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# IO 3: Virtual Crafts Training

VI-TRAIN-Crafts - Virtuell TRAINing for traditional Crafts

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*Final results*

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## 1. WHAT IS THE VI-TRAIN-CRAFTS PROJECT ABOUT?

Cultural Heritage (CH) is in the focus of the European Union as motor for employment, economic drive and development. In order to guarantee longevity & usability of European Heritage it is inevitable to keep up with the requirements of society like new technology and digitisation.

The Covid19 crisis added some urgency to the issue as training organisations strongly suffered from restrictions and new rules, which were threatening traditional education and training activities. Especially in regard to hands-on-training, where instructors need to get really close to learners to teach practical skills.

The consortium of VI-TRAIN Crafts has taken the challenge of developing innovative training for traditional/threatened crafts and handling of building damages, which will boost the digitization of training in (built) Cultural Heritage. A big focus is given to crafts that are almost nowhere trained any more. Lots of those crafts do need a lot of experience and guidance by experienced craftspeople. This training in particular will be boosted by various digitisation support.

The anticipated objectives of VI-TRAIN Crafts were:

- to identify appropriate means of distance learning for the training of craftspeople (manual work),
- to identify appropriate means of online cooperation in training, regarding functionality, GDPR and data security
- to derive success criteria for highly accepted digital solutions
- to develop and test a virtual/3D-crafts training system by using sensors and VR/AR
- to develop and test a virtual/3D-buidling damage identification training system
- to investigate and test options overcoming restrictions, e.g. move sickness,
- to develop a train-the-trainer system for application of selected tools in training of traditional crafts

Participants of the courses developed in VI-TRAIN Crafts can obtain a European certificate by undergoing a certification process provided by ECQA, which is an internationally active organisation specialised in certification of skills and competences.

VI-TRAIN Crafts enriches the offer of The European Heritage Academy (EHA), which will be in charge of delivering VI-TRAIN Crafts training courses after completion of the project. EHA is situated at Charterhouse Mauerbach, the future EU Competence and Community Centre for Architectural Conservation, being set up during INCREASES, a Pilot project for Cultural and Creative Industries, Finance, Learning, Innovation and Patenting for Cultural and Creative Industries (FLIP for CCIs-2).



## 2. BASICS FOR VIRTUAL CRAFT TRAINING

Based on findings of IO1+IO2 partners started to gather material for development of selected virtual trainings and defined relevant scenarios as prerequisites. Additionally, training craft activities virtually can present certain challenges compared to in-person sessions. Here are some of the main challenges which may occur:

1. Lack of hands-on experience: Crafts often require hands-on practice and manipulation of materials. Virtual training can limit the ability to physically touch and feel the materials, which can impede the learning process.
2. Limited visual perspective: In a virtual setting, participants may have difficulty seeing intricate details or specific angles of the craft demonstration. This can make it harder to follow instructions accurately or replicate the desired outcome.
3. Technical limitations: Virtual platforms may have limitations in terms of skill and knowledge transferring quality, video quality, connectivity issues, or software features. Technical difficulties can disrupt the flow of the training and hinder the participants' ability to engage fully.
4. Limited real-time feedback: In traditional settings, instructors can provide immediate feedback and correct mistakes during the craft activity. However, virtual training may lack the same level of real-time interaction, making it harder to address participant questions or provide timely guidance.
5. Difficulty assessing progress: Without direct observation, it can be challenging to assess participants' progress and skill development accurately. Instructors may struggle to gauge individual strengths, weaknesses, or areas needing improvement.
6. Need for preparation to have access to materials and tools: Participants may face challenges acquiring the necessary craft materials or tools for virtual training. This can hinder their ability to fully engage in the activity and limit their practice outside of the training sessions.

To mitigate these challenges the consortium plan to implement various strategies:

- a) Preparing detailed materials lists: Provide participants with a comprehensive list of required materials and suggest alternatives or easily accessible substitutes.
- b) High-quality video demonstrations: Ensure that craft demonstrations are recorded with clear visuals, multiple angles, and close-ups to compensate for the lack of physical presence.
- c) Interactive virtual sessions: Incorporate interactive elements like real-time chat or video conferencing tools to allow participants to ask questions, seek clarifications, and receive immediate feedback.
- d) Supplemental resources: Provide participants with written instructions, step-by-step guides, or downloadable templates they can refer to during the virtual training and later practice independently.
- e) Encourage participant engagement: Facilitate virtual group discussions, encourage participants to share their progress, and create an online community where they can interact, seek support, and showcase their work.



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By implementing these strategies and adapting to the virtual format, the consortium will enhance the effectiveness of craft training and help participants overcome the challenges posed by the virtual environment.



### **3. DESCRIPTION OF THE SELECTED APPROACH**

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The consortium is planning to conduct the Learner Event C1 as IT implementation process. This means to:

- Define scenarios for virtual training of manual craft work
- Select the manual craft work
- Describe user stories for each selected crafts
- Define a curriculum for virtual building damage identification
- Develop/adapt Learning Outcomes per learning element
- Define training settings (what? and how?)
- Develop/adapt training material by using the design.train.mastery Navigator
- Select appropriate and required equipment
- Invite participants to the pilot training C1
- Run the training (room 1: craftsman doing the manual craft work in presence of some observers in the room; room 2: onsite observers seeing online what is happening in room1; online: further observers)
- Analyse the results with a System Test (are the used systems working?) and with a Business User Test (Are the settings working appropriate? Are the settings delivering the expected results - repeatable and reproducible)
- Report and document appropriate settings for specific scenarios
- Translate from EN into partner languages

In addition to this approach the consortium described user stories for relevant craft work to ensure that the challenges are described sufficiently. As example there is shown below the user story for blacksmithing. Based on these stories the consortium identified the requirements which each craft activity generate for the selected scenario. Scenario 3 (Craft activities – physical execution in different places) and 5 (Craft activity with dexterity) are shown below.



### 3.1. User stories

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Name 1	Forging
Materials	To forge items, an anvil, hammer, forge, fuel (coal or charcoal), and metal ingots are needed.
Process	<p>Prepare workpiece</p> <p>Fill the forge with fuel (coal or charcoal) first</p> <p>Light the forge. The metal can be processed when it has reached a temperature above 50% of its respective melting point</p> <p>Heat the workpiece</p> <p>Pick up the heated ingot with tongs.</p> <p>Choose tool</p> <p>Cool workpiece down</p> <p>Forge workpiece (to shape an object, the metal must be struck into the right form with a hammer. The workpiece will move in different directions when it is hewn with the hammer)</p> <p>Repeat steps as required</p>
Required equipment	Anvil, forge hammer, forge tongs
Criteria	<p>Recognition of the correct temperature of the workpiece</p> <p>Correct support of the workpiece on the anvil</p> <p>Strength of the hammer blows</p>
Challenges	Stop the hammer blow
Name 2	Plastering
Materials	To forge items, an anvil, hammer, forge, fuel (coal or charcoal), and metal ingots are needed.
Process	<p>Start with clean tools</p> <p>Check the material the wall is made of</p> <p>Clean the wall</p> <p>Close cracks and holes</p> <p>Mix the plaster</p> <p>Throw the plaster onto wall</p> <p>Smooth the plaster</p> <p>Wait until the plaster is dried</p>
Required equipment	Joint trowel, Corner trowel, masonry cutter
Criteria	<p>Manual dexterity</p> <p>Identify the appropriate plaster material</p> <p>Identify the surface characteristics</p>
Challenges	Accurate digitisation of the manual movements and its effects





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Name 3	Roofing
Materials	To cover a roof with shingles, tiles or sheets, a hatchet, tile cutter, hood bridge, folding pliers are needed.
Process	Prepare the workspace (apply ladder, choose tools, check material availability) Inspect the roof: What is to repair? Single shingles or the entire roof? Clean the roof Identify the damaged shingles, tiles or sheets Spread roof tiles Replace the damaged shingles, tiles or sheets Check the completeness of work Leave the roof.
Required equipment	Roofing hatchet, Roof tile cutter, hood bridge, folding pliers, ladder, shingle lift, scaffolding
Criteria	Accuracy of laying the roof tiles Correct splitting roof tiles
Challenges	Feeling of height resp. the need to keep balance Accurate digitisation of tile splitting
Name 4	Painting
Materials	To paint a wall, brushes, spatulas, paint & pigments are needed.
Process	Prepare wall Level uneven spots first Choose colour Mix colour with pigments Paint the wall Wait until the paint is dried
Required equipment	Several painter's brushes Several spatulas Several pigments
Criteria	Manual dexterity Identify the appropriate pigment Identify the surface characteristics
Challenges	Accurate digitisation of the manual movements and its effects



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Name 5	Window repairing
Materials	To repair a window, linseed oil, putty and cleaning materials are needed.
Process	Prepare the windows Check the wooden frames, the glass elements, the putty and the antique window sashes Unhinge the wooden window and place it safely on two trestles Remove the fittings Cleaning the window Remove the paint or lacquer with scraper or sandpaper In case: Remove glass In case: Repair the wooden frame (Glue loose frame connections) In case: Refurbish the fittings Paint wooden frame with linseed oil Wait until the paint is dried Insert glass Attach the fittings Hinge the wooden window
Required equipment	Painter's brushes, scrapes, sandpaper, spatulas, sharpened blades, screwdrivers, trestles, hot air dryers
Criteria	Manual dexterity Identify the appropriate oil (linseed oil) Identify condition of the window (required repair measures)
Challenges	Accurate digitisation of the manual movements and its effects
Name 6	Bricklaying
Materials	To lay bricks, a mortar and bricks are needed.
Process	Prepare construction site Make bricks available Decide about masonry bond Start laying bricks Connect bricks with mortar according to the chosen masonry bond Finish the wall Wait until the mortar is dried
Required equipment	Masonry hammer, trowels, spirit/bubble level, plummet
Criteria	Manual dexterity (make the wall horizontal and vertical straight) Identify the right masonry bond Identify the mortar
Challenges	Condition for building up a wall (ground) Consistency and characteristic of the mortar Applying the appropriate masonry bond to the current purpose



Name 7	Fire welding
Materials	To weld iron and river sand or borax are needed.
Process	Prepare the work piece Fill the furnace with fuel (coal or charcoal) first Light the furnace Heat the workpiece in the absence of air (The metal can be processed when it has reached a temperature above 50% of its respective melting point) Pick up the heated ingot with tongs Fire weld the workpiece (in a hammer mill)
Required equipment	Fire welding furnace, pliers, hammer mill
Criteria	Recognition of the correct temperature of the workpiece Correct support of the workpiece in the hammer mill Impact strength of the hammer mill
Challenges	Working with a hammer mill (which is not really manual work for the craftsperson)
Name 8	Slacking lime
Materials	To slack lime, quick lime, sand and water are needed.
Process	Prepare construction site Build a lime pit Slack lime with water Give the bright white, yoghurt-like mass in the pit Cover the mass with water (and wait for the right time for using the lime) Mix lime with sand or gravel (setting) Use the lime mortar
Required equipment	Lime pit, shovel, rake, occupational safety equipment
Criteria	Identify the right time to use the slacked lime Identify the composition of the lime Identify the amount of water
Challenges	Illustration of reaction time (chemical reaction) in real time Illustration of mixing strength (by the person who is setting the lime)



### 3.2. Identification of scenarios

All scenarios are based on following basic definitions:

1. Trainer and learners are in different places → effect of Covid19
2. Purpose of all scenarios is the further education / enhancement of skills for executing manual craft work
3. Craft activities are determined by physical processes which depends on the initial conditions (like material composition, moisture level)

Purpose: to support learners/apprentices in training situations to execute their craft in the best possible way

Criteria	Scenario 1	Scenario 2	Scenario 3
Name	Craft activity with high physical intensity	Craft activities with existing	Craft activities – physical execution in different places
Pre-recording?	Possible	Possible	Preferred
Workpiece in real needed?	Yes	No	Yes
Tool in real needed?	Yes	Yes, but no real welding head	Yes
Training in real time?	Not required	Not required	No, not required
<i>Preconditions</i>			
Video	Yes	Yes	Yes
Audio	Yes	Yes	Yes
Simulation work progress	No	Yes	No
VR/AR Glasses	Yes	Yes	No
Motion capture gloves	Yes	No	No
Motion capture suits	Yes	No	No
Artificial Intelligence	No	Yes	No
Examples	Forging of window fittings	Welding on a flange - simulation	Welding on a flange – real, Making a brick, processing a stone



Criteria	Scenario 3a	Scenario 3b
Name	Craft activities – physical execution in different places	Craft activities – physical execution in different places
Pre-recording?	Possible	Possible
Workpiece in real needed?	Yes	Yes
Tool in real needed?	Yes	Yes
Training in real time?	Yes	Yes
<i>Preconditions</i>		
Video	Yes, multiple cameras	Yes, 360° Camera
Audio	Yes	Yes
Simulation work progress	No	No
VR/AR Glasses	No	No
Motion capture gloves	No	No
Motion capture suits	No	No
Artificial Intelligence	No	No
Examples	Window repairer, Making a brick, processing a stone	Window repairer, Making a brick, processing a stone



Criteria	Scenario 4	Scenario 5
Name	Craft activity with chemical processes	Craft activity with dexterity
Pre-recording?	Possible	Possible
Workpiece in real needed?	No	No
Tool in real needed?	No?	No
Training in real time?	Not required	Not required
<i>Preconditions</i>		
Video	Yes	Yes
Audio	Yes	Yes
Simulation work progress	Yes	No
VR/AR Glasses	Yes	Yes
Motion capture gloves	Yes	Yes
Motion capture suits	No	Yes
Artificial Intelligence	Yes	No
Examples	Slaking lime at construction site	Plastering a wall

#### Challenges of scenario 1:

Craft activities which are executed with high physical intensity like forging of windows fittings or forging a lattice gate needs a target for the strike on the anvil. If it would be only virtual executed, it would have an unpleasant side effect by missing the anvil or stop in the void.

This scenario will be further analysed but the consortium doubt about that this scenario can ever be trained virtually.

#### Challenges of scenario 2:

For welding there are some simulation software programmes available on the market. These programmes need to be integrated in training environments. For the training purpose it is needed to transfer the simulation results and the work progress. The simulation results (means weld seams) will already be visualised on screen and can therefore easily transferred to another locations. Based on that learner will receive feedback from the trainer. Parallel the work execution needs to be recorded and transferred that the trainers can identify potential improvement in the work progress. On the long run artificial intelligence can support the analysis of simulation results.

This scenario requires a small budget to be tested but testing it seems to be feasible. The conditions for the test still need to be decided.



#### Challenges of scenario 3, 3a and 3b:

This scenario is the easiest one, but it can be discussed if it is a virtual training. The physical execution of craft activities will be recorded with video and audio. Before this recording it is required to define:

- Position of cameras
- Number of cameras
- Need for motion capture
- Position of microphones
- Number of cameras

The better the recordings in resolution and recognisability of the activity carried out the better learning results can be achieved. And additional advantage can be the desynchronisation of learner's execution of craft activities and trainer analysis.

Scenario 3: A pre-condition that this scenario can be implemented successfully is that the trainer sees virtually what the learner is doing in the real world. Each and every type of video can be used for this scenario.

#### Challenges of scenario 4:

Chemical processes follow well-known principles. However, the results still depend on the initial conditions, like lime, sand and water including the moisture level of the ingredients. Together with the power to steer the mixture it will be possible to calculate the viscosity of the quick lime. But this calculation needs to be done in real-time because on time feedback is required to continue with steering. For this calculation, a large computing capacity is required to receive the information on time. To test this scenario, a lot of data is needed. But this data needs to be gathered first. Therefore, it is not feasible to test this scenario by the VI-TRAIN-Crafts consortium.

#### Challenges of scenario 5:

A pre-condition that this scenario can be implemented successfully is that the trainer sees in real time what the learner is doing in the virtual world. There are already several examples available on the market.

The VI-TRAIN-Crafts consortium will test this scenario with a training of plastering a wall.



### 3.3. Preparation of training course

Items	Description
Selected scenario	3 (Video)
Selected craft activity	Brick making: 1x with Audio; 1x w/o Audio Stonemason: 1x with Audio; 1x w/o Audio
Learning outcomes	The learner is able to evaluate virtual training using videos
Training settings	In the training room One part of the participants on screen (with beamer) Second part of the participants on their own Laptop (with headset)
Feedback	Audio: needed/not needed Beamer vs. individual Laptop Headset: needed/not needed Virtual training possible: Yes/No
Required equipment	1 Beamer with 1 Laptop 1 Laptop per participant 1 headset per participant

Items	Description
Selected scenario	3a (multiple Videos)
Selected craft activity	Repairing window
Learning outcomes	The learner is able to evaluate virtual training using multiple videos
Training settings	A) in a workshop or construction site setting -Performer of the manual craft activity -Observer in the same setting -Cameras for transmitting B) in a training room -Observer in a separate training room -Observing on a screen C) in an online monitoring room -Monitoring persons connected by video conferencing tool -Observing on their own screen
Feedback	Audio: needed/not needed Camera position: ok / changes needed (which) Virtual training possible: Yes/No
Required equipment	Min. 5 camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded file to the training room and to the online monitoring group 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool





Items	Description
Selected scenario	3b (360° camera)
Selected craft activity	Repairing window
Learning outcomes	The learner is able to evaluate virtual training using 360° Camera
Training settings	A) in a workshop or construction site setting -Performer of the manual craft activity -Observer in the same setting -Cameras for transmitting B) in a training room -Observer in a separate training room -Observing on a screen C) in an online monitoring room -Monitoring persons connected by video conferencing tool -Observing on their own screen
Feedback	Audio: needed/not needed Camera position: ok / changes needed (which) Virtual training possible: Yes/No
Required equipment	1x 360° Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded file to the training room and to the online monitoring group 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool



Items	Description
Selected scenario	5 (VR setting)
Selected craft activity	Tbd
Learning outcomes	The learner is able to evaluate virtual training using VR
Training settings	<p>A) in a workshop or construction site setting</p> <ul style="list-style-type: none"> <li>-Performer of the manual craft activity</li> <li>-Performing the craft activities with motion capture suit and motion capture gloves</li> <li>-Observer in the same setting</li> <li>-Cameras for transmitting</li> </ul> <p>B) in a training room</p> <ul style="list-style-type: none"> <li>-Observer in a separate training room</li> <li>-Observing on a screen</li> </ul> <p>C) in an online monitoring room</p> <ul style="list-style-type: none"> <li>-Monitoring persons connected by video conferencing tool</li> <li>-Observing on their own screen</li> </ul>
Feedback	<p>VR setting: appropriate / not appropriate</p> <p>Audio: needed / not needed</p> <p>Camera position: ok / changes needed (which)</p> <p>Virtual training possible: Yes / No</p>
Required equipment	<p>1 pre-defined VR setting</p> <p>1 VR glass</p> <p>1 pair of Motion capture gloves</p> <p>1 Motion capture suit</p> <p>1x 360° Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed)</p> <p>Infrastructure to transmit the recorded file to the training room and to the online monitoring group</p> <p>1 Beamer with Laptop at the training room</p> <p>1 Laptop per participant of the online monitoring group</p> <p>1 implemented session in a video conferencing tool</p>



Items	Description
Selected scenario	6 (AR setting)
Selected craft activity	Tbd
Learning outcomes	The learner is able to evaluate virtual training using AR
Training settings	There are still discussions about running these scenario by ensuring occupational safety and health protection
Feedback	AR setting: appropriate / not appropriate Audio: needed / not needed Camera position: ok / changes needed (which) Virtual training possible: Yes / No
Required equipment	1 Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded file to the training room and to the online monitoring group Pre-defined instructions for manual craft activity 1 AR glass 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool

These scenarios will be further discussed and adapted for the Learner Event.



## 4. DEVELOPING AN ECQA SKILLS CARD

### 4.1. General structure of Skills Cards

The ECQA skill sets are based on the skills definition proposed by the Department of Trade and Industry in the UK for the National Vocational Qualification standards. A skills definition contains the following items (see following Figure):

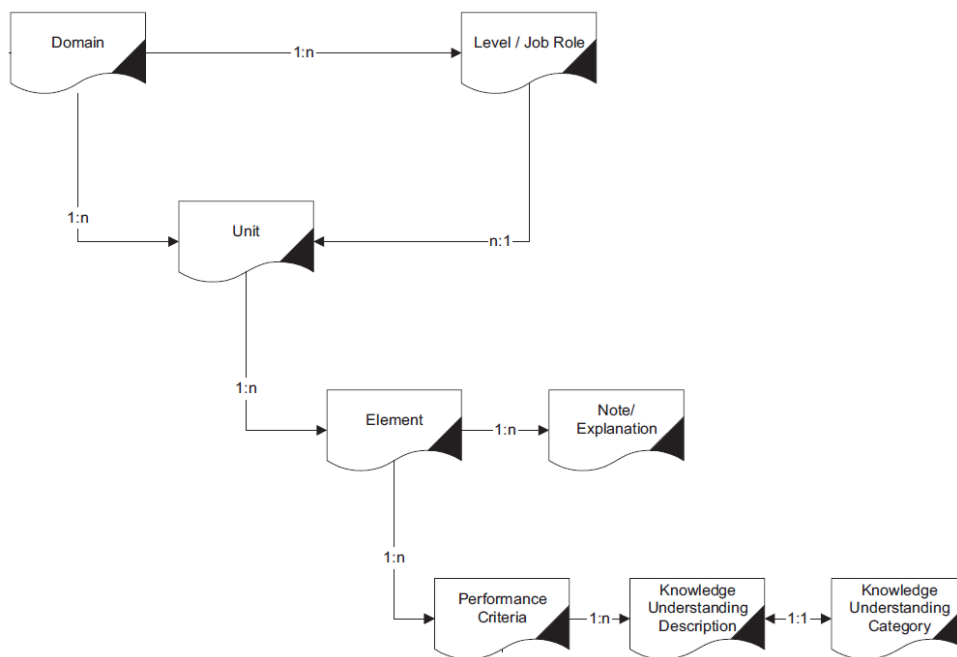


Figure 1: Structure of an ECQA skills card

It consists of following elements:

- Learning unit (identifier, name and description)
- Learning element (identifier, name and description)
- Performance Criterion (identifier, name and description)
- Performance Criterion Knowledge Understanding (Description)

The Performance Criterion description is containing the Learning Outcomes.

### 4.2. Structure of the VI-TRAIN-Crafts Virtual Crafts Training Expert Skills Cards

The VI-TRAIN-Crafts Virtual Crafts Training Expert for (Built) Cultural Heritage Skills Card is following the ECQA basic structure but put together Learning Units and Learning Elements in one part, which the consortium calls Curriculum. For this curriculum the consortium completed following elements:

- Curriculum
- Learning Outcomes
- Training Materials

#### 4.2.1. Curriculum

The current curriculum contains elements which cover:

- Introducing to Cultural Heritage Management
- Tools for virtual training of manual crafts work
- Types of training virtualisation
- Virtual training of manual crafts work
- Ecological Footprint of virtual training of manual crafts work
- Implementation of virtual training for manual crafts work

The curriculum also shows the link the chosen EQF level.

Virtual Crafts Training Expert for (Built) Cultural Heritage				EQF
	<b>U1</b>	<b>Introduction</b>		
VCE	U1.E1	Cultural Heritage Management - Overview	online	4
VCE	U1.E2	Virtualisation of manual crafts work	face-to-face	4
	<b>U2</b>	<b>Tools for virtual training of manual crafts work</b>		
VCE	U2.E1	Assessment of tools	face-to-face	4
VCE	U2.E2	Video conferencing	face-to-face	4
VCE	U2.E3	Video chat	face-to-face	4
VCE	U2.E4	Documents & File sharing	face-to-face	4
VCE	U2.E5	Online Project Management	face-to-face	4
VCE	U2.E6	Other Online Collaboration Purposes	face-to-face	4
	<b>U3</b>	<b>Types of training virtualisation</b>		
VCE	U3.E1	Simulation	face-to-face	4
VCE	U3.E2	Virtual reality	face-to-face	4
VCE	U3.E3	Augmented reality	face-to-face	4
VCE	U3.E4	Video	face-to-face	4
VCE	U3.E5	Best Practices of Training Virtualisation	face-to-face	4
	<b>U4</b>	<b>Virtual training of manual crafts work</b>		
VCE	U4.E1	Decription of scenarios	face-to-face	4
VCE	U4.E2	Scenario 1 - Decription, Test, Feedback	face-to-face	4
VCE	U4.E3	Scenario 2 - Decription, Test, Feedback	face-to-face	4
VCE	U4.E4	Scenario 3 - Decription, Test, Feedback	face-to-face	4
VCE	U4.E5	Scenario 4 - Decription, Test, Feedback	face-to-face	4
VCE	U4.E6	Scenario 5 - Decription, Test, Feedback	face-to-face	4
VCE	U4.E7	Evaluation of virtual training courses	face-to-face	4
	<b>U5</b>	<b>Implementation of virtual traning for manual crafts work</b>		
VCE	U5.E1	Implementation of virtual traning for manual crafts work	face-to-face	4

**Table 1: Curriculum “Virtual Crafts Training Expert for (Built) Cultural Heritage”**



#### 4.2.2. Learning outcomes

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VI-TRAIN-Crafts uses Learning outcomes to structure the training materials for Energy Experts. To define Learning Outcomes (LO) means:

“... think first about what is essential that students know or be able to do after the course or program – what students need to know and could make powerful use of to enhance their lives and more effectively contribute to society. We believe that such reflection will lead instructors to focus on a broad synthesis of abilities that combine knowledge, skills and values into a whole that reflects how people really use knowledge.”<sup>1</sup>

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<sup>1</sup> Battersby, Mark: “So, What's a Learning Outcome Anyway?”, p.1

Competence Card ECQA Certified Virtual Crafts Training Expert (VCE)					
Unit Identifier (starts with 1)	Unit Name (should not be empty)	Element Identifier (starts with 1)	Element Name (should not be empty)	Performance Criteria (starts with 1)	PC Comment (may be empty)
ECH-U1	Introducing to Cultural Heritage Management	ECH-U1.E1	Cultural Heritage Management-Energy Expert / Overview	ECH-U1.E1.LO1	The learner is able to explain measures for improving virtual training of craft work
				ECH-U1.E1.LO2	The learner is able to apply appropriate virtual methods to train craft work
ECH-U2	Tools for virtual training of manual crafts work	ECH-U2.E1	Assessment of tools	ECH-U2.E1.LO1	The learner is able to assess virtual training methods
				ECH-U2.E2.LO1	The learner is able to explain various tools of video conferencing
				ECH-U2.E3.LO1	The learner is able to explain various tools of video chatting
				ECH-U2.E4.LO1	The learner is able to explain various tools of documents&file sharing
				ECH-U2.E5.LO1	The learner is able to explain various tools of online project management
				ECH-U2.E6.LO1	The learner is able to explain further tools of online collaboration
ECH-U3	Types of training virtualisation	ECH-U3.E1	Simulation	ECH-U3.E1.LO1	The learner is able to describe the proper use of simulation
				ECH-U3.E2.LO1	The learner is able to describe the proper use of virtual reality for training purposes
				ECH-U3.E3.LO1	The learner is able to describe the proper use of augmented reality for training purposes
				ECH-U3.E4.LO1	The learner is able to describe the proper use of video for training purposes
				ECH-U3.E5.LO1	The learner is able to explain best practices of training virtualisation
ECH-U4	Virtual training of manual crafts work	ECH-U4.E1	Description of scenarios	ECH-U4.E1.LO1	The learner is able to explain the definition of scenarios
				ECH-U4.E2.LO1	The learner is able to evaluate virtual training using videos
				ECH-U4.E3.LO1	The learner is able to evaluate virtual training using multiple videos
				ECH-U4.E4.LO1	The learner is able to evaluate virtual training using 360° Camera
				ECH-U4.E5.LO1	The learner is able to evaluate virtual training using VR
				ECH-U4.E6.LO1	The learner is able to evaluate virtual training using AR
				ECH-U4.E7.LO1	The learner is able to explain how to evaluate virtual training courses
ECH-U5	Implementation of virtual training for manual crafts work	ECH-U6.E1	Implementation of virtual training for manual crafts work	ECH-U4.E6.LO1	The learner is able to apply the learnings related to virtual training of manual craft work
				ECH-U4.E6.LO2	The learner is being able to actively convince others from appropriate virtual training for manual craft work

**Table 2: Learning Outcomes “Virtual Crafts Training Expert”**



## 5. PREPARATION LEARNER EVENT

### 5.1. Description Training Settings per Scenario

Items	Description
Selected scenario	3 (Video)
Selected craft activity	Brick making: 1x with Audio; 1x w/o Audio Stonemason: 1x with Audio; 1x w/o Audio
Learning outcomes	The learner is able to evaluate virtual training using videos
Training settings	In the training room One part of the participants on screen (with beamer) Second part of the participants on their own Laptop (with headset)
Feedback	Audio: needed/not needed Beamer vs. individual Laptop Headset: needed/not needed Virtual training possible: Yes/No
Required equipment	1 Beamer with 1 Laptop 1 Laptop per participant 1 headset per participant 2 videos as file

Items	Description
Selected scenario	3a (multiple Videos)
Selected craft activity	Repairing window
Learning outcomes	The learner is able to evaluate virtual training using multiple videos
Training settings	A) in a workshop or construction site setting -Performer of the manual craft activity -Observer in the same setting -Cameras for transmitting B) in a training room -Observer in a separate training room -Observing on a screen C) in an online monitoring room -Monitoring persons connected by video conferencing tool -Observing on their own screen
Feedback	Audio: needed/not needed Camera position: ok / changes needed (which) Virtual training possible: Yes/No
Required equipment	Min. 5 camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded file to the training room and to the online monitoring group 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool





Items	Description
Selected scenario	3b (360° camera)
Selected craft activity	Repairing window
Learning outcomes	The learner is able to evaluate virtual training using 360° Camera
Training settings	A) in a workshop or construction site setting -Performer of the manual craft activity -Observer in the same setting -Cameras for transmitting B) in a training room -Observer in a separate training room -Observing on a screen C) in an online monitoring room -Monitoring persons connected by video conferencing tool -Observing on their own screen
Feedback	Audio: needed/not needed Camera position: ok / changes needed (which) Virtual training possible: Yes/No
Required equipment	1x 360° Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded file to the training room and to the online monitoring group 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool



Items	Description
Selected scenario	5 (VR settings)
Selected craft activity	tbd
Learning outcomes	The learner is able to evaluate virtual training using VR
Training settings	<p>A) in a workshop or construction site setting</p> <ul style="list-style-type: none"> <li>-Performer of the manual craft activity</li> <li>-Performing with a motion capture suit and motion capture gloves</li> <li>-Observer in the same setting</li> <li>-Cameras for transmitting</li> </ul> <p>B) in a training room</p> <ul style="list-style-type: none"> <li>-Observer in a separate training room</li> <li>-Observing on a screen</li> </ul> <p>C) in an online monitoring room</p> <ul style="list-style-type: none"> <li>-Monitoring persons connected by video conferencing tool</li> <li>-Observing on their own screen</li> </ul>
Feedback	<p>VR setting: appropriate/not appropriate</p> <p>Audio: needed/not needed</p> <p>Camera position: ok / changes needed (which)</p> <p>Virtual training possible: Yes/No</p>
Required equipment	<p>1 pre-defined VR settings</p> <p>1 Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed)</p> <p>Infrastructure to transmit the recorded video file and the recorded motion data to the training room and to the online monitoring group</p> <p>1 Beamer with Laptop at the training room</p> <p>1 Laptop per participant of the online monitoring group</p> <p>1 implemented session in a video conferencing tool</p>



Items	Description
Selected scenario	5 (AR settings)
Selected craft activity	tbd
Learning outcomes	The learner is able to evaluate virtual training using AR
Training settings	There are still discussions how an AR scenario can be implemented by ensuring occupational safety and health protection
Feedback	AR setting: appropriate/not appropriate Audio: needed/not needed Camera position: ok / changes needed (which) Virtual training possible: Yes/No
Required equipment	1 physical place (workshop or construction site) 1 Camera at Gemba (Japanese word meaning “the actual place”, where the manual craft activity is performed) Infrastructure to transmit the recorded video file and the recorded motion data to the training room and to the online monitoring group 1 Beamer with Laptop at the training room 1 Laptop per participant of the online monitoring group 1 implemented session in a video conferencing tool



## 5.2. Training materials

ECQA Certified Training Programme  
U2.E4 Traditional Materials

**VITRAIN**  
Virtual TRAINing for traditional crafts

**U1.E1**  
**Cultural Heritage Management**

**ECQA**  
European Certification & Qualification Association

ECQA Certified Training Material  
Authors: PRO-Heritage Project team

[www.ecqa.org](http://www.ecqa.org)

Version: 2021

## Programme



- 1. Definition**
- 2. Objective(s)**
- 3. Available Certifications**
- 4. Training Offers**
- 5. Certification and Recognition**





## U1.E1 Cultural Heritage Management

### 1. Definition



## Cultural Heritage (Asset) Management

- A (cultural) heritage asset is an item that has value because of its contribution to a nation's society, knowledge and/or culture
- They are usually physical assets, but some countries also use the term in relation to intangible social and spiritual inheritance
- It contains:
  - Historic buildings; war and other memorials; historic parks and gardens; conservation areas; archaeological sites etc.
  - Listed / not listed buildings
  - Designated / not designated
  - Independent of current use



## U1.E1 Cultural Heritage Management

### 2. Objective(s)



## Project objective(s) VI-TRAIN

The anticipated objectives of VI-TRAIN are:

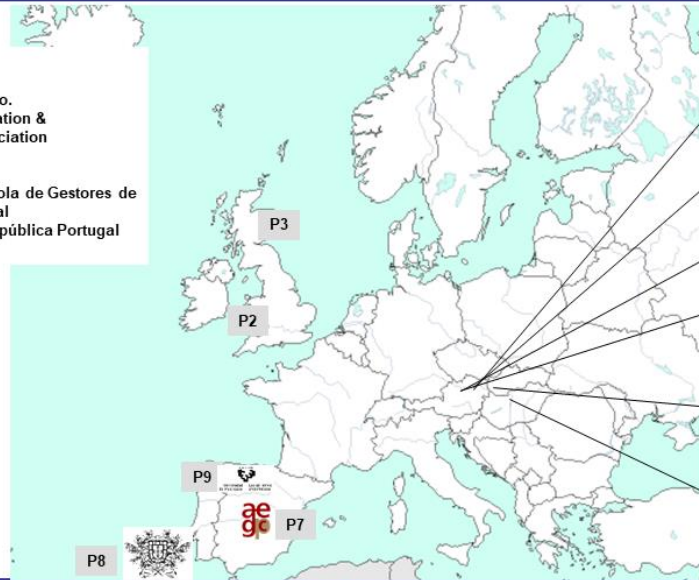
- to analyse and identify appropriate means of distance learning for the purpose of training craftspeople (manual work), specifically for traditional crafts
- to analyse and identify appropriate means of online cooperation in trainings regarding functionality, GDPR and data security
- to derive success criteria for highly accepted digital solutions
- to develop and test a virtual/3D-crafts training system by using sensors and VR/AR
- to develop and test a virtual/3D-buidling damage identification training system
- to investigate and test options overcoming restrictions, like move sickness, hesitation to use digital means, in VR/AR for craftspeople and building damage inspectors
- to develop a train-the-trainer system for application of selected tools in training of traditional crafts



## Partner



- APP ... BHOe
- P2 ... IMC Krems
- P3 ... Národný Trust, n. o.
- P4 ... European Certification & Qualification Association
- P5 ... UBW GmbH
- P6 ... MRA
- P7 ... Asociación Española de Gestores de Patrimonio Cultural
- P8 ... Presidência da República Portugal
- P9 ... UPV/EHU



- Burghauptmannschaft Österreich **APP**
- UBW** Unternehmensberatung Wagenholder **P5**
- ECQA** European Certification & Qualification Association **P4**
- imc** FH KREMS **P2**
- ae** **P3**
- MRA** **P6**
- UPV/EHU** **P9**

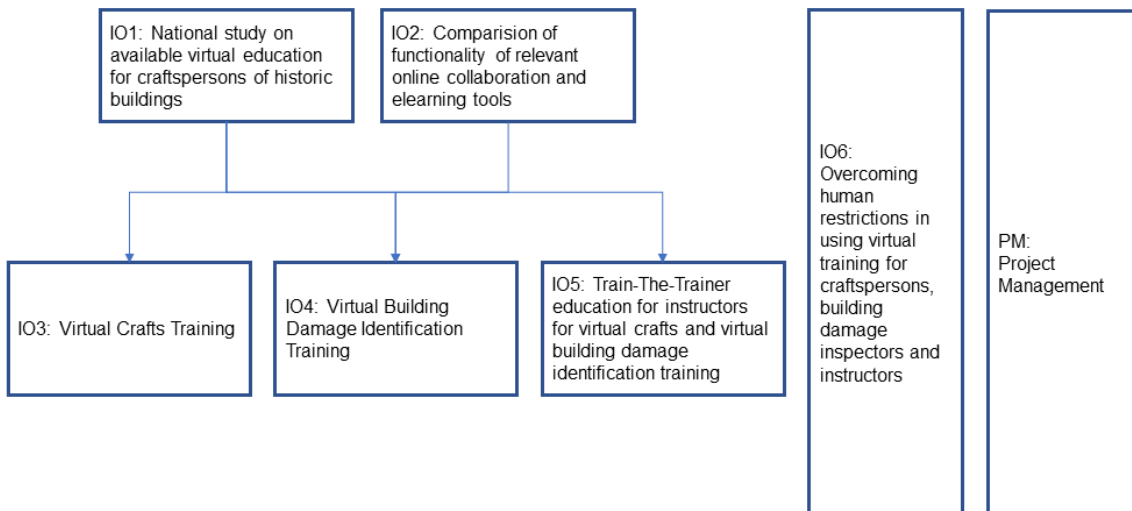


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## General approach



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## U1.E1 Cultural Heritage Management

### 3. Available Certifications



## Available Certifications

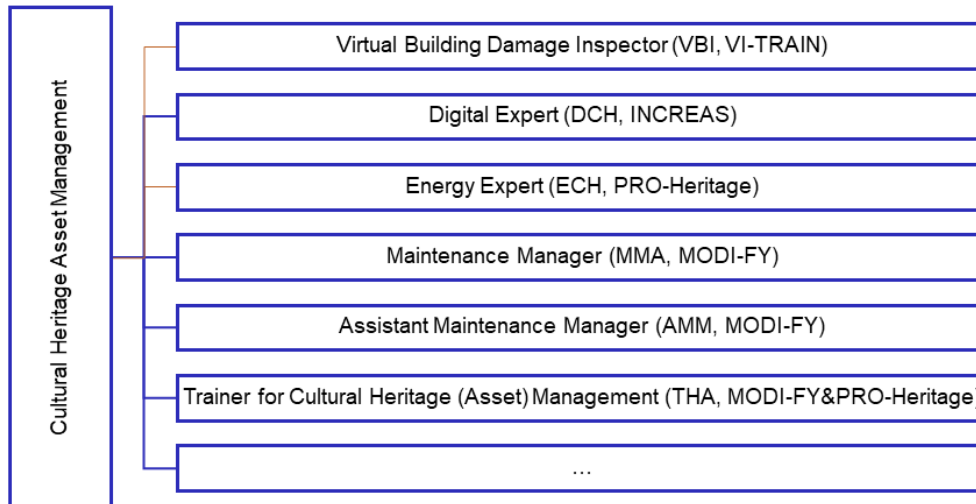
For Built Cultural Heritage:

- Certified Virtual Building Damage Inspector
- Certified Digital Expert
- Certified Energy Expert
- Certified Trainer for Cultural Heritage (Asset) Management
- Certified Maintenance Manager
- Certified Assistant Maintenance Manager
- Certified Construction Site Worker in Built Heritage





## Structure and development



## Target groups



### Persons:

- Tradespersons
- Manager of (mainly built) heritage assets, like historic buildings
- Manager of adaptive (re-)use projects in heritage assets
- Ascended staff member of responsible organisation
- Volunteers within targeted/responsible organisations
- New staff member of responsible organisation

### Professions:

- Architects and structural engineers
- Civil engineers and planners
- Restorers
- Art historians
- and many more ...



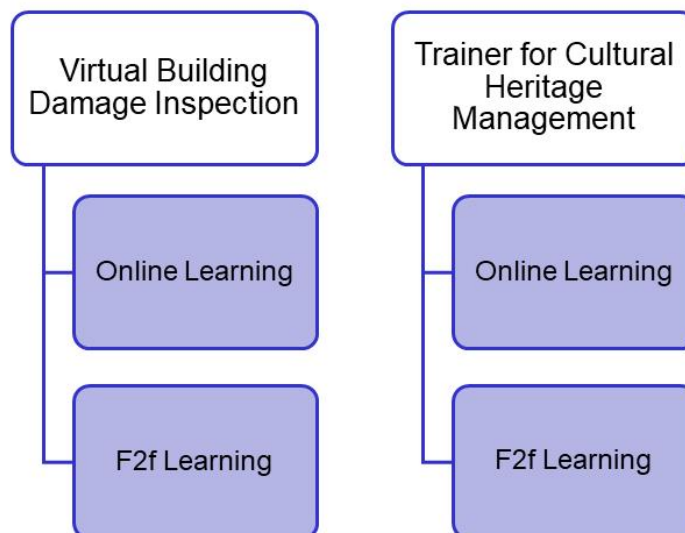


# U1.E1 Cultural Heritage Management

## 4. Training Offers



### Training offers



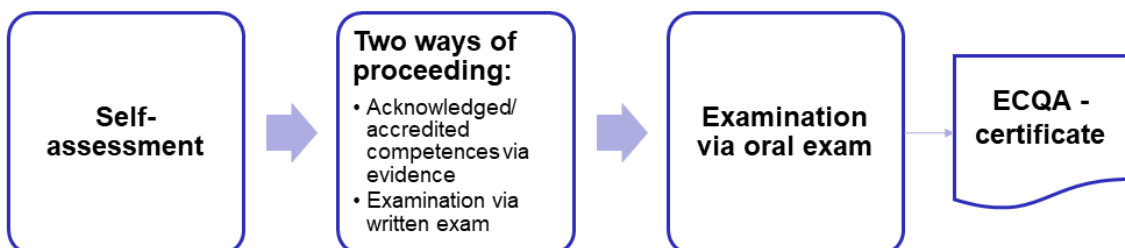


# U1.E1 Cultural Heritage Management

## 5. Certification and Recognition



## Certification and Recognition





## Author



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## U1.E2 Virtualisation of Manual Crafts Work



### Programme

- 1. Terminology**
- 2. Virtualisation of manual crafts work**
- 3. Examples of virtual trainings**
- 4. References**





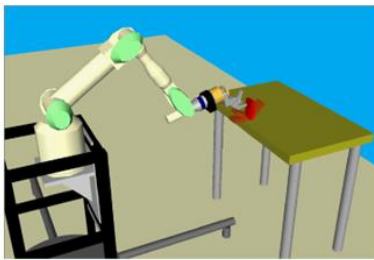
## U1.E2 Virtualisation of manual crafts work

### 1. Terminology



## Virtual Training

- Virtual training refers to training delivered in a virtual or simulated environment, or when the learner and the instructor are in separate locations
- Virtual training can be done synchronously or asynchronously
- Virtual training and virtual training environments are designed to simulate the traditional classroom or learning experience.





## Virtual Environment



- ... is a computer-generated, three-dimensional representation of a setting in which the user of the technology perceives themselves to be and within which interaction takes place
- Origin of Virtual Environment - illusion
- Key Elements to Experience Virtual Environment
- Examples: Military, Business, Entertainment, Sports

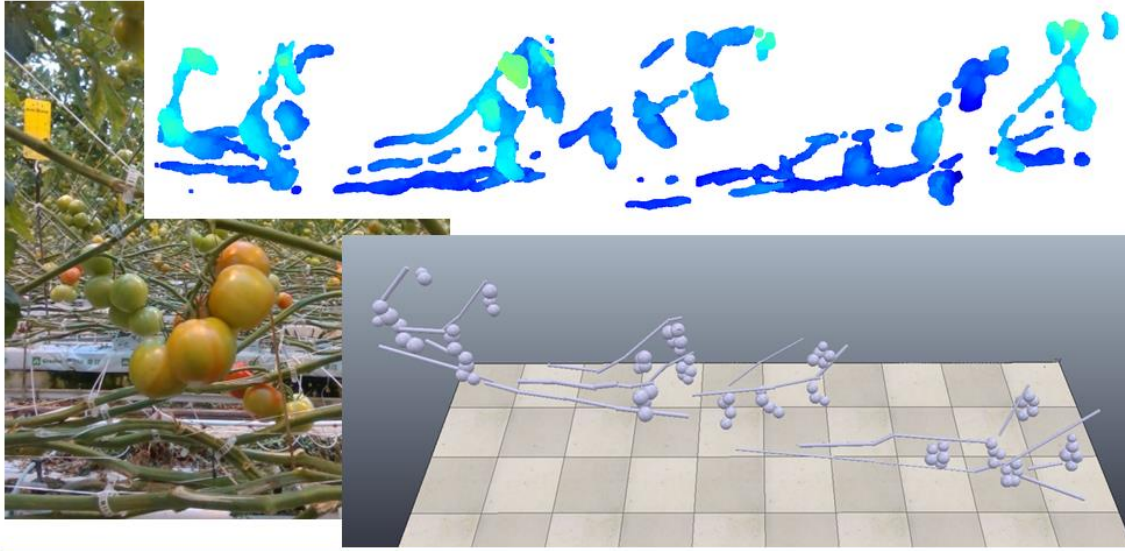


## Simulated Environment





## Simulated Environment Example

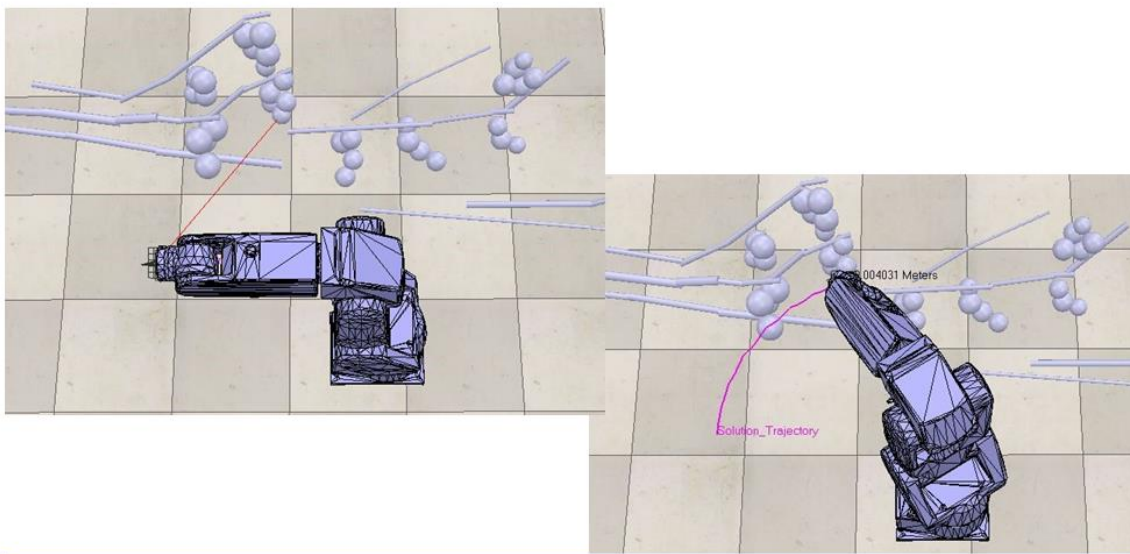


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## Simulated Environment Example



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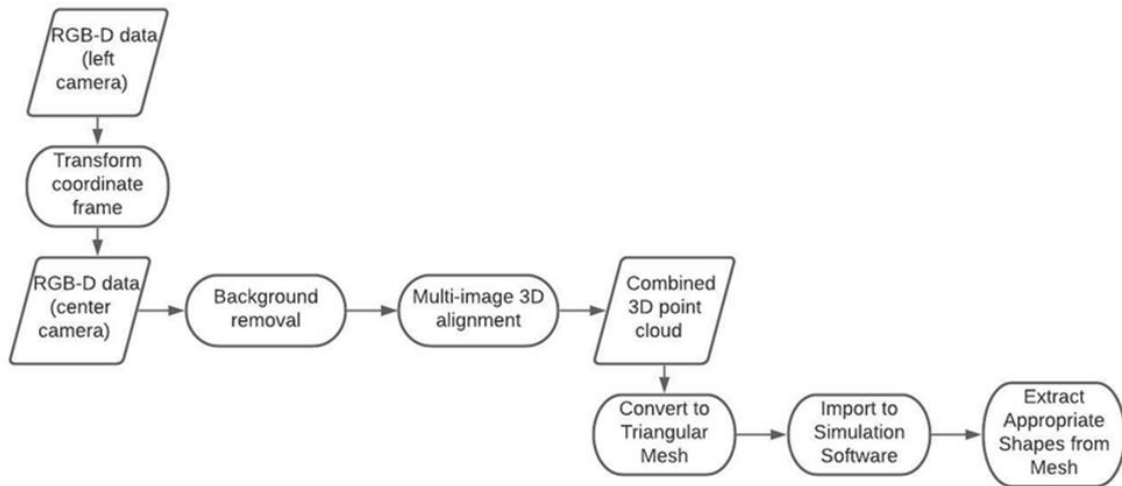
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## Simulated Environment Example



# U1.E2

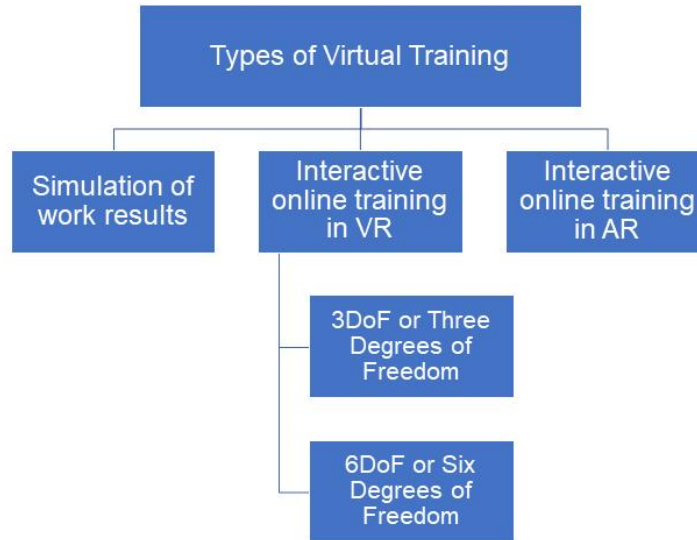
## Virtualisation of manual crafts work

### 2. Virtualisation of manual crafts work





## Types of Virtual Training

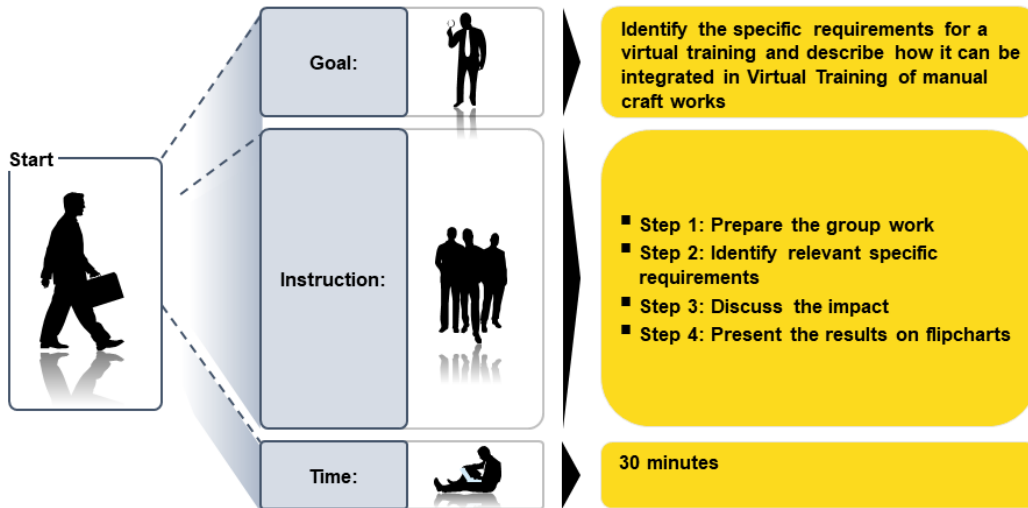


## Relevant Definition regarding Training





## Exercise: Virtual Training



## Author



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ECQA Certified Training Programme  
U2.E1 Assessment of Tools



## U2.E1 Assessment of Tools



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## Programme



1. Assessment Criteria
2. References



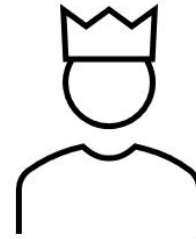
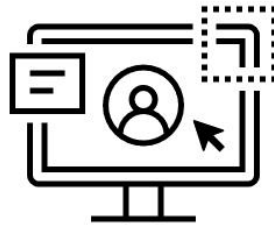
## U2.E1 Assessment of Tools

### 1. Terminology





## Definition



## U2.E2 Video conferencing

### 2. References





## Author



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## U2.E2 Video conferencing



## Programme

- 1. Terminology**
- 2. Use of video conferencing**
- 3. References**





## U2.E2 Modelling of traditional buildings

### 1. Terminology



## Definition

- “Video conferencing is a form of ... meeting where multiple (two or more) people engage in a live audio-visual connection over the internet (online) without having to be present in the same location. It allows for remote audio-visual connections between parties
- Key Points:
  - Video conferencing is a technology that allows users in different locations to hold real-time face-to-face meetings, ...
  - The stability and quality of the video conference may fluctuate with the speed and reliability of the data connection
  - There are a variety of ways video conferencing can be conducted—such as using smartphones, tablets, or via desktop computers
- Usually, the assumption is that it can be done “... often at little to no cost”



## U2.E2 Video conferencing

### 2. Use of Video conferencing



## Tools



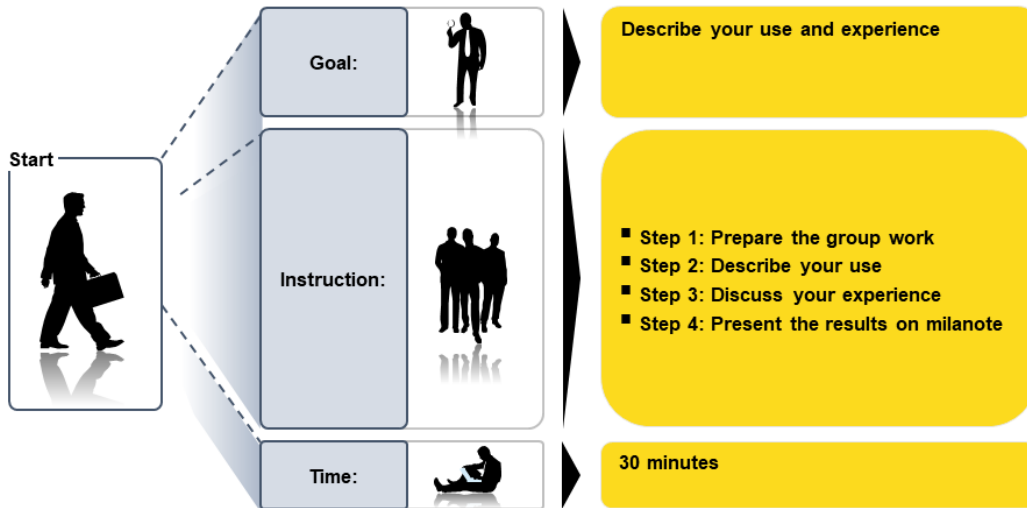
- ZOOM
- GoToMeeting
- Skype (for Business)
- MS Teams
- Cisco Webex
- Whereby

Criteria	Zoom	GoToMeeting	Skype	MS Teams	Webex	Whereby
Data protection	-	+	+	+	-	0
Usability	+	+	-	0	-	-
User-Friendliness	+	+	-	+	-	0
Use recommended	No	Yes	Yes	Yes	No	Depend on contract rules





## Exercise: Use of Video conferencing



## U2.E2 Video conferencing

### 3. References





## References



- <https://zapier.com/blog/best-video-conferencing-apps/>
- <https://crm.org/news/best-video-conferencing-software>
- <https://www.chip.de/artikel/Die-beste-Videokonferenz-Software-kostenlos-182582155.html> (only in German)



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ECQA Certified Training Programme  
U2.E3 Video chat



## U2.E3 Video chat



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## Programme



1. Terminology
2. Use of video conferencing
3. References



**ECQA Certified Training Programme**  
U2.E3 Video chat



## U2.E3 Video chat 1. Terminology





## Definition



- “*Online chat* may refer to any kind of communication over the Internet that offers a real-time transmission of text messages from sender to receiver
- Chat messages are short
- Feeling similar to a spoken conversation is created
- Online chat may address point-to-point communications as well as multicast communications from one sender to many receivers and voice and video chat or may be (also) a feature of a web conferencing service.”
- For professional purposes: limited benefit



## U2.E3 Video chat

### 2. Use of Video chat





## Tools

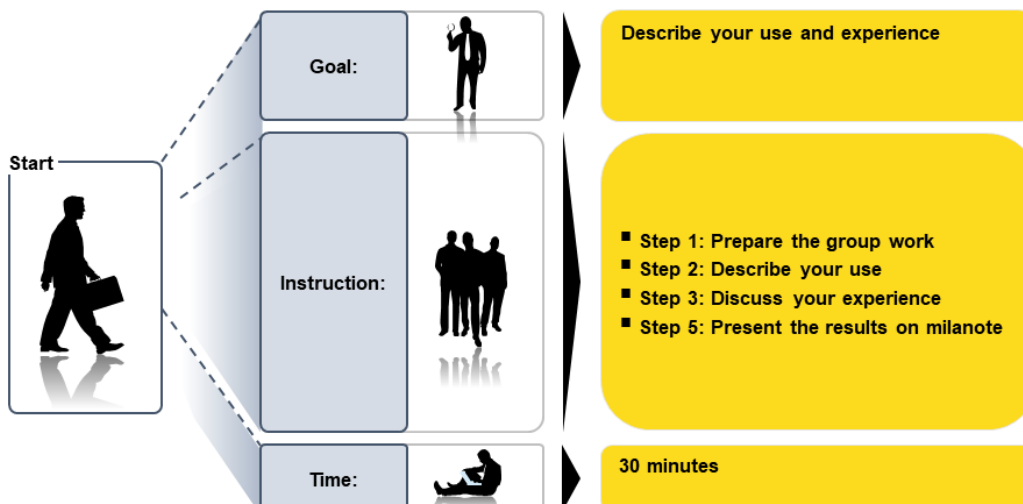


- Slack (<https://slack.com/intl/en-gb/>)
- Twist (<https://twist.com/home>)
- Chanty (<https://www.chanty.com/>)

Criteria	Slack	Twist	Chanty
Data protection	+	-	-
Usability	+	+	-
User-Friendliness	+	-	-
Result	Yes	No	No



## Exercise: Use of Video chat







## U2.E2 Video conferencing

### 3. References



## Author



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ECQA Certified Training Programme  
U2.E4 Document & File Sharing



## U2.E4 Documents & File Sharing



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## Programme



1. Terminology
2. Modelling
3. Use of BIM for Cultural Heritage
4. References



## U2.E4 Documents & File Sharing

### 1. Terminology





## Definition



- “File sharing is the public or private sharing of computer data or space in a network with various levels of access privilege
- While files can easily be shared outside a network (for example, simply by handing or mailing someone your file on a diskette), the term file sharing almost always means sharing files in a network
- File sharing allows a number of people to use the same file or file by some combination of being able to read or view, write, modify, copy, and/or print
- Typically, a file sharing system has one or more administrators. Users may all have the same or may have different levels of access privilege.”
- Document & File Sharing is a feature got increased attention over the last years due to the intensified collaboration in projects and business



## U2.E4

### Documents & File Sharing

#### 2. Use of Documents & File Sharing





## Tools



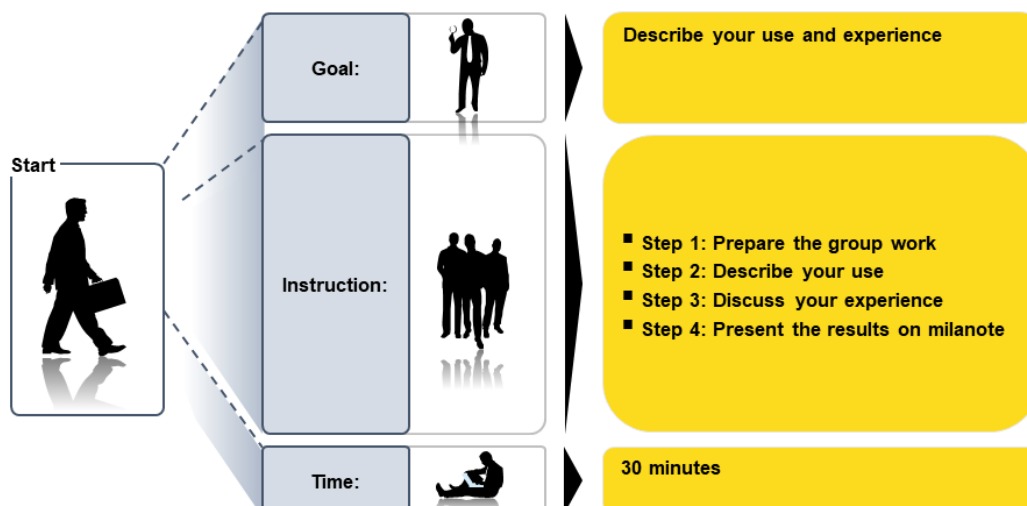
- Nextcloud
- GoogleDoc
- Dropbox
- One Drive for Business
- WeTransfer

### Other tools:

- Box
- File dropper
- Filemail
- TransferBIGFiles
- SpiderOak
- 4shared



## Exercise: Use of Document & File Sharing





## U2.E4 Documents & File Sharing

### 3. References



## Author



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ECQA Certified Training Programme  
U2.E5 Online project Management



## U2.E5 Online project Management



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## Programme



1. Terminology
2. Use of Online Project Management
3. References



# U2.E5 Online project Management

## 1. Terminology







## Definition



- Basically, digital project management is no different from classic project management
- In both cases, projects are to be kept in mind in order to carry out individual processes on time
- In addition, active communication between the project participants and the digital project manager is important
- Project implementers such as agencies thus have the opportunity to carry out their work as usual.
- Large projects in particular, depend on good structuring
- Not only about distribution of tasks, but also about clear communication
- Online tools to support project management will be used more in the future
- To use online Project Management Tools



## **U2.E5**

### **Online project Management**

### **2. Use of Online Project Management**





## Tools



- Monday ([www.monday.com](http://www.monday.com))
- Asana (<https://asana.com/>)
- Trello (<https://trello.com/>)
- TeamGantt (<https://www.teamgantt.com/>)
- Factro ([www.factro.de](http://www.factro.de) → only in German)

Criteria	Monday	Asana	Trello	TeamGantt	Factro
Data protection	+	-	-	-	+
Usability	+	+	-	0	+
User-Friendliness	+	-	-	+	+
Result	Yes	No	No	No	Yes

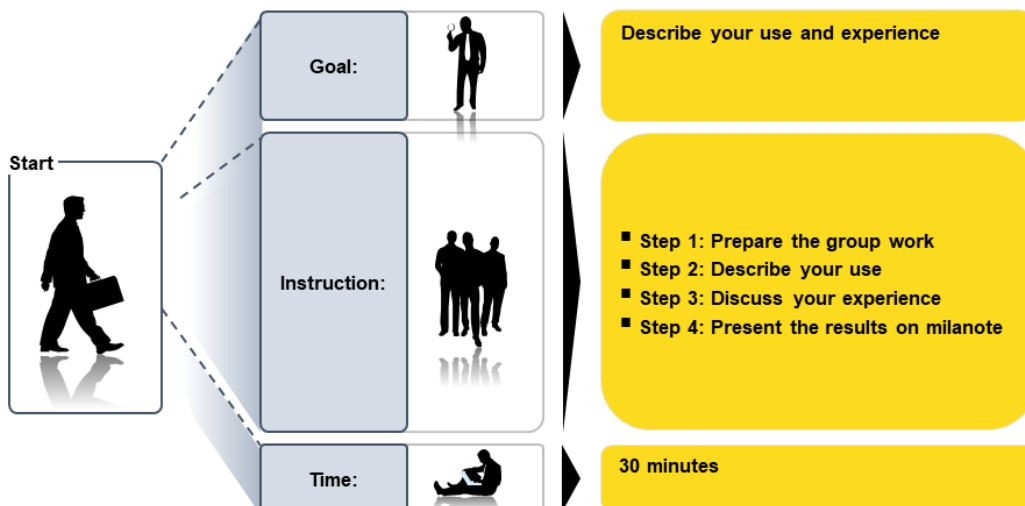


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## Exercise: Use of Online Project Management



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## U2.E5 Online project Management

### 3. References



## References

- <https://thedigitalprojectmanager.com/tools/best-project-management-software-for-business/>
- <https://zapier.com/blog/free-project-management-software/>
- <https://www.forbes.com/advisor/business/software/best-project-management-software/>



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## U2.E6 Other Online Collaboration Tools



### Programme



- 1. Terminology Online Survey Tools**
- 2. Use of Online Survey Tools**
- 3. Terminology Online Whiteboard Tools**
- 4. Use of Online Whiteboard Tools**
- 5. References**





## U2.E5 Other Online Collaboration Tools

### 1. Terminology Online Survey Tools



## Definition Online Surveys



Online (or internet) survey:

- Online survey is understood as data-collection by using web spaces or apps, where a set of survey questions is sent out to a target sample and the members of this sample can respond to the questions over the world wide web
- Respondents receive online surveys via various mediums such as email, embedded over website, social media etc





## U2.E6 Other Online Collaboration Tools

### 2. Use of Online Survey Tools



## Online Survey Tools



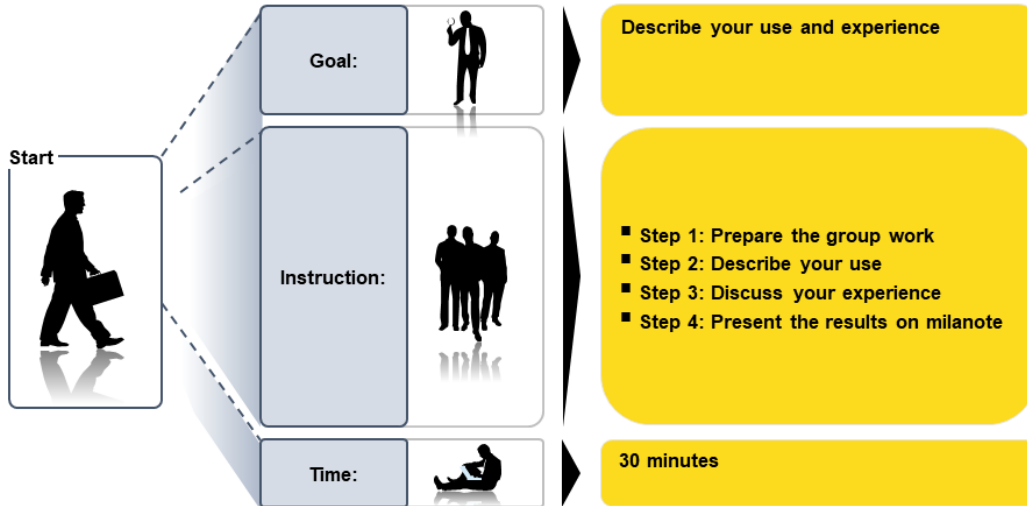
- Mentimeter
- GoogleForms
- MS Forms
- TeamGantt
- Factro

Criteria	Mentimeter	GoogleForms	MS Forms
Data protection	+	--	+
Usability	+	+	+
User-Friendliness	+	+	-
Result	Yes	No	Yes





## Exercise: Use of Online Surveys



## U2.E5 Other Online Collaboration Tools 3. Terminology Online Whiteboard Tools







## Definition Online Whiteboards



- Virtual whiteboards:
- is understood as a learning space where both trainers and learners can write and interact with learners in real time via the internet



## U2.E6 Other Online Collaboration Tools

### 4. Use of Online Whiteboard Tools





## Tools

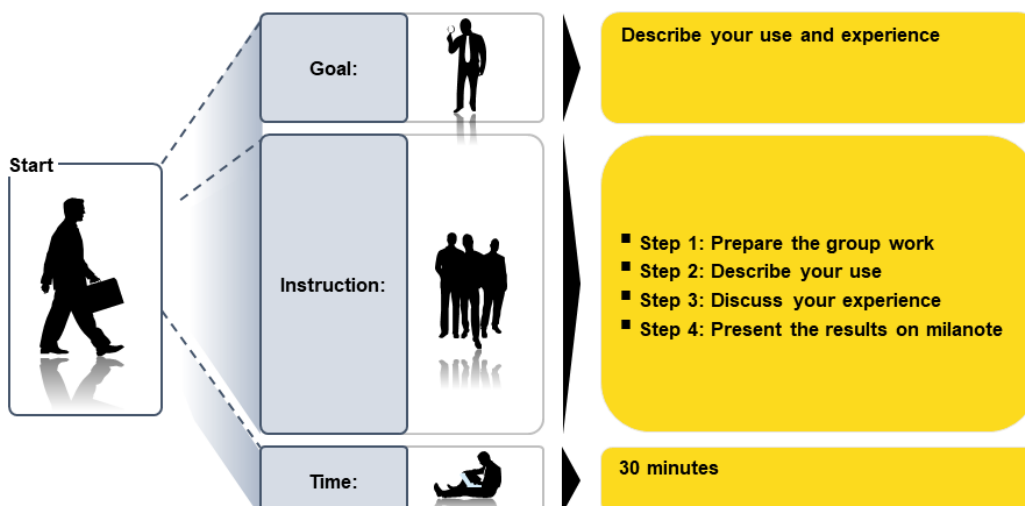


- Miro
- Mural
- Milanote

Criteria	Miro	Mural	Milanote
Data protection	-	0	+
Usability	+	+	+
User-Friendliness	+	+	+
Result	No	No!	Yes



## Exercise: Use of Online Whiteboards





## U2.E6 Other Online Collaboration Tools

### 5. References



## References



Video conferencing tools:

<https://zapier.com/blog/best-video-conferencing-apps/>

Online collaboration tools:

<https://www.cloudwards.net/online-collaboration-tools/>

<https://www.techradar.com/best/best-online-collaboration-tools>

<https://resources.workable.com/tutorial/collaboration-tools>

Latest call: 29th Oct 2023





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## U3.E1 Simulation



## Programme



- 1. Terminology**
- 2. Simulation in Training**
- 3. References**





## U3.E1 Simulation

### 1. Terminology



## Simulation



- ... is the imitation of the operation of a real-world process or system over time
- ... requires the use of models
- the model represents the key characteristics or behaviors of the selected system or process
- ... is used in many contexts, such as simulation of technology for performance tuning or optimizing, safety engineering, testing, training, education, and video games
- ... is also used with scientific modelling of natural systems or human systems to gain insight into their functioning as in economics
- ... can be used to show the eventual real effects of alternative conditions and courses of action
- ... is also used when the real system cannot be engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may simply not exist





## U3.E1 Simulation

### 2. Example



## Welding simulation



Unknown source

[https://www.southeastern.edu/news\\_media/news\\_releases/2017/august/virtual\\_reality\\_simulator.html](https://www.southeastern.edu/news_media/news_releases/2017/august/virtual_reality_simulator.html)





## Blacksmith simulation



<http://www.whatsonsteam.com/Games/721190.htm>



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**U3.E1 Simulation**



## U3.E1 Simulation

### 3. Use Case



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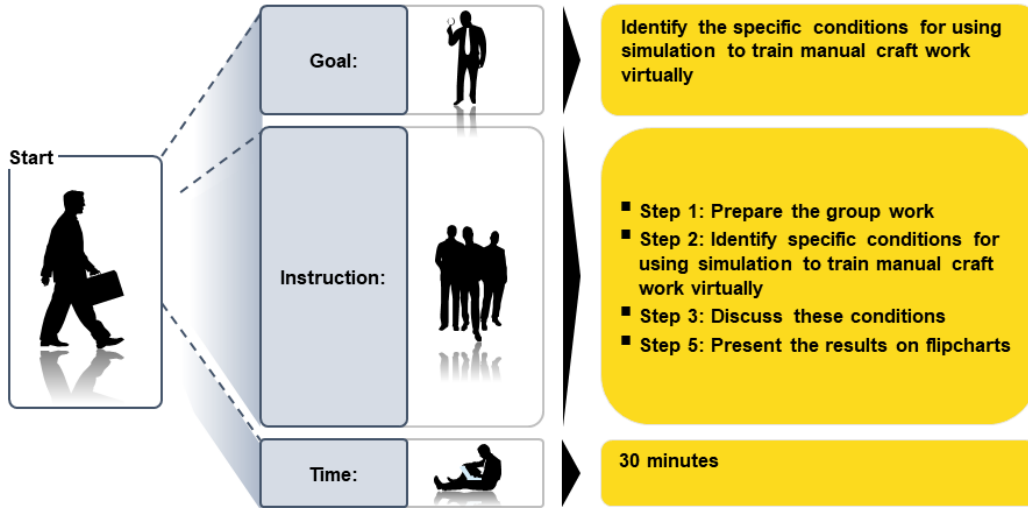
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## Modelling Traditional Building



## U3.E1 Simulation

### 4. References





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## U3.E2 Virtual Reality



## Programme

- 1. Terminology**
- 2. References**





## U3.E2 Virtual Reality

### 1. Terminology



## Virtual Reality 1

- Virtual reality (VR) is a simulated experience that employs pose tracking and 3D near-eye displays to give the user an immersive feel of a virtual world
- Applications of virtual reality include entertainment (particularly video games), education (such as medical or military training) and business (such as virtual meetings)
- Motion capture suits and gloves
- Example: <https://www.youtube.com/watch?v=jyH90Xe13Ao>



## Virtual Reality - Uses



- 1.Immersive Learning and Training
- 2.Improved Retention
- 3.Skill Development.
- 4.Remote Collaboration.
- 5.Architectural Visualization
- 6.Simulation and Testing
- 7.Reduced Risk
- 8.Accessibility
- 9.Enhanced Marketing
- 10.Data Visualization
- 11.Personalized Experiences



## Virtual Building Damage Inspection



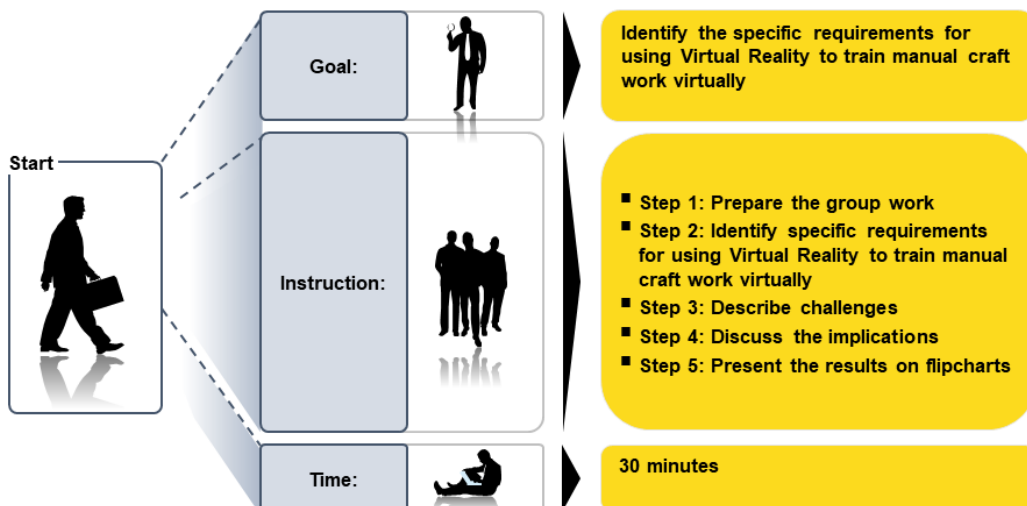


## U3.E2 Virtual Reality

### 2. Use



## Modelling Traditional Building





## U3.E2 Virtual Reality

### 3. References



## References



Photogrammetric Applications for Cultural Heritage  
Guidance for Good Practice

3D Laser Scanning for Heritage  
Advice and Guidance on the Use of Laser Scanning in Archaeology and Architecture

Metric Survey Specifications for Cultural Heritage

BIM for Heritage  
Developing a Historic Building Information Model

3D Icons Project  
GUIDELINES & CASE STUDIES

BIM4Herit  
Heritage Building Information Modelling

<https://historicengland.org.uk/advice/technical-advice/recording-heritage/#Section1Text>

<http://3dicons-project.eu/guidelines-and-case-studies>

<https://increas.eu>  
(coming soon)





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## U3.E3 Augmented Reality



## Programme

- 1. Terminology**
- 2. References**



## U3.E3 Augmented Reality

### 1. Terminology



## Augmented Reality

- ... is an interactive experience that combines the real world and computer-generated content
  - The content can span multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory
  - ... can be defined as a system that incorporates three basic features: a combination of real and virtual worlds, real-time interaction, and accurate 3D registration of virtual and real objects
  - The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment)
  - This experience is seamlessly interwoven with the physical world such that it is perceived as an immersive aspect of the real environment
- Example: <https://www.youtube.com/watch?v=O7dXn9u2WEc>



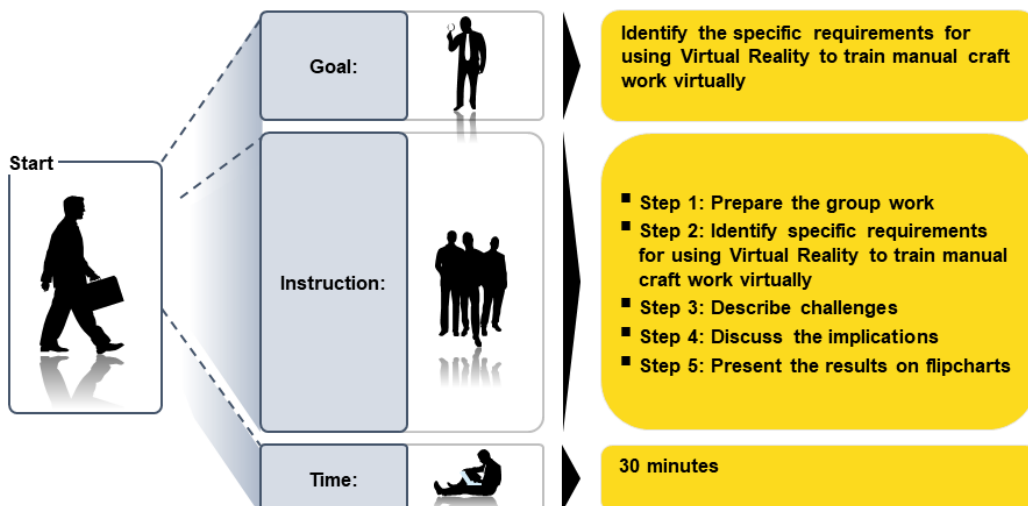


## U3.E3 Augmented Reality

### 2. Use



## Modelling Traditional Building





# U3.E3 Augmented Reality

## 4. References



# References



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## U3.E4 Video



## Programme

- 1. Terminology**
- 2. Challenges in Modelling Traditional Buildings**
- 3. Benefits of BIM use**
- 4. References**



## U3.E4 Video

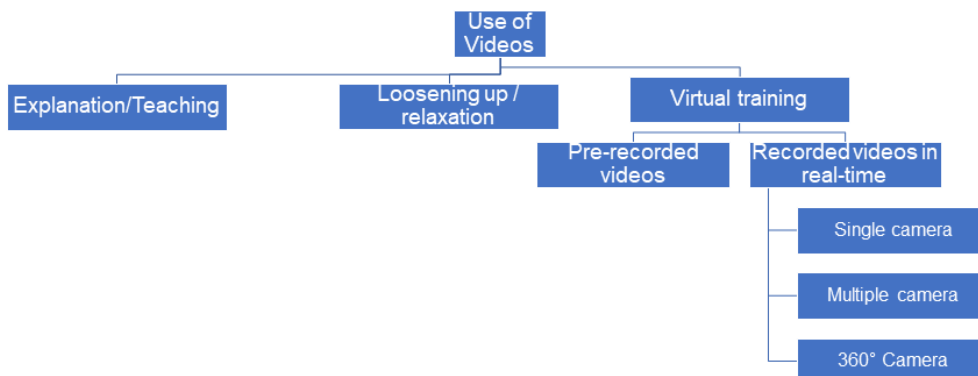
### 1. Terminology



## Videos



- ... is a recording of moving pictures and sound, especially as a digital file, DVD, etc.
- There are different possibilities to use videos:





## Pre-recorded Videos



- ... can be an effective tool for training purposes in various fields, such as education, corporate training, fitness, and sports
- ... provide flexibility to deliver consistent and high-quality content to learners, allowing them to access training materials at their own convenience
- Common use cases:
  - Online Courses
  - Employee Training
  - Demonstrations and Simulations
  - Skill Development
- Benefits:
  - Flexibility
  - Consistency
  - Reusability
  - Engagement
  - Scalability



### U3.E4 Video

### 3. Single Camera / Video







## Single Camera



- Different purposes possible
- Common use cases:
  - Instructions (also for Simulation & Scenario-Based Training)
  - Demonstrations (also for Products)
  - Lectures & Presentations
  - Interviews and Q&A Sessions
  - Feedback & Critique (also for Simulation & Scenario-Based Training and Compliance & Safety Training)
- Benefits:
  - Cost-Effective & Simplicity & Versatility
  - Portability & Quick Setup
  - Focused Content
  - Ease of Editing & Ease of Storage and Sharing
  - Minimal Distraction
  - Consistency

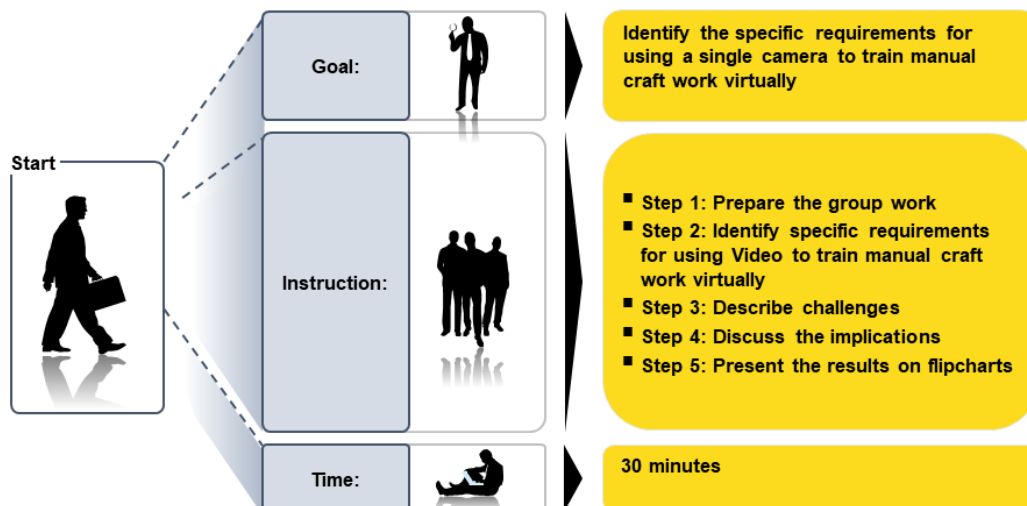


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## Modelling Traditional Building



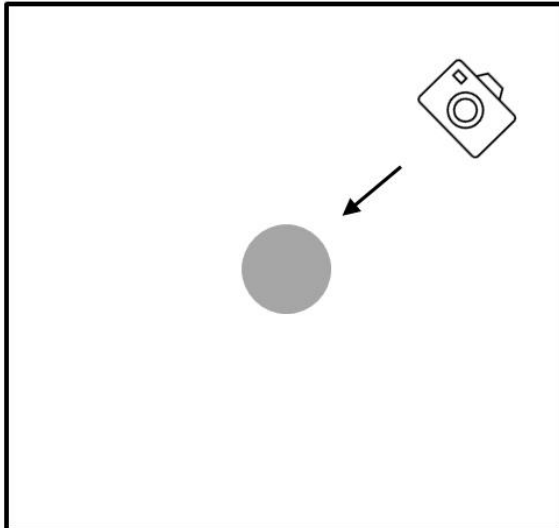
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## Single Camera / Video



### • Findings

- Needs planning to position best the camera
- Not all activities visible
- Pre-recording a virtual training?



## U3.E4 Video

### 4. Multiple Cameras / Videos





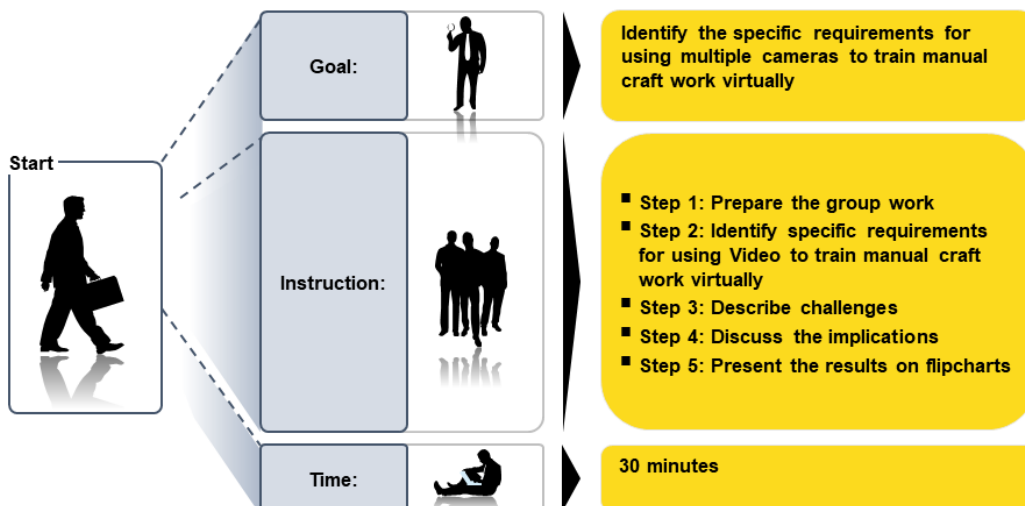
## Multiple Cameras



- Using multiple cameras for training purposes can greatly enhance the learning experience and provide a more comprehensive view of the subject matter.
- Some ways to utilise multiple cameras
  - Demonstrations and Presentations
  - Simultaneous Multiple Views
  - Split Screens
  - Video Conferencing and Remote Training
  - Feedback and Analysis
- Synchronisation
- Planning process
- Editing process
- Benefits: providing diverse viewpoints, in-depth analysis, and a more engaging learning environment

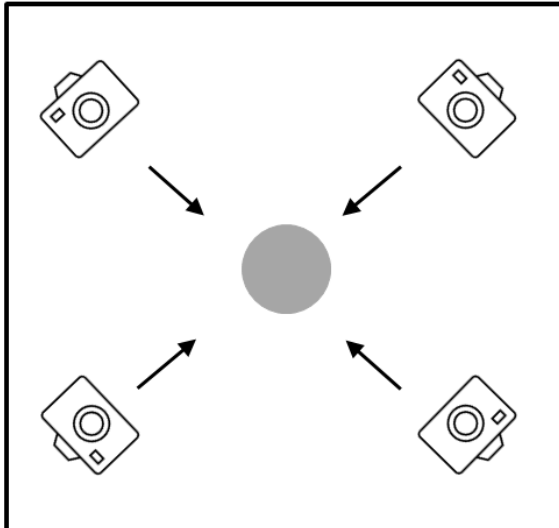


## Modelling Traditional Building





## Multiple Cameras / Videos



### • Findings

- Synchronising is helpful
- Trainers and Learners have to jump between several videos
- Don't forget perspectives like looking up and down
- Planning is essential
- Can be pre-recorded



## U3.E4 Video

### 5. 360° Camera





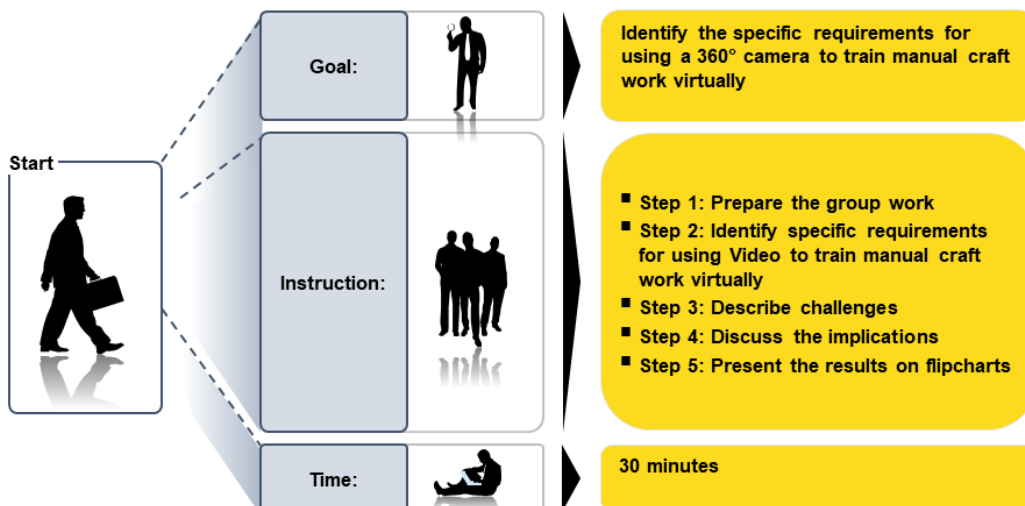
## 360° Cameras



- ... offers a unique and immersive learning experience
- ... capture a 360-degree view of the surroundings, allowing learners to explore and interact with the training environment virtually
- Some ways to utilise 360° cameras:
  - Virtual Tours and Field Trips
  - Immersive Simulations
  - Job Shadowing and Observation
  - Safety and Hazard Training
  - Soft Skills Development
  - Remote Collaboration and Training
- Quality of the video and audio
- Preparation and Implementation
- Benefits: powerful tool to create immersive, engaging, and interactive learning experiences

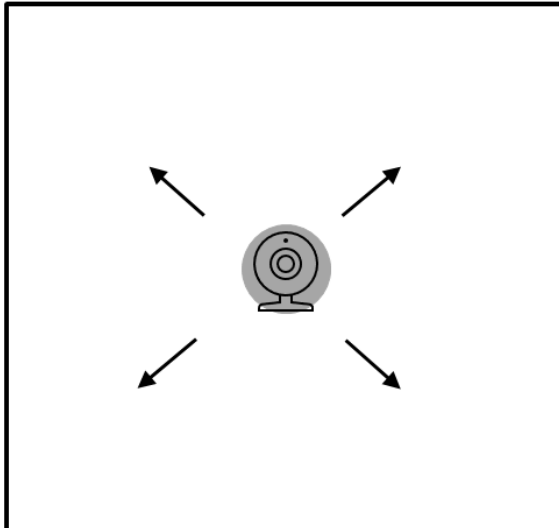


## Modelling Traditional Building





## 360° Cameras / Videos



### • Findings

- Craftspersons/Learners are positioned in the middle of the room/execution of manual work
- Not recommended for training purposes



## U3.E4 Video

### 6. References





## Author



- Gerald Wagenhofer: UBW Unternehmensberatung Wagenhofer GmbH
- Master degree in Business Administration
- Gerald is a certified Lean Six Sigma Master Black Belt, certified Scrum Master, certified Trainer for Cultural Heritage and trained more than 500 Green and Black Belts resp. project sponsors in Maintenance Management for Cultural Heritage, Lean Six Sigma methodology, Change Management and Soft Skills, like Facilitation, Meeting skills, Presentation skills. He had also trained people in Strategy and Controlling/Monitoring skills
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## U2.E5 Best Practices of Training Virtualisation



### Programme

- 1. Terminology**
- 2. Challenges in Modelling Traditional Buildings**
- 3. Benefits of BIM use**
- 4. References**







## U2.E5 Best Practices of Training Virtualisation

### 1. Terminology

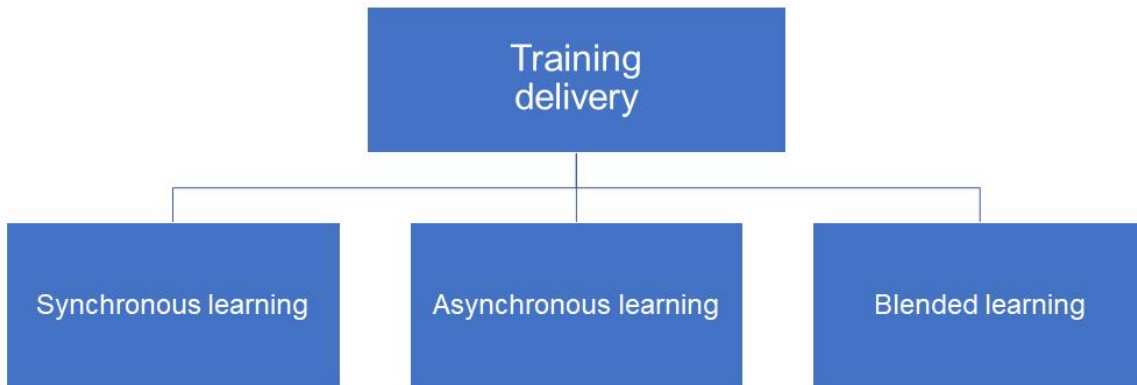


## Training Delivery





## Training Delivery



## U2.E5

### Best Practices of Training Virtualisation

#### 2. Elements of Best Practice Examples





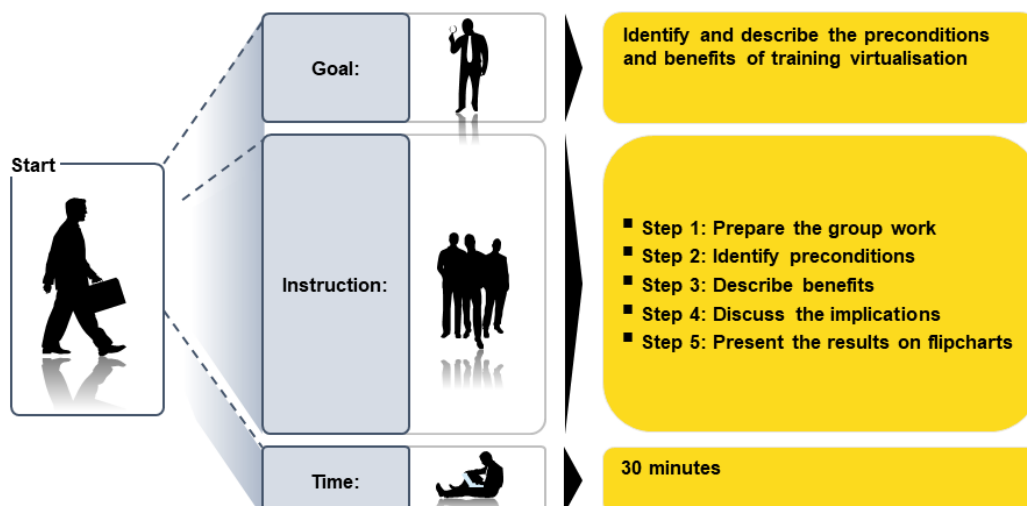
## General Findings



- General conclusions
  - Virtual training during a pandemic like Covid19 can only be supported by one or multiple cameras
  - Motion capture suits are very expensive, learners cannot afford
  - Practice, but final polish needed in f2f training
- Plan
  - Videos of all works done for traditional buildings
  - Recording of internalised knowledge of experienced craftspeople for AR applications



## Training Virtualisation





## Discussion highlights from the Pilot training



- Do not close yourself off to the use of digital possibilities from the outset
- Virtual training is not a substitute for real training, but only a supplement, albeit an important one!
- Detection of structural damage will always require haptic (tapping, spitting, ...) and acoustic (knocking, ...) verification
- Cost-effectiveness of digital tools such as motion capture suits, VR feedback gloves, etc is not given in pandemic situations (such as Covid19), because learners would have to procure these tools!
- Create the conditions for the use of digital tools



## **U2.E5** **Best Practices of Training Virtualisation**

### **3. References**





## Author



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## **U4.E1**

# **Process of Building Damage Inspection**



## **Programme**



- 1. Terminology**
- 2. Process**
- 3. References**





## U4.E1 Process of Building Damage Inspection

### 1. Definition



## Terminology

- A (cultural) heritage asset is an item that has value because of its contribution to a nation's society, knowledge and/or culture
- They are usually physical assets, but some countries also use the term in relation to intangible social and spiritual inheritance
- It contains:
  - Historic buildings; war and other memorials; historic parks and gardens; conservation areas; archaeological sites etc.
  - Listed / not listed buildings
  - Designated / not designated
  - Independent of current use



## U4.E1 Process of Building Damage Inspection

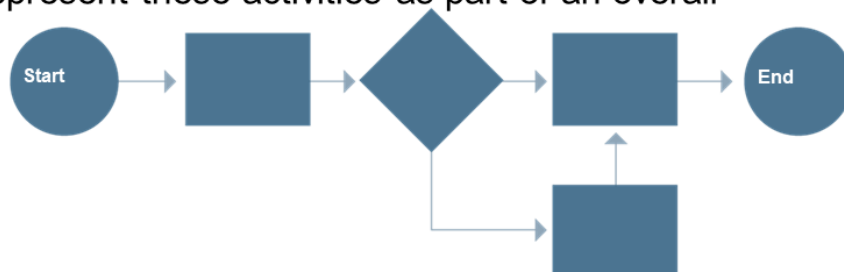
### 2. Process



## Introduction



- Just about everything we do is in the form of processes
- A process is a set of activities that transforms one or more inputs into outputs that are of value to the customer
- To gain a basic understanding of how activities occur, it is important to represent these activities as part of an overall process e.g.:







## Definition of a Process



A process is a series of activities that transform one or more inputs into outputs that are of value to the customer.



## Process Presentation



- Provides a visibly simplified structure for thinking through a complex process
- Gives the team an opportunity to look at the whole process
- Is a way of seeing that changes affect the whole process
- Identifies initial areas or steps that do not deliver value





## Process Boundaries



- Identifying the starting and ending points of the process is the first important step in process mapping. After the boundaries are established, the team can define all the necessary steps, events and activities that make up the process.
- Usually, the starting point of a process is the first step where the input comes from the supplier. The end point is usually given with the delivery of the product to the customer or the service.



## Standard Symbols for Process Representation



### Process Mapping Symbols

	Start / Finish		Task / Activity		Online Activity		Flow
	Data Input / Output		Sub-Process		Delay		Stored Data
	Manual Input		Manual Task		Manual Filing		Document
	Electronic Storage		Online Activity		Process Connector		Preparation

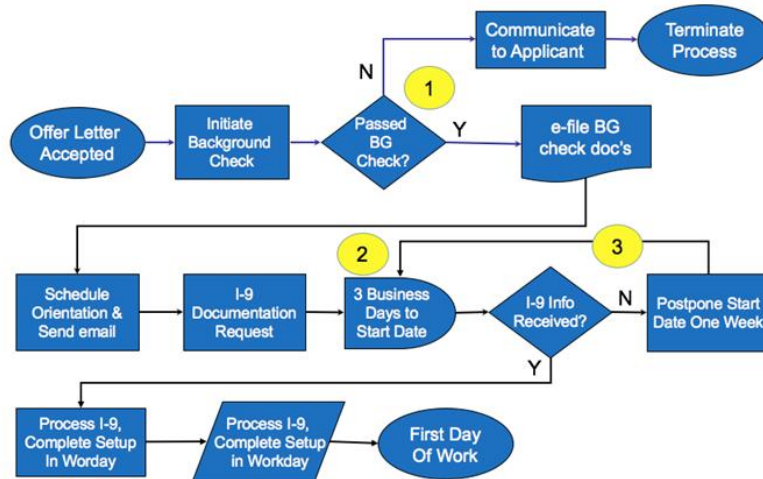




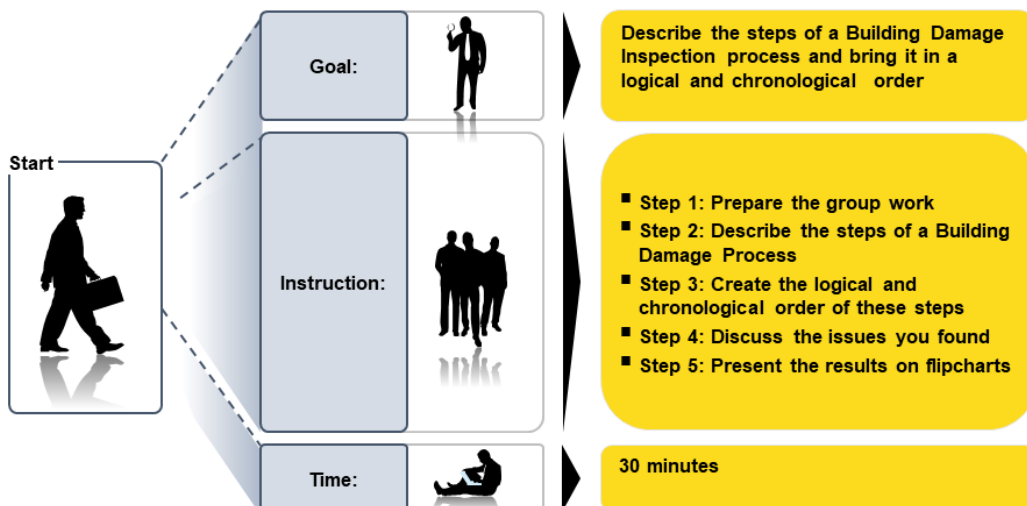
## Process Flowchart



Process Flowchart – Employee Onboarding Process

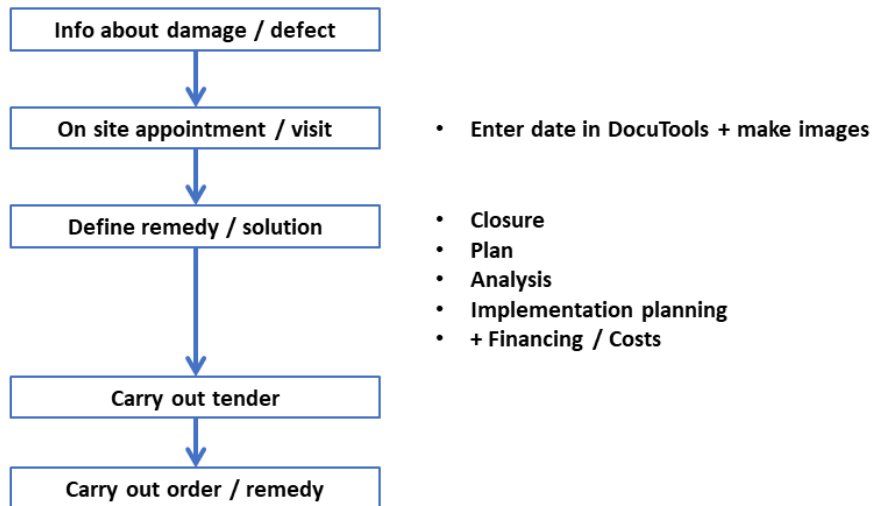


## Exercise: Process Building Damage Inspection





## Basic Process



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Authors: PRO-Heritage Project team

- Abnahme
- Statusänderung in DocuTools [www.ecqa.org](http://www.ecqa.org)



## U4.E1 Process of Building Damage Inspection

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## 6. ASSESSMENT OF SCENARIOS

---

### 6.1. Single Camera

---

Recording a manual work from one angle need some planning and preparation before using it in a training. Additional remarks were made by the partner:

- Recording a manual craft work from one angle might have the problem that some movements are hidden by the hand, the body of the craftsperson and/or equipment resp. tools.
- The position of the camera needs to be planned and tested before the recording.
- Craftspersons will mainly not start talking while doing the work. Therefore, it might be useful to keep the option to add written comments. However, this would interrupt the flow of the video and might have a negative impact. It would be still the best to have a person doing the work talking in English in real time during the video. If the person does not speak English a translation is needed.
- The person doing the work should be the one commenting, either by text or audio. If important information gets forgotten, the question is to add it in afterwards or leave it out completely.
- Sometimes, not all important things get mentioned during the video. If that is the case, you have to decide later on if something is missing. Adding an audio after the recording might not be needed. Having an opening slide simply explaining what is the problem that is being repaired is enough. The opening slide can be a still picture, the important part is that people can see what the problem (a structural defect for example) is and when the work is finished what the result is. Both can be images.
- The first slide could show what the task (a repair intervention) is and then an image of the problem. After that we see the video. At the end there is a still picture showing the repair.
- A positive element would be naming the shown building and where it is located.
- Checking the structure of the refurbished area (in the test it turn out that sequence three position two led to "sea sickness". That is because it is a ceiling with parallel beams which are all the same colour, and the cameras are moving. It might be because the surface is multicoloured. This feeling could also be because it is difficult to find focus while moving the cameras.

For the option with Single Cameras there are some open questions:

- Is a video training a virtual training? → Yes, it could be used
- Is a video training an interactive training (as we define a virtual training should be)? → Only if it is recorded on-time during the training which means a certain effort to prepare these sessions. If it is pre-recorded, the answer is no!
- Can it apply under Covid19 restrictions (separation of trainer and learner)? → Yes, a pre-recording is applicable.

However, Single Cameras are applicable for Virtual Crafts Training.



## 6.2. Multiple Cameras

---

Recording a manual work from different angles will significantly improve the quality of the videos. Additional remarks were made by the partner:

- Making video in a landscape format
- Include close-ups (because of the close-up before and after someone can see that the intervention has been successful).
- Craftspersons will mainly not start talking while doing the work. Therefore, it might be useful to keep the option to add written comments. However, this would interrupt the flow of the video and might have a negative impact. It would be still the best to have a person doing the work talking in English in real time during the video. If the person does not speak English a translation is needed.
- The person doing the work should be the one commenting, either by text or audio. If important information gets forgotten, the question is to add it in afterwards or leave it out completely.
- Sometimes, not all important things get mentioned during the video. If that is the case, you have to decide later on if something is missing. Adding an audio after the recording might not be needed. Having an opening slide simply explaining what is the problem that is being repaired is enough. The opening slide can be a still picture, the important part is that people can see what the problem (a structural defect for example) is and when the work is finished what the result is. Both can be images.
- The first slide could show what the task (a repair intervention) is and then an image of the problem. After that we see the video. At the end there is a still picture showing the repair.
- A positive element would be naming the shown building and where it is located.
- Checking the structure of the refurbished area (in the test it turn out that sequence three position two led to “sea sickness”. That is because it is a ceiling with parallel beams which are all the same colour, and the cameras are moving. It might be because the surface is multicoloured. This feeling could also be because it is difficult to find focus while moving the cameras.
- Another point is the speed of moving cameras in general.
- Safety aspects could prevent filming specific craft works, like filming in a blacksmith workshop.





- The tested sequences (filming with simple cameras hold by people) would work for woodwork, metalwork, stonework, decoration, or plaster repairs. It is applicable for all crafts on-site. Blacksmith might require an extra workshop. The filming technique can be similar, but it would show different things.
- Keep in mind the day time of filming.
- There are also certain limitations like light (including reflections), weather, or need for equipment.
- A project member shares a YouTube channel (The Repair Shop) where people bring in personal objects that need repairing. They demonstrate what the problem is when the object is brought in and the technique on how they are going to repair them. All these channels need to have a certain reputation to be accepted.
- An option could be playing all videos and be synchronised (like on security screens). This way you would have four different viewpoints in one video. IMC confirms that there is a possibility to use several video sequences on a split screen.
- There is also the option to zoom into the videos. If there are four videos in one HD video, you are no longer able to zoom in. But there are two different ways of using them. One is for seeing it in detail (and only having one video at the same time) and the other one is getting on overview and deciding which of the viewpoints might be the best.

For the option with Multiple Cameras there are some open questions:

- Is a video training a virtual training? → Yes, it could be used
- Is a video training an interactive training (as we define a virtual training should be)? → Only if it is recorded on-time during the training which means a certain effort to prepare these sessions. If it is pre-recorded, the answer is no!
- Can it apply under Covid19 restrictions (separation of trainer and learner)? → Yes, a pre-recording is applicable.

However, Multiple Cameras are applicable for Virtual Crafts Training.

### 6.3. 360° Camera

Recording a manual work with a 360° Camera will be not feasible for virtual crafts training. Additional remarks were made by the partner:

- IMC was presenting two 360° Camera, which were not related to crafts. However, the videos gives a good impression for using 360° Cameras for Virtual Crafts Training. IMC gives an explanation on how to look at the videos. If you click inside the video, you can move the viewpoint in all directions.
- IMC points out the first weakness of 360° Photography which is that the camera is always the middle point. If the camera is mounted on a helmet for example, it might be strange looking at the result. The camera position dictates the position afterwards. The middle point is the camera position and not the crafts person.
- Another weakness are light changes which need to get compensated beforehand.



- A strength of 360° videos is that you are able to look at the video on a screen or through a VR headset. The second option is even more immersive.
- Participants mentioned that if the craftsperson is moving very fast with the camera on the helmet the viewer might get dizzy.
- With a 360° video the viewer can decide what he or she wants to look at. This can be seen as a strength and a weakness.
- For recording a 360° video it also needs good quality equipment in order to get good results. For example, the number of microphones play a role.
- 360° videos are not a good option for looking or recording details. It is also difficult to get the right angle or position when using 360° Camera. It takes experience to use it correctly.
- Another strength of that the 360° videos it that they might help you to decide on what needs a closer look. They can also be combined with 3D models, VR and photogrammetry.
- As an improvement, the viewer might need a “choreography” where to look at first and so on.
- 360° videos are applicable for supervising on a construction site. BHOe assumes that when using 360° Camera for supervising the user would also need a specific manual.
- UBW explained that the camera would be fixed in the room and take 360° photos all the time. This way if something happened you could go back in history to look when it happened. Typically, you have one camera in the room but there is the option to have more than one camera in the room. This way you can walk through the room virtually. It is one option for the Virtual Building Damage Inspection. If the user wants to see details, someone is needed to move the camera. The way 360° videos work is that it records single pictures and then put them all together. This means that the singular pictures are not in a high resolution, but in total it would have a high resolution. For details using extra cameras would make sense (Combination 360° video and multiple cameras scenario).
- IMC shared an application (Noedikom) as an example. It shows a 360° museum in which you can move virtually and then look at different collections from Lower Austria. If the viewer clicked on one of the collections, they could also look at it closer through 360° photography.
- UPV asked if it is possible to zoom in on 360° photography. It depends on which device is being used. If the user is using it on a notebook, options to zoom in and out by using the mouse are available. The range for zoom in or out depends on the size of the uploaded video. Like already discussed, 360° is not suitable for details.
- Another limitation for each digitalisation is the available space required on the computer or server.



For the option “360° Camera” there are some open questions:

- Is a video training a virtual training? → Yes, it could be used
- Is a video training an interactive training (as we define a virtual training should be)? → Only if it is recorded on-time during the training which means a certain effort to prepare these sessions. If it is pre-recorded, the answer is no!
- Can it apply under Covid19 restrictions (separation of trainer and learner)? → Yes, a pre-recording is applicable.

However, 360° Cameras are not applicable for Virtual Crafts Training.

## 6.4. VR applications

Learning a manual work with a VR application was tested and evaluated. Additional remarks were made by the partner:

- In order to discuss today’s topic (Virtual Reality) a definition is needed. The definition from the internet is: “Virtual Reality is a simulated experience that employs pose tracking and 3D near-eye displays to give the user an immersive feel of a virtual world”. In that simulated environment you have the chance to interact with the system, see the reaction and get additional information. These VR applications include entertainment (video games), education (such as medical and military training) and business (virtual meetings). Virtual meetings would look like sitting together in a virtual room and having a meeting. The physical location does not play a role. It helps sometimes to have motion capture suits or gloves. This way movements can get transferred into the virtual reality and get an even more immersive reaction. UBW shows an example of a training as a blacksmith in VR.
- A problem when using VR in a training is that you do not get the haptic and thermal feedback. IMC adds that it is very theoretical because you are only guessing parameters.
- UBW mentions the change of the size of the objects during the use if the VR application.
- A strength of using VR is that viewers are able to work the steps in the right order. The main actions in each step are also visible.
- Another strength is the option to add sounds.
- Also, in VR users can simply try it out and make mistakes.
- The user can also change the surroundings. For example, you can put it in the historic context. The question is if that is helpful. When interpreting the craft, the historic context is helpful for explaining the origin of the tool. For a training purpose it would make it more difficult, and the actual context may overrule the need for a historic one.
- For trainees/learner the experience is much better in a VR application.
- An improvement could be giving additional information through written comments. IMC points out that an integration of feedback would also improve the VR application. This way when users are doing something wrong they get information on what the mistake was. It might need more detail / better resolution to avoid that objects disappear behind others. If so, it would create a more realistic impact on the objects (i.e. sharpening the axe without overlap with a whetstone).



- UPV adds that it would be an improvement to mix virtual with real images (before and after).
- A VR application could be applicable for training safely and considering necessary security measures.
- UBW demonstrates a VR application named “VR walk” (the application for testing motion sickness). Through the app “Oculus” the connection between the computer and the VR glasses can be tested. In the application users can choose a movement type (0, 1) they are willing to use. Movement type 1 is moving only through teleportation. UBW demonstrates completing a puzzle in VR. The individual puzzle pieces need to get picked up and turned in the right direction in order to complete the puzzle. The next puzzle is to build a figure using the given building blocks. Another challenge is solving a math problem by calculating and remembering the result. By moving from station to station you have to solve more math problems and write down the results.
- In conclusion, IMC points out that users will need proper training to start and use the VR application. As an improvement it would need a training for using VR equipment in general before starting a virtual training.

For the option “VR application” there are some challenges:

- Each manual craft work has to be understood as separate application scenarios which needs to develop its own VR application resp. its own specification/recording of the relevant surroundings like Workshop, equipment and tools.
- It is possible to use a common “container” (Containers are a form of operating system virtualisation. Anything can be executed with a single container - from a small microservice or software process to a larger application. A container contains all the necessary executable files, binary code, libraries and configuration files. Compared to server or machine virtualisation approaches, however, containers do not contain any operating system images. This makes them lighter and more portable, and the overhead is significantly lower. For larger implementations of applications, several containers can be provided as one or more container clusters.) for each procedure.
- The number of users for each manual crafts work are limited because traditional crafts are only a small portion of companies in the construction industry. Therefore, the scale effects for these VR applications are small. It will not be a mass market.
- The budgets needed for developing/programming VR application for all manual craft works (will be more than 50 work procedures) will be by far more than €1 million.
- Knowing the available budgets in the Cultural Heritage Sector it will be challenging to use the budget for developing VR applications. Especially, if the actual EU commission Recommendation C(2021) 7953 final will take into account.

However, VR applications are applicable for Virtual Crafts Training.



## 6.5. AR applications

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Learning a manual work with an AR application was tested and evaluated. Additional remarks were made by the partner:

- UBW demonstrated an AR application for maintain an aircraft engine. The common conclusion was that AR is working best if you apply it on standard/standardised structures like the engine in this example.
- Cultural Heritage and especially, traditional building are missing these structures. The buildings are all individual, maybe except some historic terraced houses and half-timbered houses. Therefore, AR applications are not applicable for Virtual Crafts Training.
- On the other hand, recording the work of experienced craftspersons can help to reduce the risk of craft skills dying out. Especially, if these recording are transcribed and will be accessible by an AR application. However, the structure must be delivered by the person who is using the application. This requires that the user already have some experience in the field of this craft.

However, AR applications are not really applicable for Virtual Crafts Training, but it is meaningful to use it a knowledge management system for dying crafts.



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## **7. CONCLUSIONS**

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### **7.1. Summary of achievements**

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Based on the findings of IO1+IO2 partners have started to gather material for the development of selected virtual trainings. The respective training courses and ECQA Skills card (Curriculum, Learning outcomes and training material) were developed and piloted in the Learner Event C1 in Bratislava.

The training courses are based on the selected and defined scenarios and user stories for some crafts. In the Learner Event C1 these scenarios and user stories were tested and evaluated. The consortium concluded as result that every virtual training of manual craft work will not replace the real f2f training for certain reasons. This based on the required high-quality resolution which is required for VR and AR training tools and the budget which is needed to implement such tools. Within VI-TRAIN-Crafts the consortium did not plan to develop virtual training means. In the project course it turned out that the required budget for equipment and training setting cannot afforded by training participants. Additionally, the consortium is not convinced that the required money will be available for and in the Cultural Heritage sector, yet. Especially, because the EU Commission recommend to digitise all endangered and 40% of the Cultural Heritage sites which are intensively used by tourists (see Commission Recommendation C(2021) 7953 final), for which the budget will spent first.

### **7.2. Contact to the Coordinator's Data Protect Officer**

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