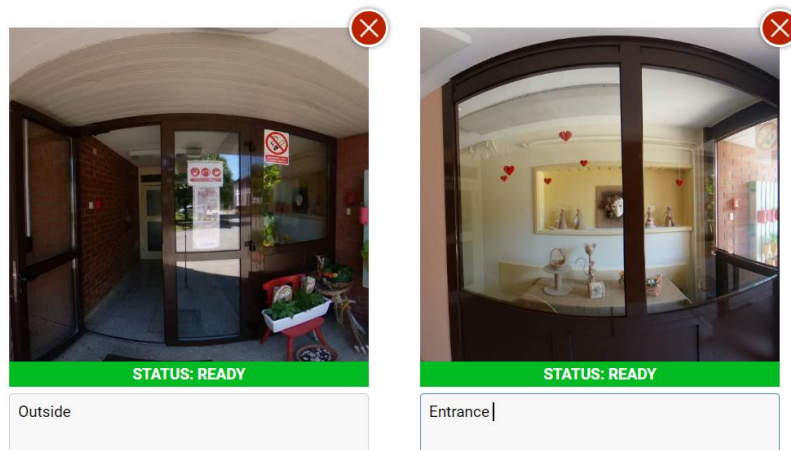


Fig. 7.12 Uploading pictures

12. Now it's time for connecting panoramas. Just drag and drop 2<sup>nd</sup> panorama and write the name of information point

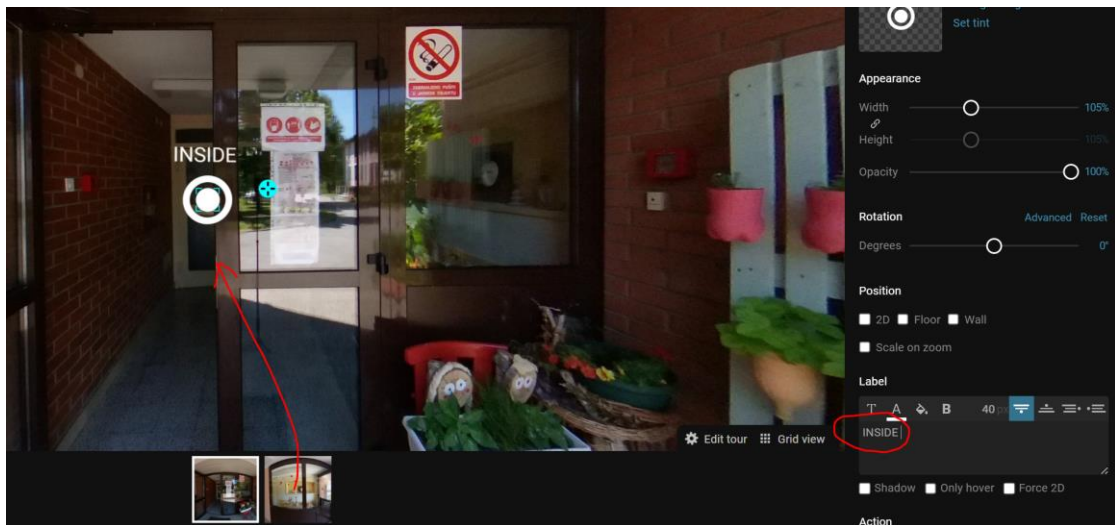


Fig. 7.13 Creating the visual panorama

13. Save and click the 2<sup>nd</sup> panorama. Repeat the same job from 1<sup>st</sup> panorama. Add information point, change color of point on the right side, and write the name of information point.

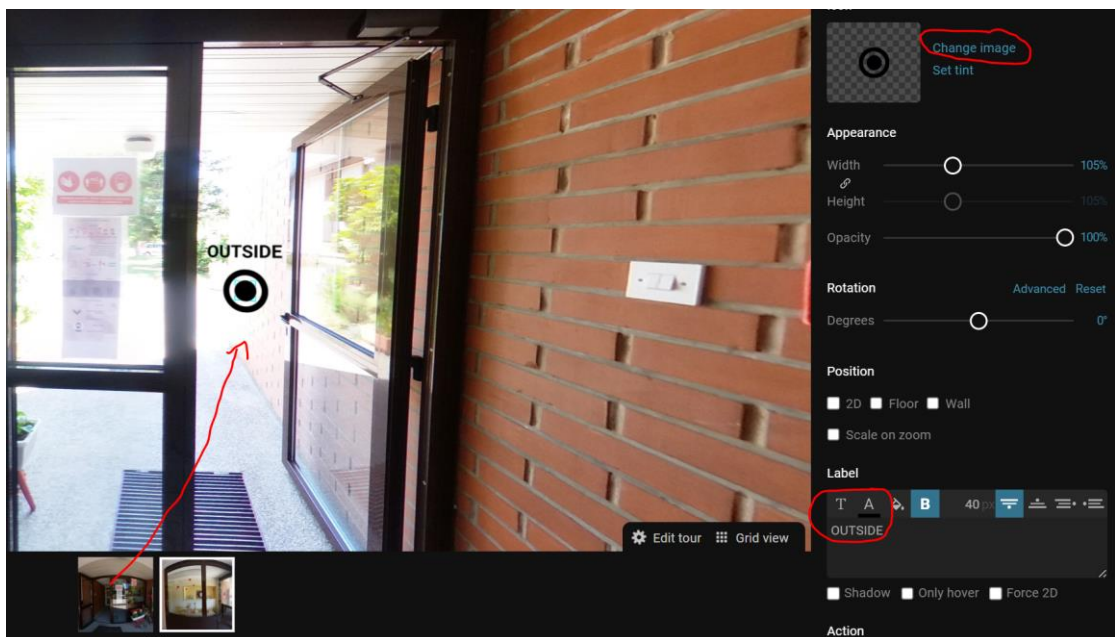


Fig. 7.14 Adding info on pictures

14. Save and close. Go to lobby and click on edit tour. We need to set loading rules.

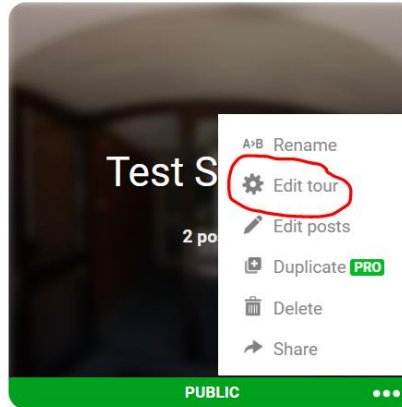


Fig. 7.15 Editing the tour and establishing loading rules

15. For the beginning I suggest to set Walk through and to Click everywhere option. This will make the tour more precise and fast for loading panoramas.

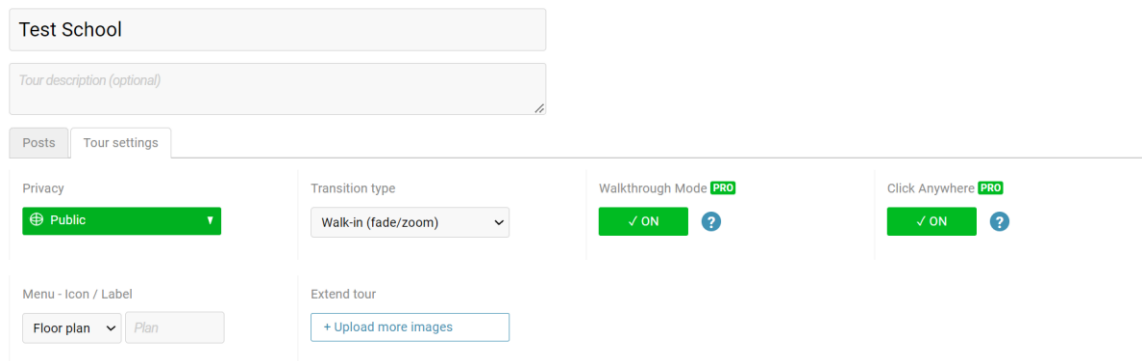


Fig. 7.16 Editing parameters for virtual tour

16. That's it for now. First virtual tour is ready to watch.

Conclusion: No matter how many panoramas we have, the procedure is always the same. Take pictures with a camera, process them in Lightroom, upload them to Kuula, connect them to each other on Kuula.

## 8. Blended teaching using different digital tools

This module is focused on two types of best practices for teaching and training, by making use of Microsoft Teams and Kahoot. Both examples are for the practical part of teaching/training. The first one is applicable to blended circumstances, while the second one focuses on physical environments.

### 8.1 Microsoft Teams (blended teaching / training)

For best practice 1, the use of Microsoft Teams, a software that primarily allows messaging, calling, video meetings and file sharing, is required. Both students/trainees and teachers/trainers need to be connected to the class/training via Microsoft Teams, and at least 50% of the class needs to be present in the classroom, while the other 50% connect online, has this example is for blended teaching/training.



Fig. 8.1 Representation of the classroom with students/trainees divided (50% present and 50% online)

A PowerPoint lecture is required to be prepared prior to the class/training, so it can be presented by the teacher/trainer to the students/trainees. This lecture must include at least one Yes or No question, for each portion of the given subject, in order to engage the students/trainees in consolidating the knowledge they are acquiring and make them aware of it.

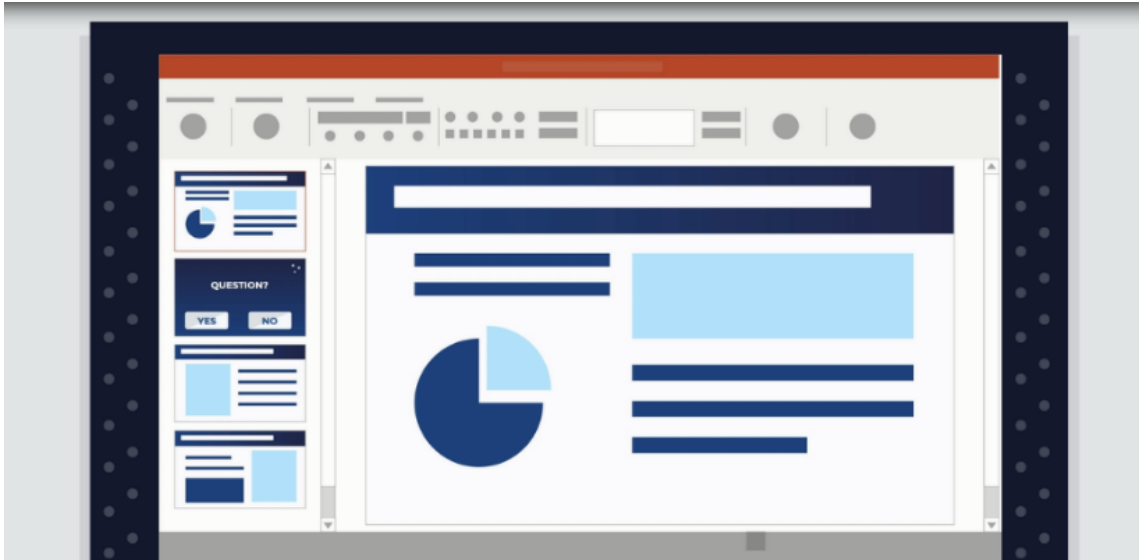


Fig. 8.2 Representation of the Ppt presentation

After the presentation, the students/trainees must be divided in small groups (3 to 4), for an interactive activity regarding the entirety of the given subject, to self-assess the knowledge acquired and identify which areas need more study. To facilitate the creation of these groups, considering they're blended, between presential and online students/trainees, the teachers/trainers should use breakout rooms. This Teams feature, can be created and managed by the meeting organizer, using the meeting controls. After breakout rooms are created, the students/trainees can either be assigned to them automatically or manually.



Fig. 8.3 Representation of the groups with presential and online students/trainees



## 8.2 Kahoot (presential teaching/learning)

For this best practice, the use of Kahoot, a game-based learning platform, is required. For this best practice the students/trainees and teachers/trainers need to be connected online, so having access to computers and the internet is needed. A PowerPoint lecture is required to be prepared prior to the class/training, so it can be presented by the teacher/trainer to the students/trainees.



Fig. 8.4 Representation of the classroom – Ppt presentation

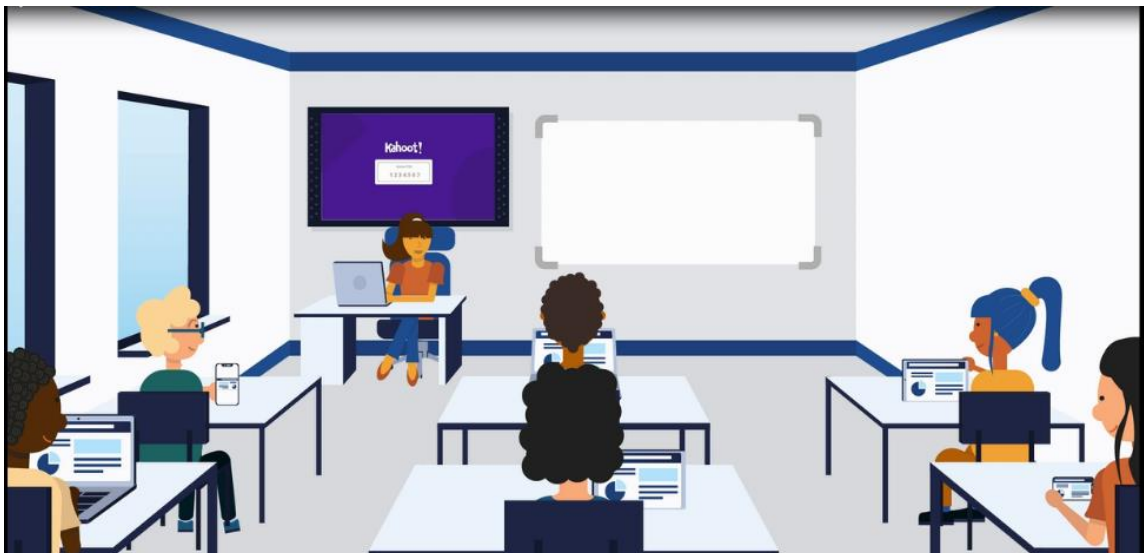


Fig. 8.5 Representation of the classroom - Kahoot questions

This lecture must include at least five specific questions, for each portion of the given subject, prepared by the teacher/trainer on the platform Kahoot. Each student/trainee must connect

to the platform, using the code given by the teacher/trainer, and answer the questions individually, to self-assess the knowledge acquired and identify which areas need more study.

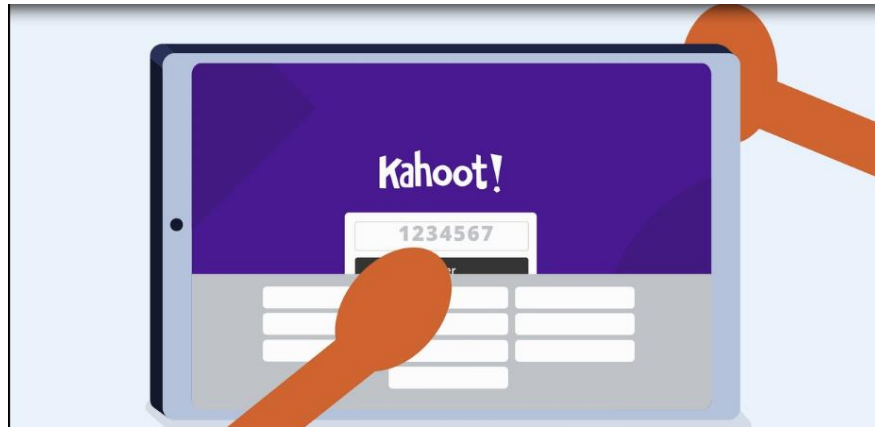


Fig. 8.6 Representation of a student/trainee connecting to Kahoot

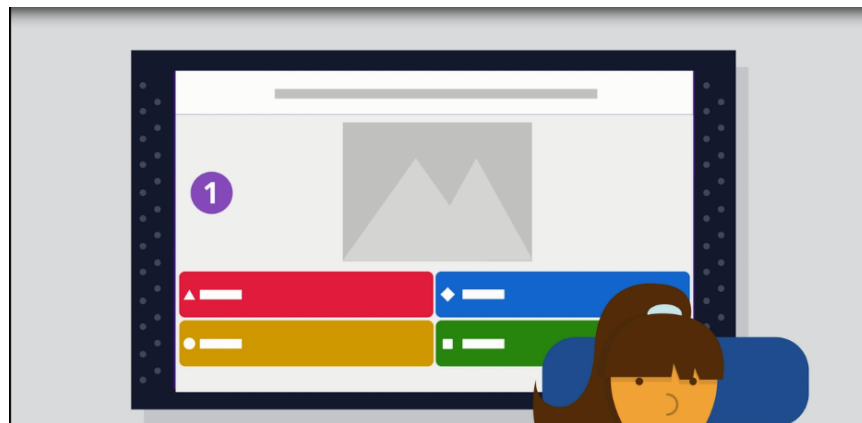


Fig. 8.7 Representation of the teacher/trainer screen with the Kahoot question

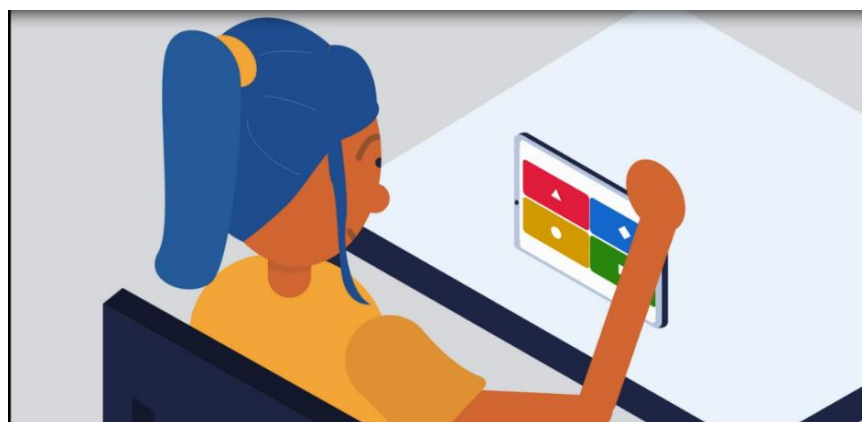


Fig. 8.8 Representation of the student/trainee screen with the options to answer the question



## 9. Facilitating classrooms and safety issues in virtual reality

Virtual reality, or VR, is taking off in education with an increasing number of schools adopting the technology.

VR allows students to experience destinations from across the world without ever having to leave the classroom. Imagine students being able to explore the pyramids of Giza whilst sitting at their desks. This is what virtual reality education allows.

Most people have heard of virtual reality (VR) but many people do not know what it is or how it is used in learning and education.

VR refers to interactive content (images or videos) which enables the viewer to explore the entire 360 degrees of a scene.

Virtual reality can improve education by providing students with memorable and immersive experiences that would otherwise not be possible. What's more, it can all take place within the classroom.

VR is accessible to every student and can be easily monitored by teachers. Virtual experiences have the power to engage and inspire students uniquely and powerfully.

### 9.1 How to use VR safely in a classroom setting

VR and the use of headsets can lead to injury. When you wear a headset, you cannot see the real-world surroundings, and after a while, your brain will get lost in the real-world space.

To ensure that everyone who has the VR headset on, you must ensure a safe environment, teach about the safety precautions and make sure that the person in VR might not get their pre-existing conditions triggered (such as epilepsy attack etc.). There are several steps one should go through to make sure that the VR experience will be safe.

1. Clear surroundings (make sure there is enough space for your students)
2. Keep an eye on the students (students can get motion sick, therefore observe your students)
3. Identify motion sickness (students might start to state it feels weird to move)
4. Identify the person's discomfort (students might make some statements and you should always listen for signs of discomfort)
5. Pre-existing conditions and safety suggestions
6. Kids and VR
7. Safe handling of the VR equipment
8. Sanitation

Before starting the headset:

Read and follow all setup and operating instructions provided with the headset.

- Review the hardware and software recommendations for use of the headset. The risk

of discomfort may increase if recommended hardware and software are not used.

- Your headset and software are not designed for use with any unauthorized device, accessory and/or software. Use of an Unauthorized devices, accessory and/or software may result in injury to you or others and may cause performance issues or damage to your system and related services.
- To reduce the risk of discomfort, adjust the viewing focus for each user before use of the headset.
- A comfortable virtual reality experience requires an unimpaired sense of motion and balance. Do not use the headset when you are: Tired; need sleep; are under emotional stress or anxiety; or when suffering from cold, flu, headaches, migraines, or earaches, as this can increase your susceptibility to adverse symptoms.
- We recommend seeing a doctor before using the headset if you are pregnant, elderly, or have pre-existing binocular vision abnormalities or other serious medical conditions.
- To charge the headsets, carefully ensure they are placed within their supplied case, with the USB cable connected to each headset. When the case is connected to the mains using the supplied power cable, the light on each headset should illuminate to show that it is charging. When the headsets are fully charged, we recommend switching the power supply off at the mains.

### **Children**

Adults should make sure children use the headset following these health and safety warnings including making sure the headset is used as described in the Before Using the Headset section and the Safe Environment section.

Adults should monitor children who are using or have used the headset for any of the symptoms described in these health and safety warnings (including those described under the Discomfort and Repetitive Stress Injury sections) and should limit the time children spend using the headset and ensure they take breaks during use.

Prolonged use should be avoided, as this could negatively impact hand-eye coordination, balance, and multi-tasking ability. Adults should monitor children closely during and after the use of the headset for any decrease in these abilities. We recommend that ClassVR is used for no more than 15 minutes in any one lesson. Short VR sessions are very engaging and are the perfect way to open a topic or reinforce a key point. The ClassVR player includes a notification to the teacher when any student has been in VR for longer than this recommended time, which is also the limit recommended for children by optometrists.

### **Seizures**

Some people (about 1 in 4000) may have severe dizziness, seizures, eye or muscle twitching or blackouts triggered by light flashes or patterns, and this may occur while they are watching TV, playing video games or experiencing virtual reality, even if they have never had a seizure or blackout before or have no history of seizures or epilepsy. Such seizures are more common

in children and young people under the age of 20. Anyone who experiences any of these symptoms should discontinue the use of the headset and see a doctor. Anyone who previously has had a seizure, loss of awareness, or other symptoms linked to an epileptic condition should see a doctor before using the headset.

### **General Precautions**

To reduce the risk of injury or discomfort you should always follow these instructions and observe these precautions while using the headset:

**Use Only In A Safe Environment:** The headset produces an immersive virtual reality experience that distracts you from and completely blocks your view of your actual surroundings.

Always be aware of your surroundings before beginning use and while using the headset. Use caution to avoid injury and remain seated unless your content experience requires standing.

- The use of the headset may cause a loss of balance.
- Remember that the objects you see in the virtual environment do not exist in the real environment, so don't sit or stand on them or use them for support.
- Serious injuries can occur from tripping, running into or striking walls, furniture or other objects, so clear an area for safe use before using the headset.
- Take special care to ensure that you are not near other people, objects, stairs, balconies, open doorways, windows, furniture, open flames, ceiling fans or light fixtures or other items that you can bump into or knock down when using—or immediately after using—the headset.
- Remove any tripping hazards from the area before using the headset.
- Remember that while using the headset you may be unaware that people may enter your immediate area.
- Do not handle sharp or otherwise dangerous objects while using the headset.
- Never wear the headset in situations that require attention, such as walking, bicycling, or driving.
- Make sure the headset is level and secured comfortably on your head, and that you see a single, clear image.
- Make sure any headphone cables if used are not tripping hazards.
- Ease into the use of the headset to allow your body to adjust; use for only a few minutes at a time at first, and only increase the amount of time using the headset gradually as you grow accustomed to virtual reality. Looking around when first entering virtual reality can help you adjust to any small differences between your real-world movements and the resulting virtual reality experience.
- Do not use the headset while in a moving vehicle such as a car, bus, or train, as this can increase your susceptibility to adverse symptoms.
- Take at least a 10 to 15-minute break every 30 minutes, even if you don't think you need it. Each person is different, so take more frequent and longer breaks if you feel discomfort. You should decide what works best for you.

- If using headphones, listening to sound at high volumes can cause irreparable damage to your hearing. Background noise, as well as continued exposure to high volume levels, can make sounds seem quieter than they are. Due to the immersive nature of the virtual reality experience, do not use the headset with the sound at a high volume so that you can maintain awareness of your surroundings and reduce the risk of hearing damage.

### **Discomfort**

Immediately discontinue using the headset if any of the following symptoms are experienced: seizures; loss of awareness; eye strain; eye or muscle twitching; involuntary movements; altered, blurred, or double vision or other visual abnormalities; dizziness; disorientation; impaired balance; impaired hand-eye coordination; excessive sweating; increased salivation; nausea; lightheadedness; discomfort or pain in the head or eyes; drowsiness; fatigue; or any symptoms similar to motion sickness.

Just as with the symptoms people can experience after they disembark on a cruise ship, symptoms of virtual reality exposure can persist and become more apparent hours after use. These post-use symptoms can include the symptoms above, as well as excessive drowsiness and decreased ability to multi-task. These symptoms may put you at an increased risk of injury when engaging in normal activities in the real world.

- Do not drive, operate machinery, or engage in other visually or physically demanding activities that have potentially serious consequences (i.e., activities in which experiencing any symptoms could lead to death, personal injury, or damage to property), or other activities that require unimpaired balance and hand-eye coordination (such as playing sports or riding a bicycle, etc.) until you have fully recovered from any symptoms.
- Do not use the headset until all symptoms have completely subsided for several hours. Make sure you have properly configured the headset before resuming use.
- Be mindful of the type of content that you were using before the onset of any symptoms because you may be more prone to symptoms based on the content being used.
- See a doctor if you have serious and/or persistent symptoms.

### **Repetitive Stress Injury**

Using the device may make your muscles, joints or skin hurt. If any part of your body becomes tired or sore while using the headset or its components, or if you feel symptoms such as tingling, numbness, burning or stiffness, stop and rest for several hours before using it again. If you continue to have any of the above symptoms or other discomforts during or after use, stop using and see a doctor.

### **Electrical Shock**

To reduce the risk of electric shock:

- Do not modify or open any of the components provided.
- Do not use the product if any cable is damaged or any wires are exposed.

### **Damaged or Broken Device**

- Do not use your device if any part is broken or damaged.
- Do not attempt to repair any part of your device yourself. Repairs should only be made by Avantis Systems Ltd

### **Contagious Conditions**

To avoid transferring contagious conditions like conjunctivitis (pink eye), do not share the headset with persons with contagious conditions, infections or diseases, particularly of the eyes, skin or scalp. The headset should be cleaned between each use with skin-friendly non-alcoholic antibacterial wipes and with a dry microfiber cloth for the lenses.

For further information, please see our guidance on protecting against contagious viruses.

### **Skin Irritation**

The headset is worn next to your skin and scalp. Stop using the headset if you notice swelling, itchiness, skin irritation or other skin reactions. If symptoms persist, contact a doctor.

## **9.2 How to facilitate your first class?**

Introducing new technology to people is always tricky. The first impression matters as well. The problem arises when a person does not have a proper onboarding to the technology which results in hesitancy and apathy towards the technology

The first use of VR can also result in dizziness and headache as the brain tries to adapt and overcome the real-world/simulated-world contradiction.

Therefore, it is important to have proper onboarding follow the safety procedures and try a simple and enjoyable experience first before diving into the VR world.

It is also important to understand what will happen in VR to avoid triggers of phobias or PTSD.

### **TEACHER PREPARATION**

Tips for Getting Started with V.R. in the Classroom

From safety precautions to technology requirements, here's what you'll need to teach.

A Tool, Not a Curriculum. Virtual reality is not a technology that should replace other teaching resources; instead, it should serve as a complementary tool that can enhance learning across disciplines. As with any new technology being introduced into the classroom, success depends on expectations, an effective strategy and the practical details of how it is being used.

Safety! Safety! Safety! We always recommend sitting when participating in V.R. experiences. Partners create an additional safety measure because the partner who is observing can ensure that his or her partner is safely experiencing the VR content.

Before starting, go over a list of dos and don'ts. Some of our personal favorites include:

- No standing up.
- If you are starting to feel dizzy or getting a headache, take the headset off.
- Do not flail hands or legs around to avoid causing potential accidents.

Virtual reality can sometimes be an intensely emotional experience. Remind students that if they are feeling overwhelmed, it's OK to stop.

Technology. To get started, you'll also need some basic technology. Here are some general requirements:

- Internet: V.R. experiences can be downloaded or streamed. We recommend downloading the experience to the device so that streaming issues are avoided.
- Mobile Device: Smartphones are essential to powering these experiences.
- Headset: Choose a headset that makes the most sense for the mobile devices that you are using. There are mobile device-agnostic headsets that could work with a variety of phones. Prices start under 2,50 EUR for a simple cardboard viewer and go up from there. Most headsets also come with compatibility specs, so that you can be better informed on how to pair accurately.
- Without Headset: 360 videos can also be viewed without a headset, but the experience isn't as immersive. When viewing 360 videos in this format, you can drag the screen while the video is playing to view the surrounding environment in 360 degrees.
- Headphones: Headphones allow the user to be more immersed and reduce the disruption to the experience that could arise from using speakers.

## **STUDENT PREPARATION**

To start teaching using the VR you need to be prepared as a teacher, but you also need to prepare your students.

### **1. Safety**

Always start your class with safety instructions. Explain to the students how to use VR safely. Main talking points should include:

How to put on the VR gear (there is always some small differences between the equipment, therefore make sure to explain how to put and secure the headset on).

### **How?**

Start by showing that you are inspecting the VR headset. Make comments on what you are observing.

The headset does not have any loose cables (if applicable), the headset is intact with no cracks or any other damage, lenses are intact (if applicable) and there are no scratches. The lenses should light up if the headset is on.

State that the headset is ready to use and start by disinfecting it with the appropriate cleaning solutions. This is in order to avoid any transmittable skin conditions. If possible (and available) use the protective masks for the VR headset such as the one in the picture below. Put it on.

Demonstrate the correct way on how to safely put the headset on and how to fasten it. Vision should not be blurred and the student should feel comfortable. In case of students with eye-sight health issues, instruct (if applicable) to adjust the focus on lenses.

### **Assign a “buddy system”**

First encounter with a lot of students might be difficult to navigate. Therefore, always pair your students to have couples. This way the “VR buddy” will become your extended arm to help and observe any discomfort of the person using the VR. They should report to you if they hear the person in VR complaining about any discomfort at all and help them remove the headset. After that they should contact and report to you directly.

### **Play a safety video**

Especially, the first encounter should be facilitated in the safest way. If you have students who have never tried VR it is important to show them what not to do. The example of video:

[https://www.youtube.com/watch?v=QEpcIx\\_lodk&ab\\_channel=Holonautic](https://www.youtube.com/watch?v=QEpcIx_lodk&ab_channel=Holonautic)

### **Ask for any of these conditions**

Former seizures, light sensitivity, flashing light sensitivity, PTSD, phobias and triggers to ensure that you will not have a student with a negative reaction. This is to build the students confidence in the use of the equipment.

### **DONT ´S**

Explain to your students that it is in no way allowed to in any way or form to touch the person using the VR unless the person using it requests help! THIS IS VERY IMPORTANT! The person using VR is in a very vulnerable position and some students might find it intriguing to have “some fun”. This can result in injuries, damage of equipment and emotional trauma. To avoid this, clearly state that no touching (with hands or objects) is allowed. Furthermore, if a person who is not using the VR is getting any close to the person using the equipment, they should talk to make the person blinded by VR aware where they are.

## First class

For first class you want to have some simple showcase of the VR. Anything that is “fun” and pleasurable to experience in the VR. To build the confidence of your students, you should make this experience as best as possible. Fact is, that the older students in VET will be reluctant with the technology. To make their first experience a positive one, we recommend to have some sort of the VR experience such as “The Blue” where the person is underwater on a ship and sees a beautiful whale approaching (ask for any phobias of deep water, animals and similar). “The dawn of art”, “Museum excursions” etc. You can watch this video for inspiration:

[https://www.youtube.com/watch?v=g3wwPZhc71s&ab\\_channel=AltVR](https://www.youtube.com/watch?v=g3wwPZhc71s&ab_channel=AltVR)

You have selected some calm experience for your students, you have taught them about safety and assigned a buddy. You explained the “ethics” and you are ready to observe your students. You are ready now. Except you are not :)

## Explanations

Why are you not ready, you might wonder. Simply, because your students need to know the following: (applicable for the very first VR encounter and to any VR class you might hold in the future)

### 1. What will happen?

Your students might be very excited to dive in and try things out. But it is your responsibility to explain what will happen inside the VR experience. This is, once again, to have your students to determine if there might be something they do not want to see/hear/ experience (for example the student might be afraid of deep water, the scale of the whale, panic because of the fact their brain got too tricked and they are worried they cannot breathe.)

Explain shortly what will happen in the experience (without going into too much detail where there is nothing more to explore). Ask for any questions the students might have before let them try VR.

### How can I move?

Now you have to go a little more into detail on the functionality of the VR. Depending on the type (tethered - VR headset connected via cable to the computer with controllers, standalone - VR headset with controllers without a cable, mobile - the headset frame uses the phone as a display).

This is crucial for people who have no knowledge about the VR and gaming as such.

- The GRID: The grid (tethered and standalone) is a “safety net” which the person in the VR can see. It shows up when you get too close to your physical space borders (walls, objects etc.). If they see the grid they has to avoid it.



- The controllers: (tethered and standalone) are your hands in the VR. You use them to interact with the VR world and its objects. Every experience is different so you need to know what experience you have selected and how to use the controllers.

### **How can I remove the headset if I am not comfortable?**

Ask your assigned buddy to help you remove the equipment. First hand off the controllers, second take of your headset. Give it to your buddy. If you feel sick sit down. The “buddy” should then come to the teacher and report what happened.

### **WHY is this important?**

First experiences are very different for each of the students. Some will grasp the idea very quickly and without any problems. However, most of the people will experience some sort of discomfort. From slight headache, eye strain and a little confusion or dizziness are normal and they should pass after a few minutes.

The problem starts with motion sickness. This can lead to people become really sick very quickly. In that case have them sit down and touch the floor. Bring some water (and a trash can in case they might throw up) and observe them. It should pass as well, but it is not a pleasant experience. It is very common with the people who have started to use VR for the first time and are not used to the system of moving in the VR space. Movement in there can be assisted by the “teleportation” where you point at a specific place and you just “appear” there. Another type, which can cause motion sickness, is the moving with the controllers, where the person with VR uses the controllers to let the world around them move while being static. This tends to be unpleasant to people with motion sickness as the brain does not understand how can you be moving while being static.

## **2. What is expected of the student**

Be clear of what is the main objective related to the learning outcome for students. Example: In the “blue” experience, you should observe and note what sort of animals were around, what has happened and how did it make you feel. By stating clear objectives from the beginning you help the student to learn that you use VR as a tool for education and not for entertainment. This will help you keep them focused and object oriented.

## **3. Observe the students**

Everything is going alright and none of your students have any troubles. However, what can occur is that the students might lose the track of time. Especially in experiences which do not have a clearly defined timer for the experience to end (for example a museum visit). It is up to you to notify them when they are nearing the end of their time allocated. It is recommended to give them a 5 minutes notice and then a 2 minutes notice so that they can complete their tasks and observations.

#### **4. Evaluation**

Part of your VR inclusion class should also be an Evaluation of the experience. Each student should provide their feedback either orally or in a written form. By doing so, you will be able to determine if the VR inclusion is meeting your learning objectives and its purpose.

For example, ask for details which are cohesive with your learning objectives and what you wanted to achieve.

#### **5. Finale**

After your evaluation ask the students to clean and put away the equipment. While doing so they should also inspect the equipment and if they find anything they should report it to you.

Summary:

1. Inspect the Equipment you are demonstrating with
2. Clean the equipment and put on the protective mask (if available)
3. Assign students their "buddy"
4. Play the safety video on how to behave with headset on
5. Provide information on what will happen in the VR scenario and ask if there is anyone with a specific problem with the content (people with PTSD, people with seizures, any sort of phobias etc.)
6. Assign the task and explain what is expected of the student after the completion of VR
7. Observe the students
8. After finalization of the class request feedback from the students
9. Ask the students to clean and put away the equipment
10. Inspect equipment for any damage or problems

## 10. Simulation of welding and online learning using digital tools

During and after the pandemic, many institutions and schools were forced to digital transfer of knowledge and manual skills. This was, for some teacher a jump into the deep end. Therefore we would like to present you in this chapter, how we teach welding related themes with online tools, digital welding training simulators and real workshop training as well as blended learning.

### 10.1 Introduction to MAG welding

In this best practice we show, how we transmit the basic knowledge on MAG welding. This includes transition of terminology, information about the equipment, some information about gases, materials, and advantages and disadvantages of the process, as well as where it is most commonly used.



Fig. 10.1 Theoretical presentation using MS Teams

As we would like to teach practical knowledge, we use a combination of online tools, digital welding simulators and real welding equipment.

First step is to hold a presentation to the class via MS Teams. This is done with a PowerPoint presentation and the teacher explains the slides. The students always have the possibility to raise their virtual hand and ask questions or inserting questions into the chat, if anything is not clear. They may also work together on various topics on the whiteboard.



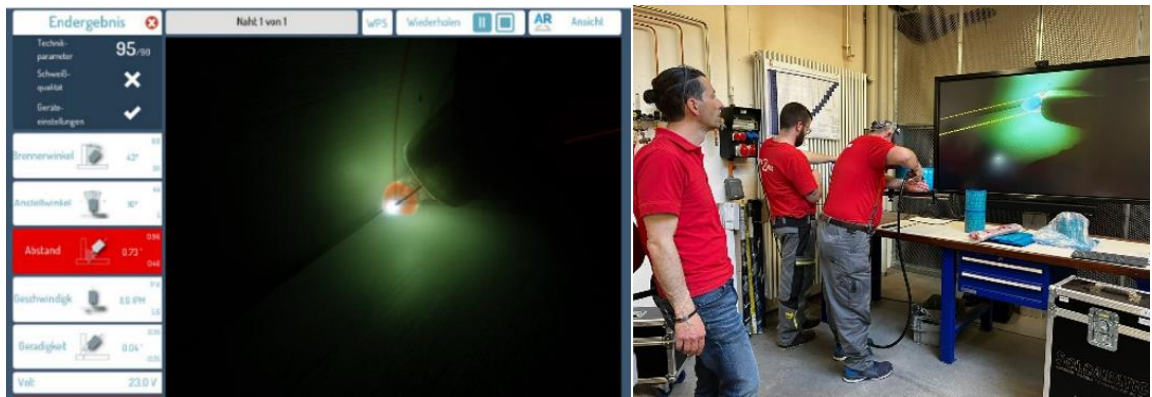


Fig. 10.4 Practical training on welding simulator

The third step is then, to first explain the welding machine and the preparation of the welding pieces, like grinding or tacking the plates. But prior to move to the real welding, all students are instructed on safety and health issues. Then the participants do their real practice work by using the wps received from the instructor.



Fig. 10.5 Practical training on real workshop

Step 4 is the control of the weld by visual or radiographic testing, and give feedback to the student where he can improve further.



Fig. 10.6 Visual testing of welds

## 10.2 Blended Learning (mixture of e-learning and teaching in a classroom) of visual testing of welded joints

In this best practice it is shown, how a learning management system LMS can be used for teaching theoretical topics in visual testing. Physical basics, the various visual testing utilities and methods, and the requirements for the testing process, such as intensity of the illumination. The different types of welding imperfections are also part of this example.

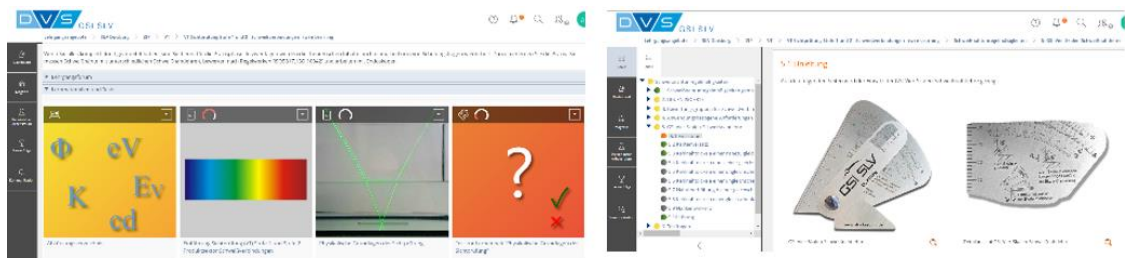


Fig. 10.7 Different types of welding imperfections

First step is to send the participants a link to access the LMS tool online. The content needs to be learned until the next physical lesson. There are some tests, that should be resolved also before the physical meeting. Here the student can get their own feedback, if they understood the topics, and if not they have the possibility to repeat them online session as often as they want and collect their questions for the physical lessons.



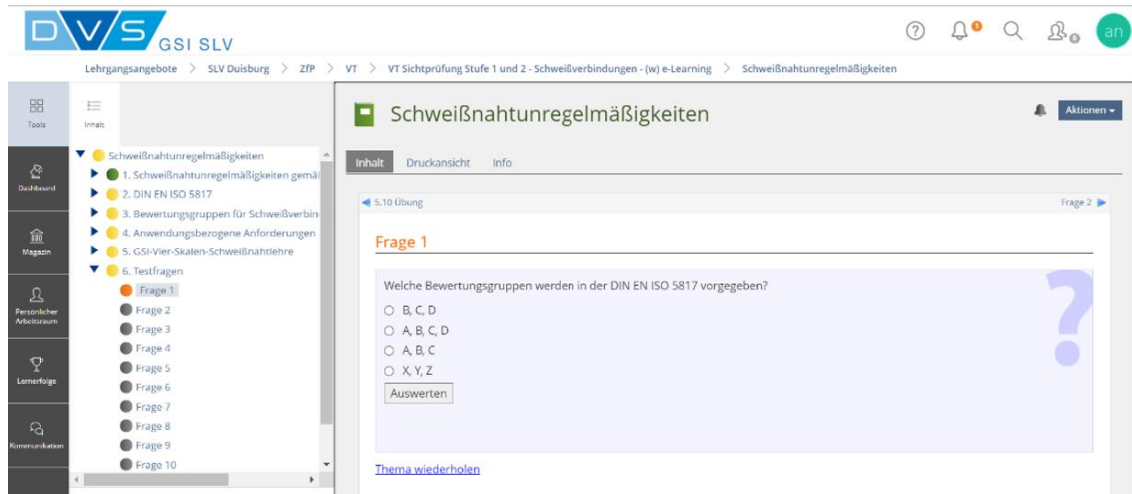


Fig. 10.8 Battery of tests prepared for students assessment

Step two is the physical lesson. First the questions and the test is discussed in the classroom.



Fig. 10.9 Physical lessons

Step three is to move to the Lab and do the practical exercises and trainings for the visual testing using the measurement instruments and all necessary other equipment. Also we show the students, how they have to use the standards for doing the measurements and assessment of the welds.

## References

1. Google Suite – <https://support.google.com/a/users/?hl=en#topic=11499463>
2. VSTEP – Ship Simulator Software 2006, User Handbook
3. Internet – <https://libertylift.com/products/beam-pumping-units/>
4. Internet – <http://www.shivers-enterprises.com/championpumpingunits.html>
5. Internet – Kuula App – [www.kuula.co](http://www.kuula.co)
6. Microsoft Teams – <https://www.syskit.com/resources/ebooks/>
7. Internet – Youtube – <https://www.youtube.com/watch?v=pANtMqNWBek>
8. Internet – Youtube  
[https://www.youtube.com/watch?v=QEpcIx\\_lodk&ab\\_channel=Holonautic](https://www.youtube.com/watch?v=QEpcIx_lodk&ab_channel=Holonautic)
9. Internet – Youtube  
[https://www.youtube.com/watch?v=g3wwPZhc71s&ab\\_channel=AltVR](https://www.youtube.com/watch?v=g3wwPZhc71s&ab_channel=AltVR)
10. Internet – Twitter – <https://twitter.com/jkamecki/status/1250175018350391298>
11. BILT project – [www.unevoc.unesco.org/bilt](http://www.unevoc.unesco.org/bilt)
12. Federal Institute for Vocational Education and Training in Germany (BIBB) – <https://www.bibb.de/de/105326.php>
13. MIMBUS Discover, Regional association for the inclusion and professional talent detection of the autistic population - <https://www.otema-tsa.fr/articles/87910-la-mallette-vr-bientot-operationnelle>
14. MIMBUS Discover, Job attractivity program launched by Pole Emploi, the French recruitment agency - <https://yookan.io/>
15. Virtual Indus Electricity: <https://www.apprentis-auteuil.org/formation-et-insertion.thml>