NAME	**AUGMENTED REALITY (AR)**
Short description (What)	Augmented Reality (AR) can best be described as a digital input to an expanded view of reality. Here, true vision is maintained, but a layer of computer-generated graphics, information, and data is added to the field of view. In this way, a fitter can e.g. guide for proper assembly of an advanced product. An example of AR that you probably know is Pokémon Go, which was taken by Denmark by storm in the summer of 2016. Here, the virtual Pokémon are added to a video feed of the real world - directly on the phone from your own pocket. At Grundfos, for example, AR teaches its employees to assemble and repair advanced pumps. Whether students want to study humanitarian sciences or technical science, augmented reality solutions for a university can be very helpful. For example, medical students can learn anatomy and practice examining the body with an AR app representing the human body inside and out. In addition, many universities use augmented reality for teaching students engineering, math, design, astronomy, and much more. Augmented reality for students makes the educational process more engaging and safe. The technology allows conducting experiments like trying different chemical combinations and seeing what can happen with no harm to students and university property. Moreover, AR applications can help students with creative activities in college and with organizing university events.
Purpose/aim (why)	☒ Immediate evaluation of learning results ☐ Co-create contents (Conceptual maps) ☒ Acquisition of new pieces of knowledge ☒ Showing job processes and techniques ☐ Systematization of contents ☒ Experiencing practical activities ☒ Problem-solving ☒ Design thinking
Contents/learning objects suitable *(on what)*	Specific contents/objects trained with this specific solution: ● AR can be applicable for both high-level theory (advanced mathematics) and a practical skill training (welding simulators) ● It has more imagery and videos as well as interactive virtual words ● A Swift And Effective Learning System ● Easy Access To Learning Materials Anytime, Anywhere

	- Immersive Practical Learning - Higher student engagement - Safer practice *Indicate (if possible) some examples of application:* - Safety education - Job procedures - Logistics - Onboarding - Maintanance of objects (welding, mechanics, robotics etc). - Application is possible on anything, the only restrictions are the currently available free versions of the AR application. However, anything can be developed for educational purposes.
Type and level of interaction	*Explain the level of interaction:* - Immersive interaction in real time (in a group or single) - Interaction with virtual objects (in real time, in a group or alone, in common or on different objects or part of it, inside an environment or specific object
Type of learning stimulated by the solution	*Verify if it's possible to close the responses and check the responses* ☐ Learning from experience ☒ Learning through creative thinking ☒ Learning from peer interaction ☒ Learning from a reflexive process ☐ Learning from imitation/observation ☒ Learning through interaction ☒ Immersive learning
Digital solutions' brand names	1. Snapchat 2. Photography and Editing 3. Hololens 4. Google ARCore 5. Pokemon Go 6. Interior Decoration Apps 7. AR Maintenance 8. Google Glass 9. Google Street View 10. Pitch Summary in Cricket 11. Neurosurgery ***Aurasma*** *– Already one of the most apps for teachers to bring AR into the classroom, the Aurasma app allows teachers to create their own "Auras" or AR experiences. Teachers can turn art or math class into an interactive experience with the help of tablets or smartphones. A student can scan a math equation, for example, and get an interactive learning experience. The opportunities are limitless!*

	Daqri Studio – *Daqri Studio another option for teachers to design their own AR experiences. It has proven especially beneficial for science teachers who have used the product to create 3D images of the human body and its organs or to bring the periodic table to life.* *Quiver* – *Quiver has coloring pages for every subject area. When paired with the app, these pages become animated. For example, a student can color an image of an airplane flying over New Zealand, pair it with the app, and watch the airplane travel around the country.* *Fetch Lunch Rush* – *This free game from PBS uses printable cards as augmented reality pieces. Students help Ruff the dog feed sushi to a movie crew by solving math problems. Each game piece is an AR element that brings them to life when scanned with the accompanying app.* *AugThat* – *Developed by a former teacher, AugThat creates AR content for classrooms targeted to students who may not be as engaged in learning as their peers. Their animated lessons come in a variety of formats, including both 3D and 360-degree views.*
Technical equipment *(the technical equipment needed to support its use in training/teaching)*	*Mobile phone (both Apple and Android products)* *Free memory space in the mobile phone* *Access to the internet* *Tablet (can be used as well)*
Equipment conditions	*Regarding HW: each student brings their own mobile phone* *Regarding SW: Licence or license free, the presence of an Educational version* *The software may be customizable or not.*
Costs	0 EUR (free accessible apps, each student brings their own phone/ tablet) 50-1000 EUR - Tablets Software can range as you can either have a monthly subscription or pay for it. The prices also vary greatly (for example medical applications/software can cost up to hundreds of euros, but there can also be applications/software which cost a lot less).
Main technical problems that can be occurred / maintenance needs	Low battery Cracked screen interferes with proper functioning Not enough space in memory to download the app

Methodological indications for trainers/teachers	Please indicate:
	     - **How can the solution be used (or designed to use) during a lesson**
	 AR can be used as a standalone class activity, skill training (for example welding), as a homework or a test of skill/knowledge.
	 AR can be used for both theory and practice so it is up to the educator to decide how the AR can support and enhance the material they are teaching.
	
	     - **Needed preparatory activities**
	 Selection of Hardware (which phones, tablets etc) and software.
	 Selection of evaluation criteria
	 Creation of the lesson and the procedural sheet (information and direction for

	students).
	- De-briefing solutions to be adopted
	In order to continuously adapt and improve the guidance and support for the participants, it is necessary to include points such as the following in the evaluation of the augmented teaching/learning experience:
	- How did the learners cope with the AR application in general?
	- How did they feel during the AR experience and afterwards?
	- What support was needed from the teacher?
	- What further support would the learners have wished for?
Describe the use onsite of that solution?	Pre-conditions: The teacher has decided on what HW and SW will be used. The teacher notified students to bring their phones, download the app or provide the necessary to the students. Students are given instructions and or activity sheets (practical information about what is expected of them to achieve, necessary equipment, and procedures). Students execute the task/procedure. Evaluation criteria are uploaded and the teacher/educator checks the outcomes.
Describe the use in the distance setting of that solution?	One of the biggest downsides to distance learning is the lack of a practical element. VR and AR have the ability to bridge the gap between distance and real-life learning; they can merge theory and practice. Virtual practice can increase a student's quality of learning and retention by up to 90%. Distance learning can also bring with it constant distractions, especially if it is being carried out at home without an optimized work-from-home setup. Video tutorials can sometimes be useful, but when a student uses a virtual headset combined with headphones, they will completely immerse themselves in the practical task at hand. This provides them with a better learning environment. This can be incredibly useful, whether you're a teacher wanting to demonstrate a chemistry experiment, or a computer science student wanting to learn data quality software development. Pair programming is also a great concept that allows the teacher to share your virtual screen and guide you through the process. VR/AR distance learning does not only act as a replacement for real-life learning, but it can actually enhance it.
Main pedagogical problems that can be occurred	- Risk of "amusement park" approach to learning - Students side tracking - Lack of clear instructions

	- Hardware or Software failure
Troubleshooting suggestions	Restart the application/software Restart the phone (usually after installation) Re-install the mobile application Check for display problems (cracked screen, burned out screen etc.)
Role of the teacher/trainer	Preparation of the curriculum and lessons. Search for appropriate software solutions Preparation of the evaluation
Strengths *(regarding contents, techniques and processes)*	● The training usefulness of the error: a game is a protected environment in which a student can test errors avoiding consequences. After a failure, he/she can restart without fear to reach the final aim. ● Immediate feedback provided during the game ● The competition and the game as a lever for learning ● Through a game you can re-create a real situation (workplace) if no equipped rooms are available ● Easy access, effectiveness and direct involvement of students ● The hardware is already provided by most students (access to a mobile phone) ● High level of motivation for the student ● Very interactive and user-friendly ● Immersive learning ● Higher retention of the knowledge ● Practical for repetitive skill learning
Weaknesses *(regarding contents, techniques and processes)*	● Bad internet connections can interrupt the creation of a multimedia presentation. ● Outdated software does not support the platform. ● Students do not have the appropriate equipment (computer or tablet, internet connection) at home. ● The teacher does not have the skills and knowledge to use the equipment and the platform. ● In general, the best platforms are in English. A lack of language skills can make it difficult to use the platform. ● The level of students' digital competencies is uneven. ● Outdated phones do not run the applications correctly ● Big differences between IOS and Android ● Cracked screen may interfere with the application
Linked practices *(if available – see the other scheme)*	Gamification

Main characteristics *(Evaluate each characteristic)*

	Low	Medium	High
Level of interaction among trainees during the experience	☒	☐	☐
Level of interaction with the trainer during the experience	☒	☐	☐
Autonomy in the use of the solution by the trainee	☐	☐	☒
Easy to use (friendly?) by the trainee	☐	☐	☒
Easy to use (friendly?) by the trainers	☐	☐	☒

	Level of peer-to-peer collaboration	☒	☐	☐
	Inclusiveness (in relation to disadvantaged groups)	☐	☐	☒
	Level of engagement	☐	☐	☒
	Motivation			☒
Other relevant information				
Comments	*Highly applicable to all VET sectors! Easily scalable.* *It can be used to teach/train theory, training practical skills, training soft skills, team building etc.* *AR is quite straightforward. Providing access to the available software, and teaching them by trying it out themselves.* *Pay attention to devices used: some mobile phones might not be "strong enough" to have the AR application functioning properly.*			
A contribution by	*Virsabi*			