Pedagogical Guidelines

Guidelines for inclusion of Digital Reality in education

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Executive Summary

The Pedagogical guidelines serve as suggestions and onboarding on Digital Reality solutions. This document is aimed at anyone who is interested to include these tools in their educational plan.

The guidelines start with the basics about the tools to make sure that educators with any level of technical understanding from absolute newbies to experts can have a basic understanding of the concepts and tools. The practical state-of-the-art solutions are listed and fact-checked as of October 2022.

The second part of the guidelines is focused on a methodology which is an example of how can DR tools be practically included in education followed by the practical checklists for organizations and educational centres. Moreover, information about the safety and practicalities are addressed.

Lastly, we have references to other DRinVET project results which can aid you with a deeper understanding. The annexes include national plans and templates to be used.

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1.Introduction

1.1 What are DR Tools?

Digital reality is generally defined as the wide spectrum of technologies and capabilities that inhere in AR, VR, MR, 360° video, and the immersive experience, enabling the simulation of reality in various ways

Digital Reality tools allow students/trainees to complete a real task with a simulated tool or in a simulated environment mirroring reality, which ultimately solves the burning problem of practical training and assessment.

Vocational training will begin to feel the impact of virtual and augmented reality over the next year or so. The ability to experience training in 360 is invaluable – and imagine budding mechanics viewing a working engine from all angles without leaving the classroom. All this is possible right now with ClassVR.

Reality-virtuality continuum infographic with examples: real environment, augmented reality, augmented virtuality and virtual reality. **Source:** https://creatxr.com/the-virtuality-spectrum-understanding-ar-mr-vr-and-xr/
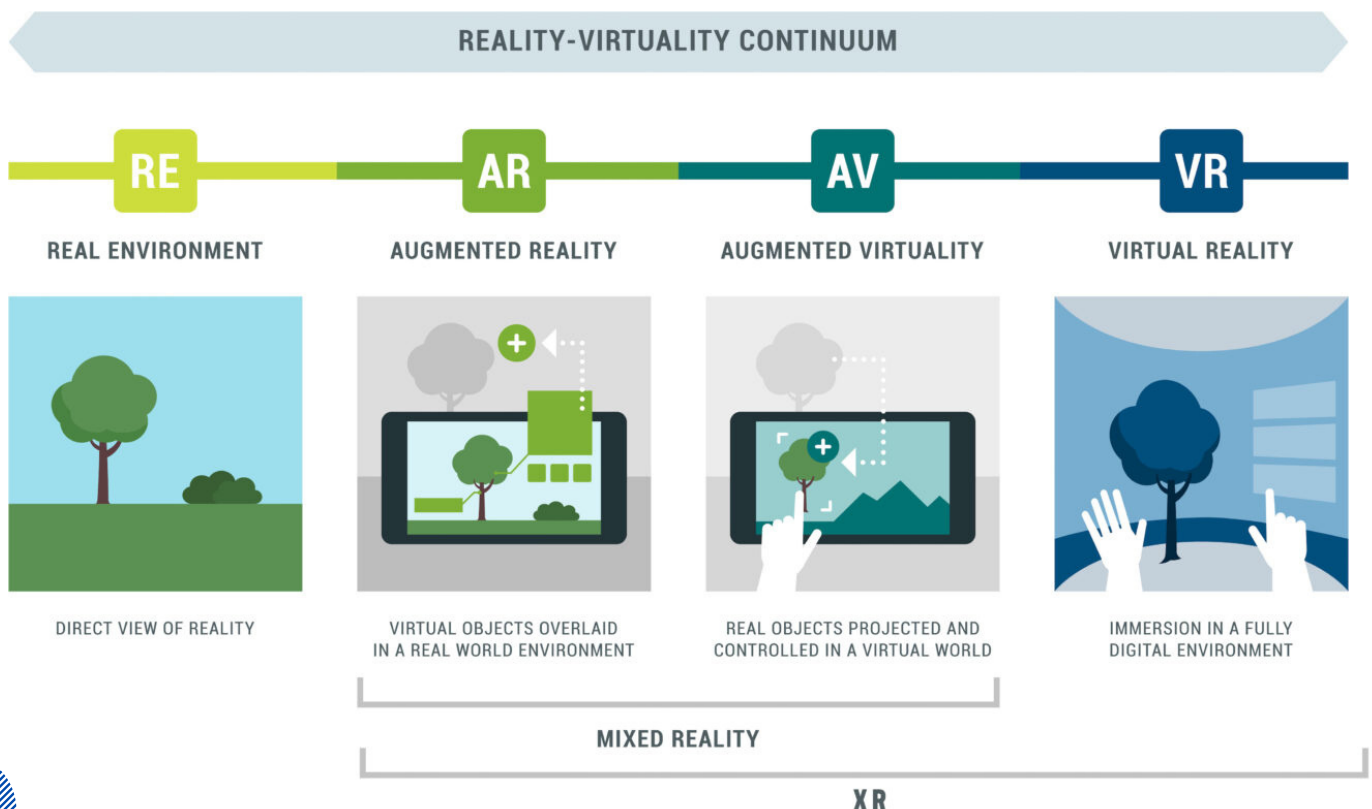
1.2 Explanation of terms

1.2.1 XR - Extended Reality

XR refers to all real-and-virtual environments generated by computer graphics and wearables. The 'X' in XR is simply a variable that can stand for any letter. XR is the umbrella category that covers all the various forms of computer-altered reality, including Augmented Reality (AR), Mixed Reality (MR) Virtual Reality (VR).

1.2.2 MR - Mixed Reality

XR refers to all real-and-virtual environments generated by computer graphics and wearables. The 'X' in XR is simply a variable that can stand for any letter. XR is the umbrella category that covers all the various forms of computer-altered reality, including Augmented Reality (AR), Mixed Reality (MR) Virtual Reality (VR).

EXAMPLE

Microsoft HoloLens in action. The person uses special Googles to talk with an expert abroad. The task to solve is to fix a specific part of the machinery. The expert sees what the person with Google sees.
Other solutions Realwear, Iristick Z1, Epson Moverio BT-200, Sony SmartEyeglass , Google Glass, Vuzix M300, Carl Zeiss Smart Glass, Seebright Wave, CastAR, .

Discovering exactly how mixed reality is best utilized is a great task – the possibilities are endless. Remote assist is one of the latest additions to the growing app pool for the Hololens and it's best described as a highly advanced form of Skype.

Remote assist allows the Hololens user to get in touch with experts to help fix issues using live virtual communication. The expert will be able to see live video from the Hololens, and then draw and add graphics on top of this view for the Hololens wearer to see in real-time.

Problem-solving has never been this fast and easy. This is a great stepping stone for companies wanting to get into the Hololens and mixed reality technology. Below you will find a short video about remote assist on the Hololens.

1.2.3 AR - Augmented Reality

MR removes the boundaries between real and virtual interaction. It is a blend of physical and digital worlds, unlocking natural and intuitive 3D human, computer, and environment interactions.

In higher education, augmented reality is used for a wide range of applications. Faculty use AR platforms to incorporate gamification into curricula and create educational material. Through AR technology, teachers can materialize abstract concepts to help students visualize and understand challenging subjects.

EXAMPLE

An AR app like I-Mechanic allows you to digitally view car diagnostic and maintenance information. The app suggests potential fixes and points out trouble areas with your vehicle. This allows people without any car maintenance experience to understand and learn about issues with their vehicle.

Youtube has led to an increase in shared knowledge. Anybody can learn basic survival and maintenance skills by watching a few videos on the subject. The next logical step is to take these tutorial guides and convert them into an augmented reality for education example.

1.2.4 VR - Virtual Reality

VR is an artificial environment created with software and presented to us that we start to believe and accept as a real-life environment. A person can primarily experience VR through a computer using two of the five senses: sight and sound.

Because the focus of vocational training of craftsmen is on the transfer of action-oriented knowledge, VR can particularly support education with its immersive interaction possibilities, especially in terms of action-oriented content.

EXAMPLE

Having a virtual lab to ensure a safe and interactive environment for students to learn STEM subjects is certainly a great tool to possess. With companies like Labster VR, this becomes possible. Labster VR already provides more than 100 types of virtual labs for schools and universities, and the experience is great.

For example, in the Exercise Physiology Simulation, students can participate in a clinical trial to investigate "the acute and chronic physiological effects of high-intensity interval training (SIT) on a sedentary lifestyle."

SUMMARY

XR - Umbrella Term for all the Digital Reality Tools
MR- Combination of simulated and real-world
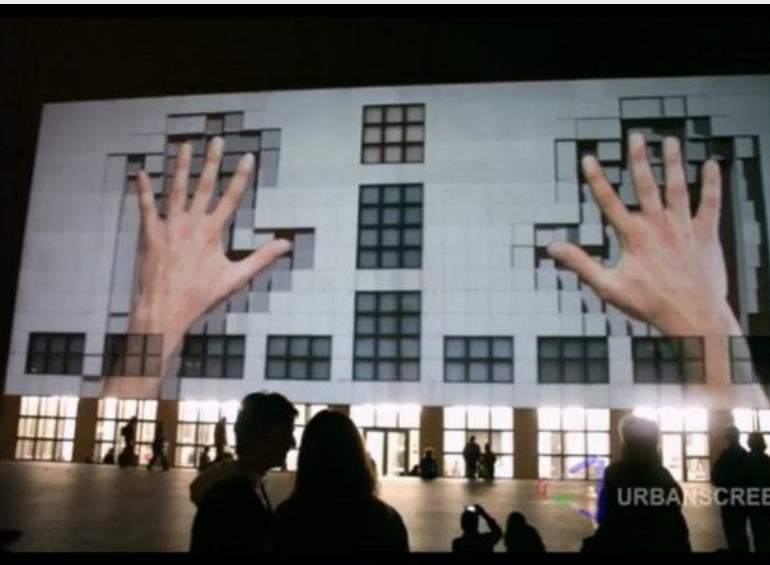AR - Simulated elements in the real world
VR - Simulated virtual world

AUGMENTED REALITY

MIXED REALITY

VIRTUAL REALITY

Projected Reality

Projected reality renders virtual objects directly within or on the user's physical space. A key benefit of PR is that the user does not need to wear a head-mounted display.

Instead, with the use of spatial displays, a wide field of view and possibly high-resolution images of virtual objects can be integrated directly into the environment.

For example, virtual objects can be realized by using digital light projectors to paint 2D/3D imagery onto real surfaces, or by using built-in flat panel displays. The projection technology can turn any space into a type of interactive display, by projecting images on different surfaces and objects. Through the projected reality every object can become a canvas, creating a visual narrative.

Assisted Reality

Assisted Reality gives you access to the right information right when you need it, allowing you to have full situational awareness.

Unlike AR, it's a real-world first, digital second experience. Assisted Reality allows a person to view a screen within the immediate field of vision, hands-free. Information is not overlaid with a real-world view.

Assisted reality is between augmented reality and normal, everyday reality. Information Age explained it well saying, "It differs from augmented reality in that it doesn't change what the user is seeing, only adds an extra layer of information into their peripheral vision." Assisted reality can be in the form of something like smart glasses while augmented reality would often completely obstruct your view of what is actually around you. Both assisted and augmented reality can be used to increase efficiency in manufacturing facilities.

1.2.6 What DR tools are available

VR and AR tools

The worldwide market for augmented reality and virtual reality (AR/VR) headsets grew 92.1% year over year in 2021 with shipments reaching **11.2 million units**, according to new data from the International Data Corporation.

Meta's Quest 2 was by far the most popular product with a **78% share of the combined AR/VR market during the year.** In second place was DPVR, which has had plenty of success in Asian markets and captured a 5.1% share globally. ByteDance's Pico VR products ranked third (4.5% share) and, like DPVR, are well positioned in Asian markets but have also done well in North America and Western Europe where it has helped fill the void left when Meta discontinued its Oculus Go. **VR pioneer HTC and China-based online video platform iQIYI rounded out the top 5.**

New entrants, as well as broader adoption from the commercial sector, will propel the market further as headset shipments are forecast to grow 46.9% year over year in 2022 and experience double-digit growth through 2026 as global shipments of AR/VR headsets surpass 50 million units by the end of the forecast with a 35.1% compounded annual growth rate (CAGR). (Source:https://www.idc.com/getdoc.jsp?containerId=prUS48969722)

VR as of September 2022

There is way too much VR headset equipment that it would take several pages to describe.

However, you can see the currently available and confirmed VR headsets in this good company comparative analysis from Wikipedia.

Link:
https://en.wikipedia.org/wiki/Comparison_of_virtual_reality_headsets

However, the most mainstream and available brands are HTC, Sony, Oculus (META/Facebook), Varjo, Pico Neo, HP and many more. This technology is currently experiencing a huge boom as more competitors are entering the market.

Furthermore, it is not only the headsets but also the additional equipment which is taking of.

VR suit

A virtual reality suite also allows for full-body tracking in virtual reality because sensors can transmit the position and posture of the entire body in VR.

Tactsuit from bHaptic, TeslaSuit, and Hardlight Suit/NullSpace VR are a few examples of VR suits that use sensors and have haptics to help immerse either the entire body, lower body, upper body, or other parts of the body in VR experiences.
This suite lets you experience touch sensations, physical exertions, weight, roughness or smoothness of an object in VR, heat and cold sensations, and other haptics in different parts of the body, from a first-person level as though you were actually and in real life, doing those things you are doing in VR.

Virtual Reality Haptic Gloves

The first application of virtual reality gloves is to let you see your hands inside the VR environments so you can touch and control virtual objects in games, etc. With hand and multi-angle finger tracking technology, you can see those hands in real-time inside of the VR system.
That way, for instance, you can feel the weight of objects when lifting weights such as in weight-lifting applications. Therefore, these are the best virtual reality controllers for quick VR immersion.

Foot VR controller

Feet-based VR controllers may translate feet and toe movements like described above for hand controllers using motion and position tracking. Some also incorporate haptic feedback.

Virtual Reality Chairs

In traditional rotational tracking VR, the user has the headset on and can move their head sideways, top, and down, but the body is still seated, unable to turn sideways as the user browses VR content.

The VR chair allows the user to turn the entire body as they turn the head and change the line of sight of VR environments on their VR controllers for PC or other systems.

These chairs use a footplate attached to a motor system and the user presses on the plate to turn. Some chairs, for instance, those used in racing, have footplates to place the gas and brake pedals, stands to hold the steering wheel, and an e-brake handle.

VR Treadmills

Virtual reality treadmills are used for training and also for gaming or 360 degrees VR navigations since they allow the trainee or user to walk/run/jump/fly in every direction or 360 degrees in VR, but when the user is physically restricted to the equipment.

The VR treadmills are made of a plastic construction on which users strap themselves using a waist harness and then wear the unique shoe to reduce friction. The treadmill also has sensors to track the user's position, stride length, and speed of movement/running/walking. These are relayed into the game environments and converted into game movements.

Augmented Reality as of September 2022

Here are some facts from brandmine.com
The global augmented reality market size was 4.16 billion in 2020. The market is projected to grow from 6.12 billion in 2021 to 97.76 billion in 2028 at a CAGR of 48.6% in the 2021-2028 period.

The biggest brands investing in AR: are Apple, Google, and Nvidia.
In 2022, there will be an estimated 1.1 billion mobile AR users worldwide.

AR adoption is tracking with the mobile usage boom – by 2025, nearly 75% of the global population and almost all smartphone users will be frequent AR users.

Gen Z / Millennials are both 71% more likely to use AR all the time vs. older generations.

Older generations are nearly 20% more likely to view AR primarily as practical.

WebAR

Another important trend in augmented reality is WebAR. Powered by web browsers, WebAR doesn't require users to download additional software. This is the best-case scenario for accessibility. However, it comes at a cost — WebAR offers the most basic AR experiences and lacks many of the features that native AR can offer on mobile devices.

However, in some cases, WebAR can be very useful for simple experiences. Like adding filters to faces, changing the color of hair or objects, background replacement, and simple 3D objects. Simpler virtual try-on experiences are possible with WebAR. These are used by a number of businesses like L'Oréal and Maybelline for their cosmetic products.

pixelplex

	WebAR	MobileAR
Accessibility	Any device	Only the devise an app is installed on
Cost	Faster and cheaper	Takes considerable money and resources
Complexity	Lacks details and accuracy	Highly interactive and rich in details
Internet connection	100% dependence	Can store data on the device

Indoor and outdoor navigation

In 2022, AR navigation has become more fluid and achievable than ever before. Most importantly, the rise of technologies like Bluetooth Low Energy (BLE) antennas, Wi-Fi RTT and ultra-wideband (UWB) make indoor navigation much more viable than in previous years. One of the most useful applications of this technology is for displaying AR directions in large indoor locations like distribution centers, shopping malls, and airports.

Healthcare and Augmented Reality
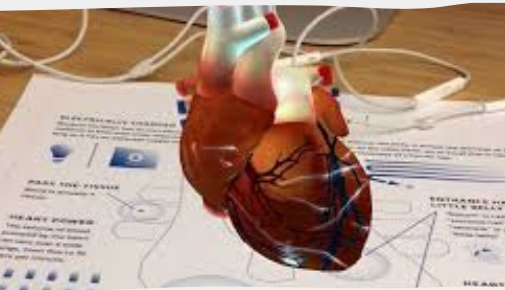
Augmented reality and AI will transform the traditional healthcare business model by offering AR/MR-enabled hands-free solutions and IA-based diagnostic tools. For example, Microsoft Hololens 2 can provide information to the surgeon while allowing them to use both of their hands during the procedure.

With the continued restrictions associated with Covid-19, the use of augmented reality solutions is becoming increasingly important to address issues such as the complexity of remote patient support and the increased burden on hospitals. This includes both telesurgery solutions and mental health apps that are helping people to maintain psychological balance during these difficult times. For example, features such as drawing and annotating on the 3D screen can make communication between doctors and patients much easier and clearer. Remote assistance tools can also help clinicians support their patients while reducing downtime.

Smart Mirrors

As quarantine lockdowns have come to an end and brick-and-mortar stores have seen customers return, there is still an opportunity for AR to help with in-store experiences too. Smart mirrors are a great way to enrich the in-store experience and reduce the load on fitting rooms. Customers can walk up to smart mirrors and try on clothes in-store with advanced AR technologies not available on their smartphones.

Smart mirrors are also helpful in situations where certain sizes of clothes aren't available in store and need to be shipped to customers. Smart mirrors and virtual fitting room technologies from home can help with these needs.

Augmented Reality in Manufacturing

Many AR applications are consumer-focused. However, AR has a lot of potential for use in industries like manufacturing. For example, worker training can be enhanced with AR experiences powered by CAD data. AR can also assist technicians through routine maintenance processes. AR applications can highlight elements of devices being worked on to guide technicians through the process at hand. This is generally more accessible through head-mounted solutions than through mobile applications.

In more simple applications, AR can help give workers more contextual information about objects in a factory when set up appropriately. By highlighting an object with a mobile device, a worker can learn more about it and if any action, such as maintenance, needs to be taken. AR also has a promise for remote troubleshooting. Remote support agents can place virtual markers on the screen for workers to follow on the other end of the call. This can allow for more rich and valuable remote support in factory locations.

Augmented Reality in Automotive Industries

Augmented reality has a number of different applications that can be useful for the automotive industry. One of the more futuristic and interesting technologies emerging in this space is AR highlights on-road objects through the use of a heads-up display (HUD). This can make drivers aware of hazards and GPS directions without requiring them to take their eyes off the road. AR is also in use for entertainment and information, such as 3D car manuals and other applications.
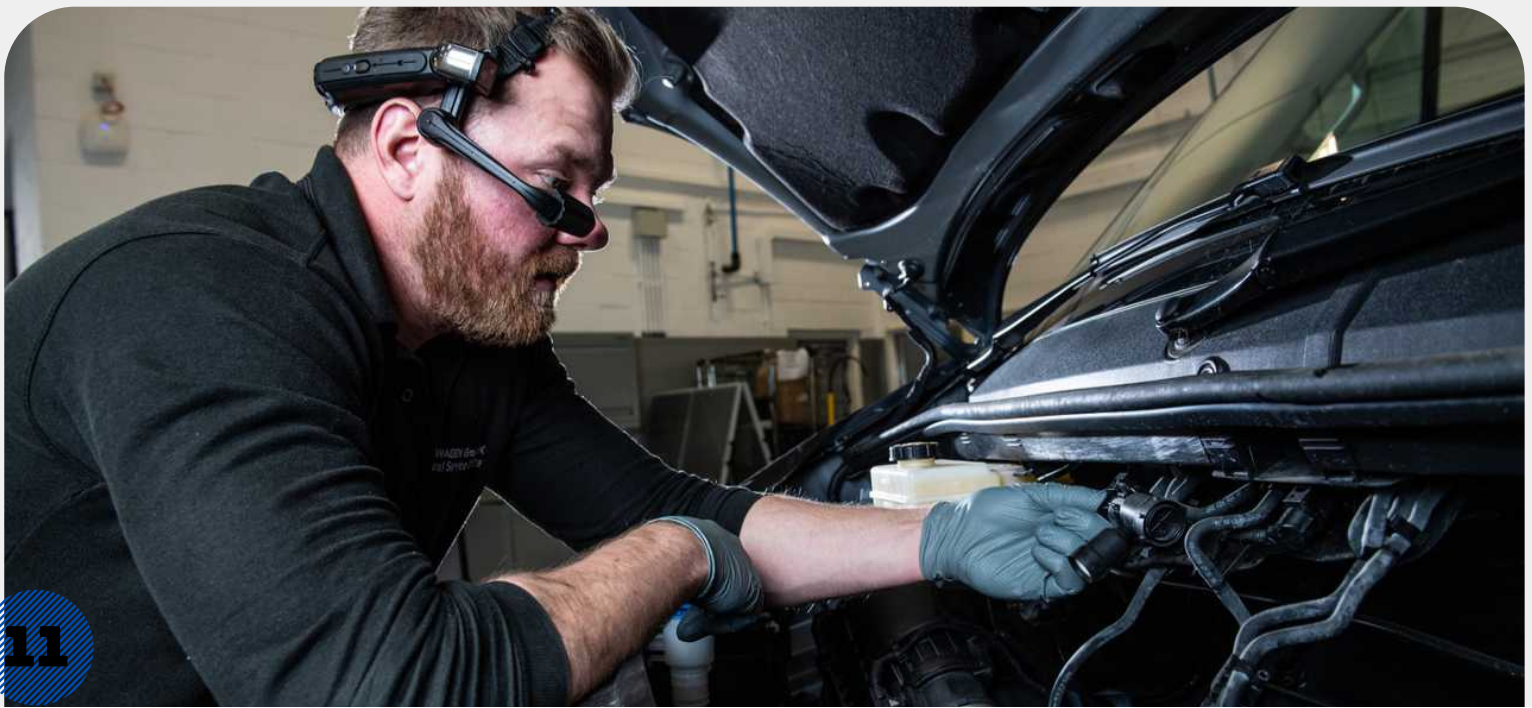
MOBIDEV WAKEUP APP: DRIVER AWARENESS ASSISTANCE

The WakeUp app developed by MobiDev also can be a great example of using augmented reality in the automotive industry.

The objective of WakeUp is to help keep drivers awake by using ARKit facial recognition technology to detect when a driver's eyes are closed or their head is tilted.

If the eyes remain closed or the head is tilted for too long, the device plays an alarm to help wake the driver up.
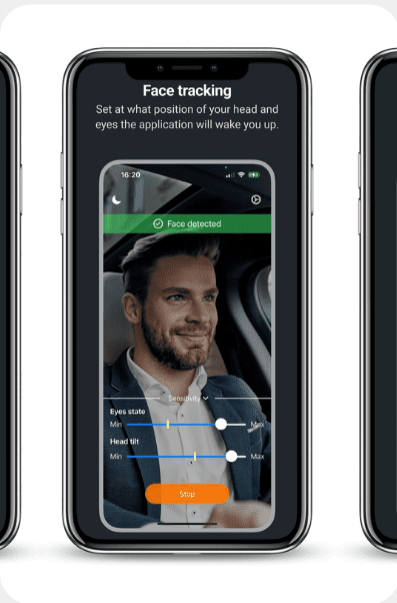
Future of Augmented Reality

The augmented reality market will continue to grow as the years go by, especially as technology becomes more and more accessible to consumers. With there being a significant growth in the focus on metaverse technologies, AR is the next step for many businesses. Those who are playing the long game may want to jump into this sector a bit early.

However, those looking to respond to more immediate growth and change may find better success in retail and mobile applications. AR-capable smartphones and tablets are everywhere and are great opportunities to advertise and extend conversion-driving experiences to users.

With the market expected to reach $97.76 billion in 2028, it's clear that augmented reality is the future for many industries. That future will be determined by businesses that adapt to today's challenges in new and innovative ways.

Companies that offer rich AR experiences to their customers will be much better equipped to stand up alongside their competition.

RESOURCES LIST

Website articles

Reality-virtuality continuum infographic with examples: real environment, augmented reality, augmented virtuality and virtual reality (CreateXR)

CLICK The Future of Community Media is Extended Reality (softgeni)

CLICK Augmented Reality in Education: 7 Awesome Examples (Ryan William, 2020)

CLICK Augmented, Virtual, and Mixed Reality Employee Training (Reid Manning)

CLICK 4 Inventive Examples of Virtual Reality in Education (Bridgette Hernandez, 2019)

CLICK Projected Reality – Outdoors and In (Fred Abler, 2012)

CLICK AUGMENTED REALITY VS. ASSISTED REALITY (Jacob Lauzier, 2019)

CLICK VR Controllers And Accessories For An Immersive Experience

CLICK Augmented Reality (AR) Market Size, Share & COVID-19 Impact Analysis, By Component (Hardware, and Software), By Device Type (Head Mounted Display, Heads Up Display, Handheld Devices, Stationary AR Systems, Smart Glasses, Others), By Industry (Gaming, Media & Entertainment, Automotive, Retail, Healthcare, Education, Manufacturing, and Others), and Regional Forecast, 2021-2028

CLICK +20 Augmented Reality (AR) global market and user statistics for 2022

CLICK 12 Augmented Reality Trends of 2023: New Milestones in Immersive Technology

CLICK Johnston, E. A., Olivas, G. W., Steele, P., Smith, C., & Bailey, L. W. (2018). Virtual Reality Pedagogical Considerations in Learning Environments. Student-Centered Virtual Learning Environments in Higher Education, 21–39. https://doi.org/10.4018/978-1-5225-5769-2.ch002

CLICK Pantelidis, Veronica. (2009). Reasons to Use Virtual Reality in Education and Training Courses and a Model to Determine When to Use Virtual Reality. Themes in Science and Technology Education. 2.

CLICK Five Ethical Considerations For Using Virtual Reality with Children and Adolescents. (2016, August 17). KQED. https://www.kqed.org/mindshift/46103/five-ethical-considerations-for-using-virtual-reality-with-children-and-adolescents

DRINVET
DIGITAL REALITY - THE BASIS OF SKILLS TRAINING

PLACE FOR NOTES

2. Methodology example

Learn, See, Practice, Prove, Do, Maintain: An Evidence-Based Pedagogical Framework for Procedural Skill Training in Medicine
By: Taylor Sawyer, DO, MEd, Marjorie White, MD, MPPM, MEd, Pavan Zaveri, MD, MEd, Todd Chang, MD, Anne Ades, MD, Heather French, MD, JoDee Anderson, MD, MEd, Marc Auerbach, MD, MSCI, Lindsay Johnston, MD, and David Kessler, MD, MSCI
Academic Medicine, Vol. 90, No. 8 / August 2015

Below you can find cited and interpreted perspectives articles to show how the potential use of the DR tools (simulators) from a pedagogical perspective.

You can learn more about the framework and read the full freely accessible article here.

2.1 Learn, See, Practice, Prove, Do, Maintain Pedagogical Framework

2.1.1 Learn

This step focuses on conceptualization. You can assign a reading, didactic session etc. Suitable for both individuals and groups. Verification of the knowledge can be done via standardized tests.

EXAMPLE

Teaching about VR safety:
Provide the necessary knowledge about the subject as you would normally do.
Let your students read the safety guidelines and recommendations.

2.1.2 See

Teacher/Trainer/Educator/Instructor demonstrates the material taught. The demonstration can be done in verbal and in a non-verbal manner. The demonstration can be presented via video or the teacher showing each step to the students. If the demonstration is done by the teacher, you can add your commentary or extra tips.

EXAMPLE

Show the students a video of the task being executed, if you are teaching some abstract concept you can use DR tools as a demonstration. You can also execute the task yourself and teach by example.

Teaching about VR safety:
Show your students the following <u>video</u>.

2.1.3 Practice

Practising the task, procedure or knowledge is to prepare to prove competency (Prove). In this step of the framework, the student/learner practices the task in a safe manner and safe environment.
Key features of practice:
- motivated learners
- well-defined learning objectives of the task/activity/knowledge
- precise measurements of performance
- formative feedback

EXAMPLE

Language learning simulator:
The student wants to practice her/his understanding and pronunciation in a VR environment. The student goes through the VR task or a scenario and at the end she or he is evaluated:
a) by the VR equipment, which shows the student the percentage of how many sentences or words were recognized.
b) by the teacher who observed the student and gave direct feedback to the student on where to improve.

2.1.4 Prove

The learner undergoes an objective skill assessment on a simulator. This step should use SBML (simulation-based mastery learning) which includes:
1. clear learning objectives
2. baseline skill assessment
3. valid assessment tool with predetermined minimal passing standard
4. practice
5. skill testing
6. continued practice as needed to pass the predefined learning objectives

EXAMPLE

Real life operation on a patient:
For this step to be successful and safe, the learner must initially be directly supervised during the performance and receive a real time assessment and feedback on the technique.

2.1.5 Do

The learner undergoes an objective skill assessment on a simulator. This step should move from the simulation to real life. This step is necessary for high-skill education such as medicine, welding etc. Therefore, if you are teaching abstract material you can skip this step. This step is used to refine, polish and practice the task in the real world.

EXAMPLE

Real life operation on a patient:
For this step to be successful and safe, the learner must initially be directly supervised during the performance and receive a real time assessment and feedback on the technique.

2.1.6 Maintain

When competency or knowledge is achieved, and maintenance of the skill is required, the maintenance step starts. This is due to the fact of "de-skilling". The de-skilling is more rapid in the early stages and slows down with more experienced students.

How XR Training Can Improve Employee Performance and Retention?

Comprehensive employee training that makes an impact is essential for business success. Navigating the evolving work environment is more of a challenge than ever before, and many companies are falling short of successfully adapting their training programs.
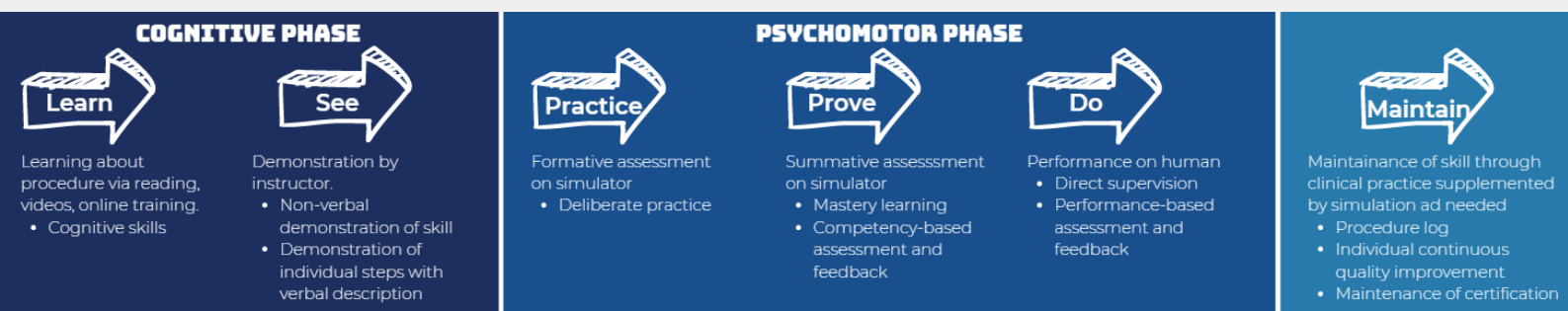Reduced Turnover
Heightened Accuracy
Enhanced Soft Skills and Diversity Awareness

Learn more - XR Training: ROI and Cost Effectiveness

A proposed pedagogical framework for procedural skill training in medicine.

COGNITIVE PHASE		PSYCHOMOTOR PHASE			
Learn	**See**	**Practice**	**Prove**	**Do**	**Maintain**
Learning about procedure via reading, videos, online training. • Cognitive skills	Demonstration by instructor. • Non-verbal demonstration of skill • Demonstration of individual steps with verbal description	Formative assessment on simulator • Deliberate practice	Summative assesssment on simulator • Mastery learning • Competency-based assessment and feedback	Performance on human • Direct supervision • Performance-based assessment and feedback	Maintainance of skill through clinical practice supplemented by simulation ad needed • Procedure log • Individual continuous quality improvement • Maintenance of certification

The progression of the development of expertise in procedural skills using Simpson's and Harrow's taxonomy of psychomotor skill development correlated with the Dreyfus and Dreyfus lexicon of medical skill acquisition.
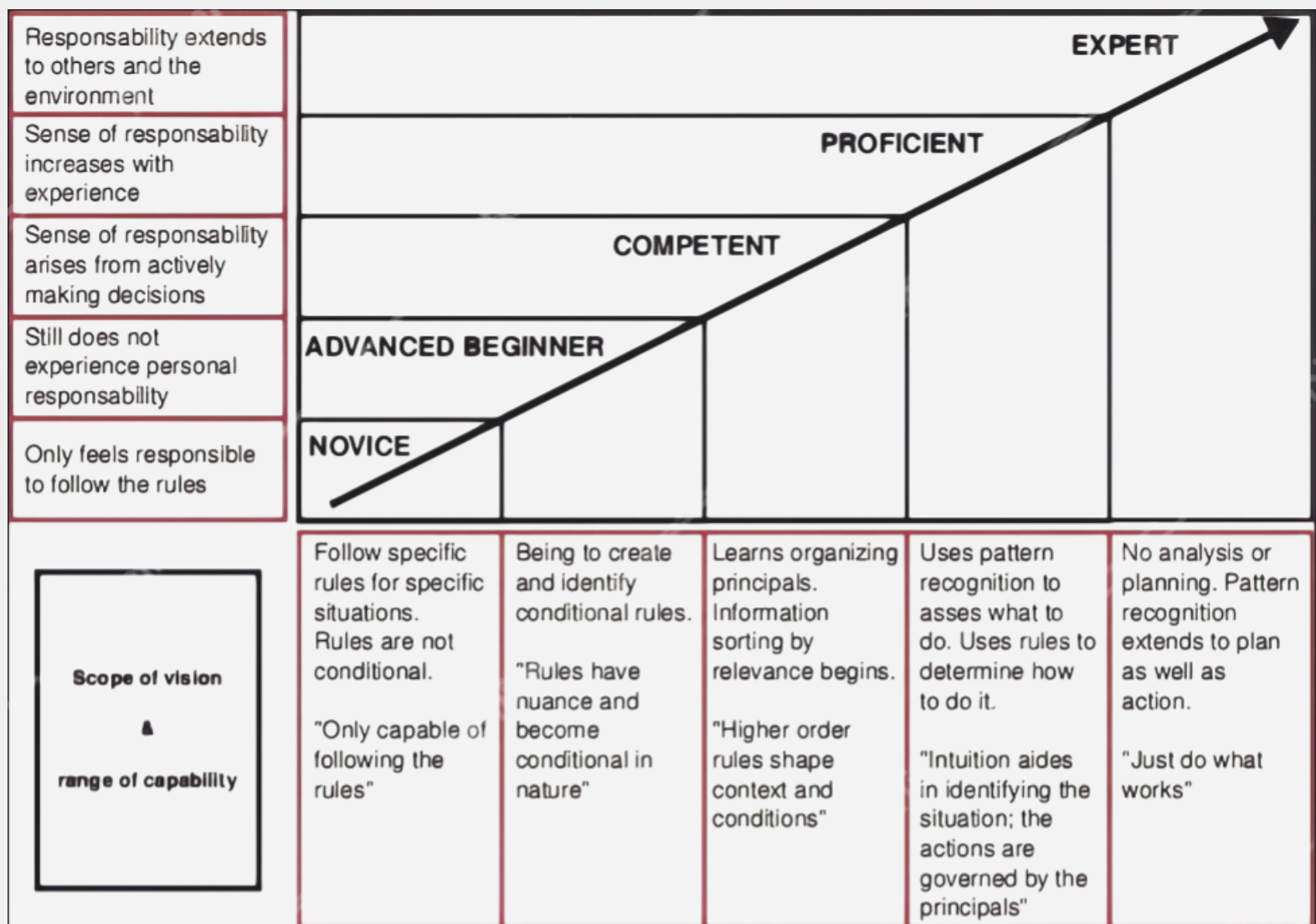
2.2 How to use DR as a teacher/trainer/educator

2.2.1 What does the _educator_ need to use DR tools?

- ✓ General knowledge about what VR/AR/XR/MR is

- ✓ Understanding of safety guidelines

- ✓ Aid the students in safe use of the tool

- ✓ Ability to select appropriate simulators or DR tools

- ✓ Ability to add to the curriculum extra curricular activities

- ✓ Basic technical knowledge of troubleshooting and setting of the DR tools (similar to your mobile phone)

- ✓ Ability to create evaluation questionnaires

2.2.2 What does the **student** need to use DR tools?

✔ Onboarding on how to safely use the equipment

✔ Explanation of awaits in the use of the DR tool (to avoid triggering content)

✔ Protective hygienic gear

✔ If use of personal phones is required, have access to a charging station

✔ A buddy or a classmate (to ensure safe use of the tool in the initial stages)

2.2.3 Questions and considerations

In preparing for VR use, educators will need to consider factors such as:

- Space
- Equipment
- Costs, training
- Potential national certification
- Desired VR content

In many ways, using virtual reality in educational environments is an extension of existing educational technology, such as computer-assisted instruction (CAI), computer-based training (CBT), computer-guided tutorials, and distance learning; however, early decisions should be made about the necessary support.

Hardware and software are required as well as support for installation and maintenance of software. Equipment for virtual reality normally includes goggles for hardware and the VR application that is going to be used.

In addition, computers are needed that may comprise laptops, tablets, and mobile phones. Using the latest and most advanced systems for hardware for virtual reality will be important.

Existing classrooms or studies used as computer labs could work well for teaching and learning with VR. Remote computer labs could function as the context for self-study away from the traditional school environment. Such environments will be effective as long as the necessary hardware devices, for example, an iPhone and a Google Cardboard viewer, and the VR application are available.

ETHICS

1. Long-Term Effects and Prolonged Exposure
2. The Impact of Environment on Agency and Behavior
3. Aggravating Pre-existing Psychological or Emotional Issues
4. (Un)Reality and Diminished Real World Interactions
5. Privacy and Data Gathering

2.3 How to teach using the DR tools?

When assessing DR applications for the curricula:
- know the students;
- assess skills;
- refer to predetermined desired learning goals and outcomes;
- analyze student progress based on desired goals and outcomes
- evaluate
- make necessary adjustments

A key element in DR curricula should be understanding what could enhance student learning, as well as how the student learns and how the experience influences the meaning derived from that experience.

The DR tools can be used to assess multiple types of skills and connections in learning. When assessing the content of the DR application, looking at how and if an individual learned, understood, and was able to apply the knowledge learned made a difference in determining whether to repeat a particular program or not. This is achieved by student feedback on the learning experience.

Assessment for student mastery could depend on predetermined desired skills based on specific pedagogical foundations. For example, if the goal is guided lessons with feedback, direct instruction could be applied; for encounters in an immersive environment, experiential learning could be the choice.

Pre-use planning and post-use assessments consisted of rubrics, self-reflection, observation, and/or mastery goals included in the app content. In pre-use, after instruction in the DR application use and description of what to expect, certain specifics could be disclosed to the student, such as certain goals to achieve or challenges to consider.

Assessment of learning outcomes
Process of appraising knowledge, know-how, skills and/or competencies of an individual against predefined criteria (learning expectations, measurement of learning outcomes). Assessment is typically followed by certification. Comment: in the literature, 'assessment' generally refers to the appraisal of individuals whereas 'evaluation' is more frequently used to describe the appraisal of education and training methods or providers. Source: Cedefop, 2004.

Evaluation of education and training
Judgment on the value of an intervention, training programme or policy with reference to criteria and standards (such as its relevance or efficiency). Source: Cedefop, 2011.

2.3.1 Lesson evaluation

How was the experience? (Qualitative feedback - open ended question)

Is this kind of presentation useful for memorization?

Is this kind of presentation useful for understanding?

Did the presented device seem real?

Would you like to use the system as a part of classes?

How do you rate the experience? (Quantitative feedback - select a scale)

Do you find this tool useful for presenting the exercises?

Do you find this tool useful in passing down knowledge?

2.3.2 What to include in the lesson

1. Briefing of safety guidelines and use of the selected DR tool

2. Demonstration of a safe use

3. Buddy system - work in pairs

4. Pre-defined learning goals
If you want to teach knowledge, having some fact sheets will be beneficial
If you want to teach practical skills, explain what will happen in the DR tool

5. Buddy system - work in pairs

6. Demonstration of a safe use

7. Briefing of safety guidelines and use of the selected DR tool

THE SUPERVISOR
The supervisor should be keeping an eye on the students to make sure they are not tangled in any cords or getting too close to a wall. They should also guide the participant through the experience by giving instructions. The supervisor should generally stay out of the tracked area, except to help put on or remove the headset (if applicable).

THE STUDENT
The participant should be mindful of cables near them and the VR grid that lets them know when they are approaching a physical wall so as to not collide or trip during their time in VR. They should also be communicating any concerns with the supervisor and listen to any instructions they receive.

THE AUDIENCE
The audience should watch the screen or the participant but should not enter the tracked area if the participant is wearing the headset. The audience should also be quiet enough to hear instructions from the supervisor and not prevent the participant from hearing instructions as well.

2.3.3 Criteria for use of DR tools

Use or consider using DR tools when
• a simulation could be used.
• teaching or training using the real thing is dangerous, impossible, inconvenient, or difficult.
• a model of an environment will teach or train as well as the real thing.
• interacting with a model is as motivating as or more motivating than interacting with the real thing.
• travel, cost, and/or logistics of gathering a class for training make an alternative attractive.
• shared experiences of a group in a shared environment are important.
• the experience of creating a simulated environment or model is important to the learning objective.
• information visualization is needed, manipulating and rearranging information, using graphic symbols, so it can be more easily understood. Reasons to Use VR in Education and Training 65
• a training situation needs to be made really real.
• needed to make the imperceptible.
• developing participatory environments and activities that can only exist as computer-generated worlds.
• teaching tasks involving manual dexterity or physical movement.
• essential to make learning more interesting and fun.
• needed to give the disabled the opportunity to do experiments and activities that they cannot do otherwise.
• mistakes made by the learner or trainee using the real thing could be devastating and/or demoralizing to the learner, harmful to the environment, capable of causing unintended property damage, capable of causing damage to equipment, or costly.

Do not use DR tools if
• No substitution is possible for teaching/training with the real thing.
• interaction with real humans, either teachers or students, is necessary.
• using a virtual environment could be physically or emotionally damaging.
• using a virtual environment can result in "literalization" (Stuart, 1992), a simulation so convincing that some users could confuse the model with reality.
• Virtual reality is too expensive to justify using, considering the expected learning outcome.

2.3.4 Safety guidelines

Read the manual from the manufacturer and follow the safety guidelines to improve the durability of the equipment.

With VR training, you want to ensure that your learners are safe. These five tips can help you do so.

- Create A Safe Environment
- Use Short VR Activities
- Use The Buddy System
- Use Proper Sanitation
- Watch For Symptoms

Side effects for VR

The most common "side" effect (health complication) is cybersickness. Cybersickness is closely related to motion sickness. If the person starts to feel nauseous, dizzy or sick, remove the headset immediately. Allow the person to take a break and offer a glass of water. Cybersickness will go away by itself after a few minutes.

Other short-term effects following VR use include:
- eye soreness and trouble focusing
- impaired hand-eye coordination
- reduced depth perception
- decreased reaction time
- loss of balance
- prolonged nausea.

The physiological (bodily) effects that it induces can include:
- loss of spatial awareness
- nausea
- dizziness
- disorientation

Side effects for AR

There are no side effects unless you use a wearable AR equipment, in that case follow the VR information above.

In case of use of the AR in the field (outside a classroom) keep track of the terrain and surroundings and avoid places with traffic as the AR can be very immersive.

20 Minutes

Try to select the learning material which is not shorter than 15 minutes and not longer than 30 minutes. The proper selection will ensure that students will not forget the time. VR is very immersive, and time flies by exceptionally quickly. It is essential to take breaks.

Sit down vs Walking(Room-scale) experiences

There are different types of freedoms inside of virtual reality. In some experiences you can just sit down and enjoy and in some you have to walk and interact. In case you know that your student has motion sickness, try to find an experience where the student does not need to walk or move.

Safe physical space

The designated VR space should not under any circumstances have any objects inside of the VR area (unless you need a chair to sit down). These objects can cause injuries and damage to the VR equipment.

2.4 Example of a lesson

Create Scenarios for Practical Training

Practical training on inland navigation simulators is usually performed in laboratory conditions, but in special cases imposed by COVID-19 restrictions can be done at home. For practical training, the students will have to accomplish the scenario and then upload their work to the virtual classroom, in the Assignment/Practice Module category.

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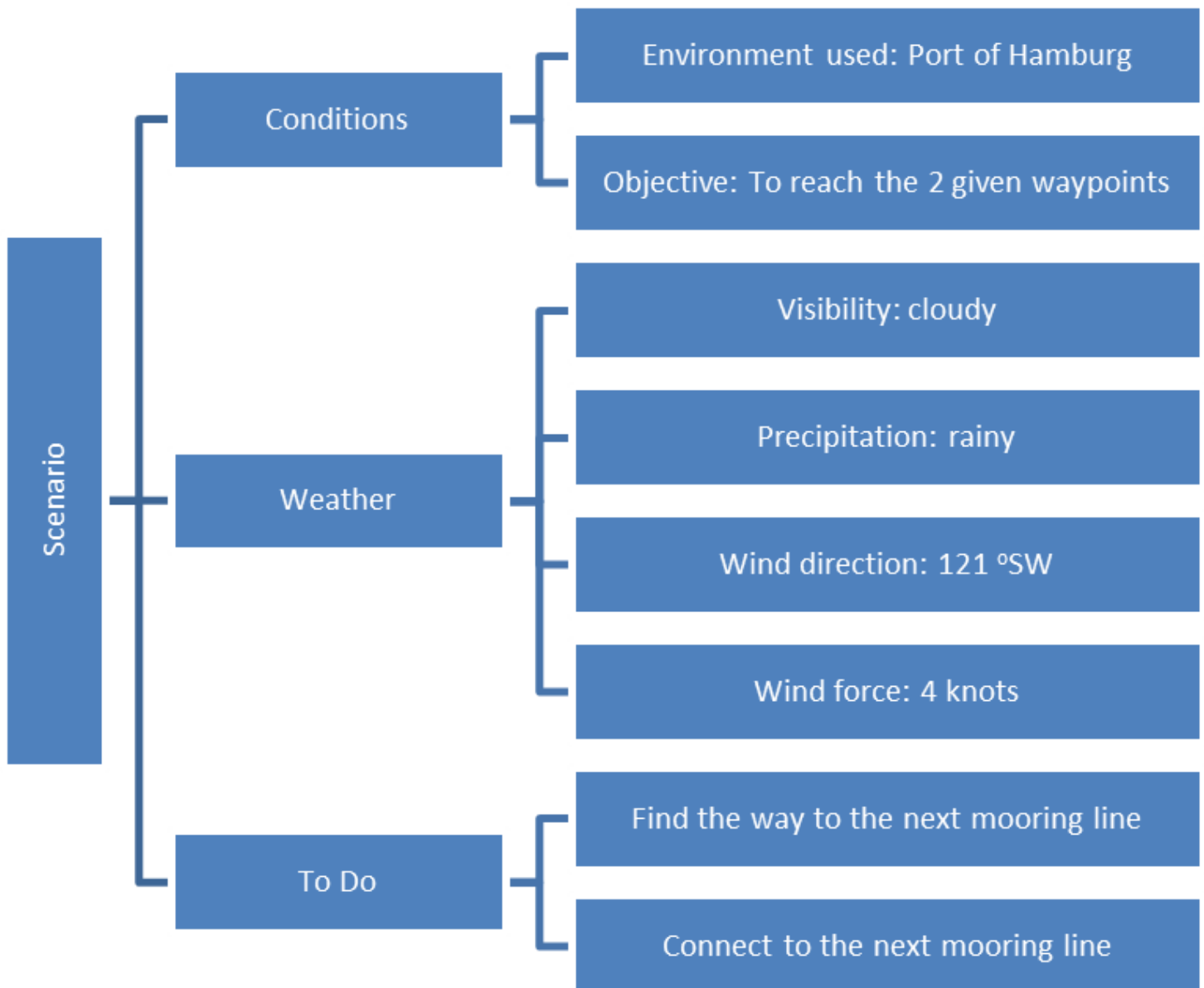
Create Quiz for Theory Assessment

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

Create Scenarios for Practical Assessment

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

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

Evaluate the student accordingly

Use the metrics provided by the software you are using to determine the success of the student in percentage.

Evaluate the experience

It is always good to go and evaluate the experience itself to maintain the main point of using the DR tools - acquire knowledge in a more effective way.

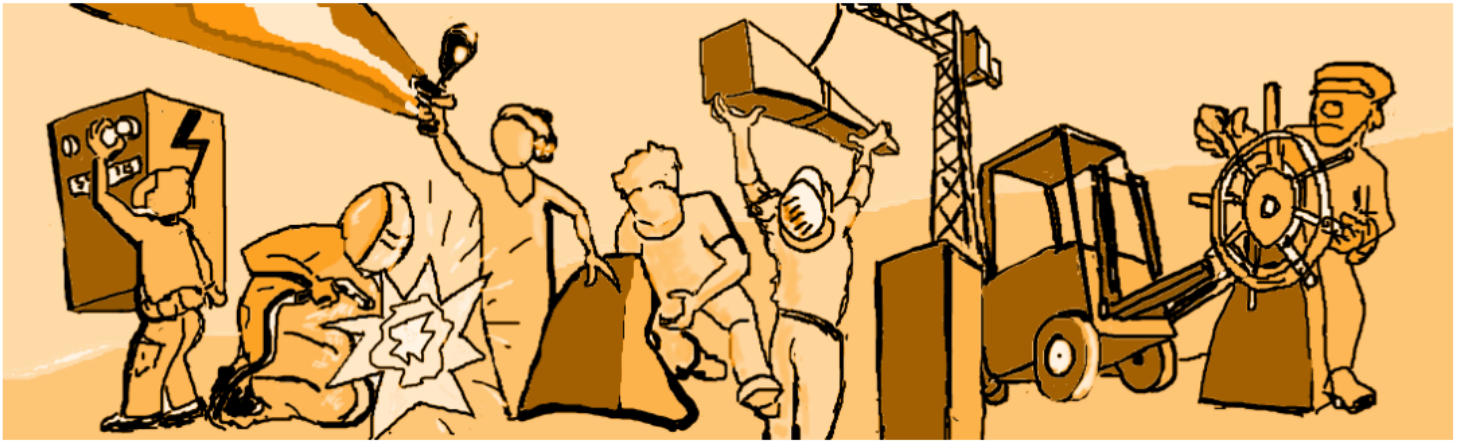# RESOURCES LIST

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DRINVET
DIGITAL REALITY - THE BASIS OF SKILLS TRAINING

PLACE FOR NOTES

DRINVET HANDBOOK

About this handbook

This Handbook on Digital Reality in Vocational Education (DR in VET) is dedicated to teachers, trainers and decision makers in vocational education systems, to help to get familiar with digital reality tools and systems when you plan to implement them. Last but not at least the book is dedicated to the young generation breaking new ways in teaching and learning.

We wrote this book for you because we'd like to :

- show you how VR devices can broaden the horizon
- Introduce the wide range of digital reality solutions
- tips on how to choose the most appropriate solution.
- offer tips new ideas to make learning delightful and funny
- Guidelines for teaching with and implementing digital reality solutions.

Find on ww.drinvet-project.eu/results

CLICK

DIGITAL REALITY

Introductory handbook for skills trainers and teachers

32
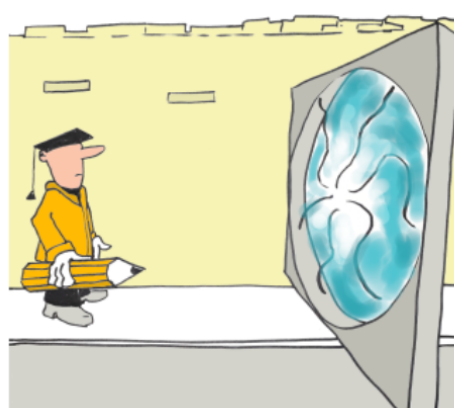
DR DATABASE

Find on ww.drinvet-project.eu/results
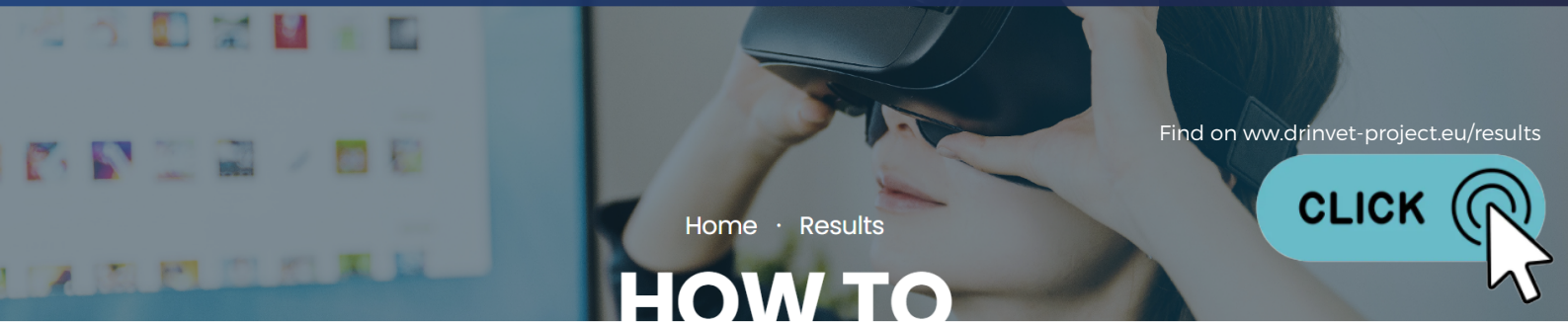
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Home · Platform

VET LIBRARY OF DR

The database consists of the digital content creators/developers (teachers/trainers/specialists) across Europe who can contribute to the development of digital training in the VET field through e.g., elaboration of theoretical lesson materials, practical exercises, and real-life situations that can be simulated using Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR) or in the umbrella term of Extended Reality (XR) technologies.

There is a total of 68 entries and you can search accordingly to your needs. Below is a small peek at the database itself. You can also click on Social media which will redirect you to the social media of the selected solution.

Country	Name of Institution ▲	Level of education	Area of training ⇕	Type od DR⇕	Theory / Practice	Social media
Croatia	VEVU	High	Human anatomy	VR	Practice	🐦🔗📘📷▶️
USA	AfterNow	Adult	Practical Use Cases and Entertaining	MR & AR	Both	🐦📘📷▶️
Italy	Alex Gonzalez VR	All	Education and training	VR	Practice	🔗▶️
USA	Alpine Metal Tech	Adult & Secondary	Teen Driving	VR	Practice	🔗▶️
USA	Apex Officer	Adult	Police	VR	Practice	🐦🔗📘📷▶️
Spain	Apolo Studios	All	Welding, Forklift	VR	Practice	📘
Sweden	BAE Systems Hägglunds	Adult	Military	AR	Practice	🐦🔗📘📷▶️
Canada	CAE VimedixAR	Adult	Medicine	AR	Practice	🐦🅱️🔗📘📷▶️
Belgium, Australia, Denmark, Netherland	Charming	All	Chemistry, Chemical Engineering and Chemical Operations	VR & AR	Both	🐦🔗📘📷

BEST PRACTICES

Find on ww.drinvet-project.eu/results

CLICK

Home · Results

HOW TO

Best practice examples from VET digital classrooms across Europe

RESULTS

Best practice examples from VET digital classrooms across Europe
This document describes practices collected by partners as well as an educational video showcasing how the practice is executed in the partner´s setting using different DR tools.

A total of 16 varied best practices are available on the DrinVET web page.

SUPPORTING DOCUMENTS BEST PRACTICES IN TEACHING AND LEARNING – POWERPOINTS:

Blended Learning	Blended Learning	Criminalistic Inspection	Online Learning
Online Teaching	Welding Learning	Kahoot	Microsoft TEAMs
First Encounter	VR Safety	VR Simulator	Electromechanical
Virtual Tour	Training System	VR Training	VR Simulator

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CLICK

Home · Results

TECHNICAL MANUAL

Minimum conditions for education, training and testing in educational processes in virtual environment

RESULTS

6. MINIMUM REQUIEREMENTS FOR INTEGRATION OF DIGITAL REALITY IN EDUCATIONAL PROCESS

In addition, teachers who to use RD tools in their c must have certain chara such as being proficient of these tools in general have an open mind to le improving their manage their integration through methodological innovati a comprehensive and ef of RD.

Finally, the importance of assessments should be noted. With a n methodology and new tools, teachers need to adapt their assessm end, in IO4 of this project, a pedagogical guide has been develope relevant aspects to ensure quality when performing online asses rules, examples and templates.

5.1. Learning benefits and li Reality

Extended reality presents some differe respect to its application in teaching. O offers even greater immersion, however of various technologies and tools, as we

Ortega-Rodríguez (2022) points out fou sector:

- The high investment required f create new learning experienc possible to create new learning
- The personalization of training. point, so that the pace of learni learning pace and teaching ap needs of each student.
- The integration of active meth which involves the developmer or flipped classroom, in which f prepare the syllabus before a c put the content into practice.
- The search for meaningful learning, which does not conceive of emerging technologies only as an end, but also as tools at the service of teachers and students to improve the teaching-learning process (p.201).

2. AUGMENTED REALITY IN THE EDUCATIONAL PROCESS

Augmented Reality (AR) emerged around 1992 by Tom Caudell when he developed a device that helped electricians in an aeronautical factory to perform their work with information added through glasses (Kreleven, 2007). Augmented Reality is understood as

www.drinvet-project.eu

ns of the e-Learning application, student and eated. With this, the practice and performance of ored to see their progress, as well as their strengths y, the contents and practices can be adapted to aspects for each student.

red by this tool is the possibility of connecting te a simulation classroom, so that the instructor can ractice being carried out by each of the students in mented Lab and is usually connected to a physical

various welding processes (GMAW, FCAW, SMAW rent positions and materials (carbon steel, stainless efore, it is a tool with multiple simulation llows to configure customized practices, apart from d with the simulator. In this configuration you can different parameters such as wire diameter, gas (in t), bead length, number of passes or pattern,

Images: ATS

MINIMUM REQUIEREMENTS FOR THE EGRATION OF DIGITAL REALITY IN THE EDUCATIONAL PROCESS

et's highlight what is needed from trainers and training centers to n effective integration of the different forms of Digital Reality in the onal process.

n requirement for the incorporation of AR, VR, MR and XR in on is to ensure the "specific training of teachers in order to create s that improve the teaching-learning process" (Ortega-Rodríguez, 94), as well as to certify their knowledge of the tools with which they g to teach in the classroom. Therefore, it is essential, first of all, to il-trained and qualified trainers, both in their subjects and in the ion of the tools.

ther hand, it is necessary to have access for the creation of content with DR, as well e devices with which to implement it[4]. In of using specific solutions, it will be ry for them to receive training from the tion company and be given access to the prior to its implementation in the m in order to be able to practice what learned before teaching.

Simulators
- Kyalio

4- For more information access to IO3 HOW TO... Best practice examples from VET digital classrooms across Europe.

22

Technical Manual

Tools and requierements for the integration of Digital Reality in Education

Prepared by
DRinVET project n° 2020-1-HR01-KA226-VET-094650

ONLINE ASSESMENT

GUIDELINE FOR ONLINE ASSESSMENT

Tools with procedures to perform harmonized online assessment of learnings gained though virtual environment

RESULTS

Guidelines and online tools to ensure quality when performing the assessment of Digital learning outcomes. The guidelines describe the procedures and conditions in which the online assessment shall be conducted and also consider best-practices in development of the assessment tools, which is in the form of case study projects, multiple choice questions, and short essays.

Examples of online assessments in the form of case study projects, multiple choice questions and short essays:

Case Study Projects

Multiple Choice Questions

Short Essays

Good Assessment Practices Using Simulators

Templates for online assessment in the form of case study projects, multiple choice questions and short essays:

Case Study Projects

Multiple Choice Questions

Short Essays

CLICK

Find on ww.drinvet-project.eu/results

ANNEXES

DRINVET
Intellectual Output 4

Task 1 - Identify which technological means are currently available and how are they used

PDF

NATIONAL PLANS CROATIA

General Overview

In the Republic of Croatia, it was founded in 1991 Croatian Academic and Research Network – CARNET is a public institution operating within the Ministry of Science and Education in the field of information and communication technology and its application in education.

CARNET network is a private network of the academic, scientific and research community of the Republic of Croatia and the institution within the primary and secondary education system.

CARNET services are available to primary and secondary schools, institutions from the science and higher education institutions, as well as to numerous public institutions such as certain ministries, hospitals, etc. 4130 locations across Croatia are connected to the CARNET network.

National Development Strategy of the Republic of Croatia until 2030
Strategic goal 2: Educated and employed people
Priority areas of public policy:

Accessibility to early and preschool education.
Acquisition and development of basic and vocational competencies.
Implementation priorities in the field of education policy:

- Improving reform processes by defining the structure of national curricula and adapting educational institutions to a curriculum approach based on learning outcomes and a student-centred approach to educational work
- Improvement and modernization of the primary and secondary education system in order to extend the effective time spent in learning and achieve the set educational outcomes
- raising reading, mathematical and science literacy
- developing analytical reasoning and critical and creative thinking, as well as algorithmic and conceptual thinking
- promoting the cognitive, ethical, emotional, aesthetic and physical development of children and students
- ensuring equal conditions for systematic upbringing and education by gradually introducing full-time classes for primary school students
- developing comprehensive support for children and pupils and preventing them from leaving the education system and joining the NEET group, with a focus on vulnerable groups and children and pupils with disabilities
- Ensuring early recognition and support in the upbringing and education of gifted children and students
- raising the qualification standards of teachers and principals and attracting and retaining quality educational staff, with special emphasis on those for whom there is a shortage of educational-educational system

- increase the quality, efficiency and relevance of the vocational education system by strengthening and promoting work-based learning, excellence and flexibility
- further development of regional competence centres and improvement of the quality of work of vocational schools and their connection with the economy and the labour market
- development of core competencies, including "learn how to learn" competencies and entrepreneurial competencies
- Encouraging and rewarding innovative, creative and entrepreneurial endeavours of educators and students
- Improving the quality and relevance of adult education programs in order to increase the share of the adult population in lifelong learning processes
- strengthening the information and communication infrastructure in educational institutions and digital literacy of students and educators
- development of a comprehensive and computerized system for ensuring the quality of education and increasing the level of digital maturity of schools.
- Improving higher education
- Harmonized and promising labour market

Strategic goal 11: Digital transition of society and economy
Priority areas of public policy:
The digital transition of the economy
Digitization of public administration and justice
Development of broadband electronic communication networks
Development of digital competencies and digital jobs
Priorities for the implementation of policy in the field of education and training and work in a digitally transformed society:
increasing the number of highly educated ICT professionals entering the labour market
raising the digital competencies of professionals from non-information professions
support for secondary and higher education for jobs in the digital society
retraining and acquiring digital competencies needed for jobs in the digital society
raising the level of basic and advanced digital skills of citizens for active participation in the digital society.

CROATIA NOW

Computer security	Communication and collaboration	Training and consulting
Content Filtering Vulnerability Scanning Abuse Service	Distance learning Office 365 for Schools Google Workspace for Education CARNET Medusa CARNET Video Conferences News	CARNET Users Conference CUC Modern Technologies in Education – MTE Advisory and Educational Support for the Implementation of E-learning

Internet services	Digital education enablers	CARNET connection
CARNET Services Hosting for Schools CARNET Webmail CARNET Web for Schools CARNET mToken e-Citizens mToken Electronic Certificates Mobile Device Management (MDM) MSDC Domains Public server Services for CARNET System Engineers	e-Class - e- Class Register for schools - e-Class Register for Teachers - e-Class Register for students and parents Loomen e-lektire Portal škole.hr e-Laboratory Portal Nikola Tesla Edutorij Digital Educational Content – e-Schools DEC e-Schools Teaching Scenarios Education management application – EMA Services for e-Schools - CARNET AERO - CARNET Delta - CARNET Sigma - CMS Clasroom Management System	Permanent Connection Individual Users Access to the CARNET Network CARNET meter

CROATIA
CARNET PROJECTS COMPLETED

EU programmes and projects	CARNET projects
e-Schools: Establishing a System for Developing Digitally Mature Schools (pilot project)	ProMikro – Equipping Primary Schools with Microcomputers
An Approach to Motivating learners to Read in European Schools – AMORES	National Secondary School Leaving Examination
Assessment of Transversal Skills 2020	E-learning Academy
ACDC – Advanced Cyber Defence Center	eSkills
CRISS	ICT Edu
Capacity building for the development of accessible digital content	MS Wi-Fi in Schools
e-VET READY	Schools 2.0
ECOLAV	Classroom of the Future
Empowering CARNET employees in Social Media, Adult Education and Leadership	Pilot Projects
Ensuring Access to Croatian Public e-services within e-Citizens Platform	
eVET2edu	
GrowCERT	
I CT Curricula	
ICT Knowledge Exchange	
Inspiring Science Education	
Capacity building for the development and review of CARNET's services connected with the Use of ICT	
Open Discovery Space (ODS)	
CARNET Study Visit	
Stronger Together	

NATIONAL PLANS DENMARK

The adult vocational training system in Denmark has a long tradition and is based on close cooperation with social partners at the national level.
The vocational training programmes are secured through:
1) tripartite agreements between the employers' organisations, the trade unions and the government;
2) the legal framework for adult education is based on negotiations between these parties;
3) the financing of adult education depends on both public funding and funds from social partners. It is also in this context that priorities and strategies for digital development within the field of adult education are set.

Furthermore, the social partners, who continuously assess the need for competencies in the Danish labour market, carry out the development of vocational training programmes in accordance with the identified needs.

National Strategy for Digitalization (May 2022)
In October 2021, the Danish Government Digitisation Partnership presented 46 recommendations for how to harness the possibilities of digital technologies in Danish society. Based on these contributions, the Danish government presented the National Strategy for Digitalisation in May 2022.

The visions of the strategy
Vision 1 - Strengthened cyber and information security
Vision 2 - Coherent service for people and businesses
Vision 3 - More time for welfare through increased use of new technology
Vision 4 - Increased growth and digital SMEs
Vision 5 - The digital healthcare of the future
Vision 6 - Acceleration of the green transition through digital solutions
Vision 7 - A strong, ethical, and responsible digital foundation
Vision 8 - Denmark at the centre of international digitalisation
Vision 9 - A population ready for a digital future

The aim of the strategy is for more Danes to acquire better digital skills by 2030 to be equipped to meet the demands and opportunities offered by digital development.

Learn more HERE.
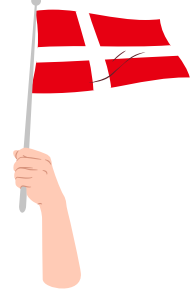
NATIONAL PLANS DENMARK

Current national strategy on digitization in the VET-sector
The national strategy for the digitization of VET was launched in 2018. As part of the strategy, three analyses were carried out:
a) Opportunities and barriers to e-learning
b) The use of digital offerings in VET by enterprises and the workforce and
c) Practices for digitising VET.

The national strategic effort for digitization was initiated in 2018 with the initiation of three analyzes of opportunities and barriers for e-learning courses, companies and the workforce's use of digital offers in VEU and practices for digitalization of VEU. All three analyzes show that there is great interest in prioritizing e-learning and blended learning, both on the part of institutions and companies and that it is the flexibility of e-learning, in particular, that is attractive.

Based on the analyses, a pool was initiated in 2019 to test collaboration models on digital teaching courses in the VEU area and a project on capacity building for teachers in general adult and continuing education.

Further information on digitization and the use of digital tools in VET:
• For further information on Adult Vocational Training in Denmark, please see the following link:**https://eng.uvm.dk/adult-education-and-continuing-training/adult-vocational-training**

• You can also find a lot of useful information about digitization in adult education and descriptions of best practices in both Denmark and throughout Europe on the platform EPALE (Electronic Platform for Adult Learning in Europe), which is funded by the European Commission: **https://epale.ec.europa.eu/en**

• The Danish National Agency for IT and Learning (STIL) promotes digital development within all the ministry's (Ministry of Children and Education) areas and carries out tasks within the overall objectives of the Ministry. Their website has detailed descriptions of the digital learning platforms used in the Danish Education system. Please note, the platform is only available in Danish: **Forside - Styrelsen for It og Læring (stil.dk)**

• You can find more information about adult education and diploma programmes on a higher education level on the website of the Ministry for Higher Education and Science: **https://ufm.dk/en/education/higher-education/business-academies-1**

Relevant excerpts from the Hungarian National Digitalization

Strategy (NDS) source: https://digital-strategy.ec.europa.eu/en/policies/broadband-hungary

Main aims and measures for broadband development

Hungary's National Digitalisation Strategy 2021-2030 was approved in Autumn 2021. The strategy is based on four pillars: digital infrastructure, digital skills, digital economy and digital state. It sets out the following targets to be achieved by 2030:

- 95% of households are covered by gigabit networks,
- less than 2% share of people without digital skills in the 16-71 age group,
- more than 30% of processes in businesses are digitalised,
- 90% of inhabitants use e-government services.

The strategy outlines infrastructural, educational and economic support measures. To ensure the availability of wired and wireless digital infrastructure with adequate service capability and quality, the strategy foresees the development of gigabit networks, digital infrastructure of educational and higher education institutions, further development of the national telecommunications backbone network, wireless communication for professional organisations, expanding supercomputing capacity as well as encouraging the development of 5G networks.

The development of gigabit-capable networks will include wide implementation measures:
- planning and implementation of a nationwide "Gigabit Hungary 2030" network development programme, connected to 5G, in order to have internet connections with speeds of at least 1 Gbps available by the end-2030,
- clarification of infrastructure and network sharing under competition law and regulation of access to optical and radio networks, in particular the sharing of passive (and partly active) infrastructure elements,
- transposing the European Electronic Communications Code into national law,
- reviewing and, if necessary, amending the rules for the construction of telecommunication networks,
- alleviating the reporting and administrative burdens on service providers,
- reviewing the quality and consumer protection regulations for communications services, reviewing standards, formulation of minimum requirements,
- review of the Communications Regulation to better support policy objectives related to digitisation, micro- and macro-level competitiveness,
- updating national standards for electronic communications networks,
- positioning digital networks as critical infrastructure for the general public

Encouraging the development of 5G networks will need further multiple actions:
- strengthening and expanding the activities of the 5G Coalition,
- launching strategic agreements between service providers and the government to accelerate state-of-the-art fixed & mobile and converged technology developments,
- development of R&D&I support scheme in line with digital infrastructure development, especially 5G,
- development of Széchenyi István University 5G Center of Excellence,
- contribution to the construction of EU 5G corridors,
- preliminary analysis of 6G technology.

Specific goals:

The achievement of the overall objective of the NDS is supported by the following **specific objectives for each pillar**:

1 The availability of wired and wireless **digital infrastructure** of sufficient quality and coverage;

2 Continuous improvement of citizens ' digital skills and workers' **digital skills**;

3 Increasing the **digital readiness of businesses**, the **integration** of digital technology, and encouraging the development and uptake of innovative digital solutions;

4 Expanding the range of available customer-friendly **digital public services** and strengthening the openness and motivation for their use among citizens and businesses, creating cross-border service delivery in the areas expected by the EU and supporting all this by increasing the efficiency of administrative back-office processes through automation and developing a web of interoperable data connections for data-driven operations.

Relevant indicators of the National Digitalisation Strategy

DIGITAL COMPETENCE

- **DK1**: The proportion of people without digital skills (the proportion of people aged 16-74 who do not use the internet) should fall below 2% by 2030
- **DK2:** The proportion of regular internet users among 16-74-year-olds should be 100% by 2030
- **DK3:** The share of graduates of its higher education majors in bachelor's degrees should double (14%) by 2030

Indicator	Baseline (year)	Target (year)
DESI Human Capital Index (sub-index) annual value	41.8% (2020)	60% (2030)
The proportion of people without digital skills(proportion of people aged 16-74 who do not us ethe internet)	14.2% (2019)	2% (2030)
Regular internet use rate among 16-74 year old	87% (2019)	100% (2025)
The proportion of graduates of higher education programmes in computer science for bachelor's degrees	7,56% (2018)	14% (2030)

NATIONAL PLANS HUNGARY

Strengths

1. Full Internet coverage, high WiFi institutional coverage

2. Citizens aged 16-50 have a high number of internet users

3. Development/extension of TWIN programs

4. Introduction of DigKomp 2.1 framework

5. There are well-functioning digital competence development projects

6. The number of e-learning-based training/upskilling is increasing in all segments

7. NAT includes the knowledge needed to acquire high-level digital skills

8. Thanks to the Sulinet program, the digital infrastructure has improved and the equipment supply of Hungarian schools has increased

9. Djp Network coordinated by Digital Well-Being Coordination Center (DJKK) with nationwide coverage of 1681 DJP Pontoons and nearly 2000 DJP With a mentor, you can reach 1 Million citizens

Weakness

1. Digital illiteracy is well above the EU average

2. Awareness of adult education programmes is low

3. There has been no widespread DigiKomp 2 survey to assess real needs/identify action points

4. Low number of users of digital competence development programs, low awareness of programs

5. The number of modern digital devices is low in educational institutions, the replacement of outdated devices is possible

6. Low awareness and uptake of teleworking and distance learning opportunities
.
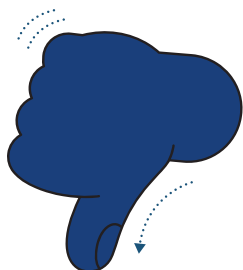
In general education, digital competence is not sufficiently developed in other subjects besides the field of digital culture, as these do not appear among the development tasks or appear only to a limited extent, and the preparedness of teachers and the equipment are insufficient, the proportion of independent IT occupations is low

NATIONAL PLANS HUNGARY

Options	Threats
1. Extend existing good digital education and competency development programs	1. Lack of support (e.g. lack of equipment) means that the transition to digital education is lagging behind Low willingness to transition due to resistance from teachers/students (low digital competence)
2. Greater involvement of the market sector to increase digital competence (private-public cooperation programmes)	2. Low willingness to transition due to resistance from teachers/students (low digital competence)
3. Extension of free labour market entry programmes, especially for the over-50s	3. The large number of digitally illiterate people is an economic burden on society: a) declining employment opportunities b) the need to maintain hybrid solutions further c) slowing down the spread of digitally based, cost-effective solutions d) there should be no technological advantages – eg. health solutions – realising
4. Reducing digital unemployment	4. people over 50 years of age permanently they are "stuck" in the camp of the digitally illiterate, so their employment chances are significantly impaired
5. Increasing the number of participants in IT training/VET	5. The digitalisation of jobs is at a faster pace than digital workforce developmen
6. Digital competence development across the entire spectrum of education can lead to significant labour market capacity buildin	6. Due to a lack of resources (few teachers, tools for education , incomplete modern knowledge transfer), the labour
7. Clearly defined roles and effective government coordination can help to make proper use of development fund	7. The lack of ICT developments in public education and higher education institutions causes labour market disadvantages and competitiveness problems for individuals, businesses and the state
8. DJP Network can reach more than 1 Million citizens	8. The lack of capacity of the institutional system for allocating EU funds may hinder the timely use of funds, lack of project management knowledge can delay the process of implementation
9. The DJP Network's 1681 DJP Points attract thousands of people every week, and their involvement is still an option in the future	

NATIONAL PLANS PORTUGAL

The education and training system in Portugal comprises optional preschool education, covering children from three to six years old; basic education (nine years), integrating three cycles (EQF levels 1 and 2); secondary education (EQF levels 3 and 4); post-secondary non-tertiary education (EQF level 5); and tertiary education (EQF levels 6, 7 and 8) (Portugal (europa.eu)).

VET programmes are usually part of secondary education but, in 2004, education and training programmes for young people were introduced in the second and third cycle of basic education. In the 2020 national reform programme, among the targets identified to be addressed, one of the relevant aims for the purpose of this task, is to reduce the number of individuals without basic digital competencies. This objective emphasises the importance of combating existing inequality and the socioeconomic effects of the Covid-19 pandemic and upskilling human resources to boost the economy (XXII Government of Portugal, 2020 - Government Composition - XXII Government - Portuguese Republic (portugal.gov.pt)).

For this document, the information provided has per based on the Action Plan for the Digital Transition, published in 2020, by the Minister of State, the Economy and Digital Transition of Portugal, since one of its missions is to track the implementation of the inter-ministry measures to carry out the Government's Programme on the digital transition, jointly with the Minister of State and Finance, the Minister of the Modernization of the State and Public Administration, the Minister of Science, Technology and Higher Education, the Minister of Education, the Minister of Labour, Solidarity and Social Security, the Minster of Infrastructure and Housing, and the Minister of Territorial Cohesion (Economy and Digital Transition - XXII Government - Portuguese Republic (portugal.gov.pt)).

The Action Plan for the Digital Transition contains three pillars: Pillar I: Qualification and digital inclusion, Pillar II: Digital transformation of the business sector and Pillar III: Digitalization of the Stat. To provide information for the sections below, the focus fell upon the first pillar. Pillar I: Qualification and digital inclusion addresses people's empowerment and digital inclusion, and has three sub pillars concerning digital education, vocational training and re-qualification and inclusion and digital literacy. The main aims of this pillar are Digitalization Program for Schools; an Intensive and specialized digital training program for 3,000 professionals; Digital Inclusion Program for 1 million adults and a Social tariff for access to Internet services (Action Plan for the Digital Transition in Portugals).

Portugal Digital exists to speed up the country's digital transformation so that no one is left behind, projecting Portugal to the world, towards becoming a digital nation. (Home - Portugal Digital). The Action Plan for Digital Transition approved by the Council of Ministers' Resolution No. 31/2020 reflects the strategy defined for the country's digital transition, as laid out in the Portugal Digital Mission Structure (Plano de Ação para a Transição Digital de Portugal (portugaldigital.gov.pt)). Includes three main pillars of action: Empowerment and digital inclusion for everyone; Digital transformation of business environment; Digitization of the State.

Digitisation Programme for Schools consists of the development of a programme for the digital transformation of schools, through the constitution of a working group led by the governmental area of education, to analyse and propose the Programme, which should contemplate the following dimensions:

- provision of individual equipment adjusted to the needs of each educational level for use in the learning context;
- guarantee free mobile connectivity for students, teachers and trainers of the National Qualifications System, providing quality access to the Internet at school, as well as access to the Internet anywhere; access to quality digital educational resources (e.g., textbooks activity booklets, interactive lessons, interactive tests, exam preparation, performance analysis, diagnosis and performance analysis, diagnosis and proposal of learning pathways, progress reports for dictionaries);
- access to collaborative tools in digital environments that promote innovation in the learning process, stimulate creativity and innovation, allow distance monitoring of the classroom (especially in the case of illness or special needs) and online collaborative work, and bring the student closer to the teacher and his or her parents, and online collaborative work, bringing new generations closer to the new paradigms of life in society and the society and the world of work;
- definition of processes leading to the electronic performance and grading of external assessment tests in a digital environment.

The programme also foresees a strong investment in the training of teachers, trainers of the National Qualifications System and information technology technicians in each school, through a digital training plan for teachers, which ensures the acquisition of skills necessary for teaching in this new digital context.

Expected benefits:
This measure will actively contribute to the technological modernisation of schools, bringing students closer to the productivity and collaboration tools that they can find in a professional working environment.
This measure is coordinated by the governmental area of education and involves the governmental area of the economy and digital transition entity.

Digital school (Getting to know the Digital School - Portugal Digital) aims to provide computers and internet access, as the beginning, so all students, teachers, and schools can collaborate, teach and learn in a digital environment. The key initiatives to implement the Digital School in Portugal are:

-Provide equipment and an internet connection to students, teachers, and schools;
-Instruct and prepare teachers for a digital world;
-Provide digital collaboration platforms and access to digital pedagogical resources for students and teachers;
-Establish an action plan for digital development in each school.

Programme of intensive and specialised training in the digital area – Upskill consists of the creation of a national programme for the reconversion of 3.000 active, employed and unemployed people, into ICT professionals. The programme involves a period of intensive training, of six and nine months, using the network of polytechnics for the theoretical training, during which the trainees are supported by the Government, followed by practical training in a work context and their professional integration in a company.

In the implementation of the initiative, the importance of the involvement of the following actors stands out, responsible for the realization of a set of actions, namely:

- Adherent companies, through the completion of a survey on TICE competence, need in the next three years; to develop training content in conjunction with polytechnics and the Employment and Professional Training Institute, I. P. (IEFP, I. P.), and the National Agency for Qualification and Vocational Education, I. P. (ANQEP, I. P.); shared teaching of the courses in the practical training component in a work context; commitment of employability of the trainees after the conclusion of the training courses.
- Polytechnic Network, IEFP, I. P. and ANQEP, I. P, through the operationalisation of the training programme, in line with the identified needs plan and employability commitment of the adhering companies; adaptation of the training portfolio, in order to respond to the needs expressed by the programme.
- Trainees, by accessing the programme through a pre-qualification and selection mechanism; obtain a good performance in order to ensure integration in a Company (profile of intermediate or higher specialisation in a situation of unemployment or in functions that do not capitalise on their potential).
- Government, by guaranteeing a training grant equal to the value of the national minimum wage during the training period; availability of the subsidy program to support the construction of contents and time of teaching developed by specialized professionals from each company.
- Expected benefits: This measure is expected to actively contribute to the reconversion of 3,000 workers into ICT professionals, thus increasing net qualified employment, the average remuneration of workers and the satisfaction of national companies' demand for this type of professional; it will be coordinated by the Portugal Digital Mission Structure and involve the Governmental area of the economy and digital transition, governmental area of labour, solidarity and social security, the governmental area of science, technology and territorial cohesion, Polytechnic Network and adherent companies.

Adult Digital Inclusion Programme consists in the development of an educational project for the digital inclusion of one million info excluded adults within the legislature, based on a national network of 10,000 young volunteers and 950 training centres. The basic training contents covered in the programme involve among others, the creation and management of an e-mail account, the ability to search online consultation and use of digital public services, and access to services such as home banking or access to social networks. The initiative comprises the following activities: development and monitoring of a National Network with 950 centres (secondary schools, universities, polytechnics, Private Social Solidarity Institutions, and universities, among others); development and monitoring of a National Network of 10,000 young volunteers; and programme communication actions (publicity, events and media), online presence (centres' website, volunteer App and centres, Volunteer App and social networks) and global coordination of the programme.

This measure is expected to actively contribute to the training of 1,000,000 info-excluded adults in basic digital skills by 2023, thus reducing the percentage of the Portuguese population that does not enjoy the benefits of digitalisation in several domains, among which are communications, access to information and use of digital public services; it will be coordinated by the Portugal Digital Mission Structure, and involve the Governmental area of the economy and digital transition, governmental area of Finance, Governmental Area of the Presidency of the Council of Ministers, Governmental Area of Science and Higher Education, Government of Education, Government of Modernisation of the State and Public and Public Administration, the governing area of labour, solidarity and social security, the governing area of territorial social, the governing area of territorial cohesion, the governing area of agriculture, local authorities among others.

Social tariff for access to Internet services consists in the creation of a social tariff for access to Internet services, allowing a more generalised use of this resource widespread use of this resource, to promote inclusion and digital literacy in the most disadvantaged sections of the population. This measure is aligned with the capacity-building initiatives included in the XXII Constitutional Government's Programme**,** inserted in axis 1 of the INCoDe.2030 Program, which promotes digital literacy and the use of basic digital services that need connectivity guarantee, namely consultation and use of digital public services; access to home banking; and email account management.

Expected benefits: This measure will actively contribute to promoting inclusion and digital literacy among the most disadvantaged sections of the population and reduce the percentage of citizens who do not use the Internet.

This measure is coordinated by the Portugal Digital Mission Structure and involves the Governmental area of the economy and digital transition, the governmental area of the presidency of the council of ministers; the governmental area of work, solidarity and social security social, infrastructures, territorial cohesion, ANQEP, I. P., National Authority of communications, the association of Electronic Communications Operators and telecommunications operators.

To ensure the management and operationalization of this strategy for digital development, the "Digital Portugal" was created, which is a technical structure for monitoring and implementing the measures approved under the Digital Transition Action Plan (Resolution of the Council of Ministers no. 31/2020). It aims to support the coordination of the Plan, its articulation with other programs and the communication of this Plan at national and international levels (Action Plan for the Digital Transition in Portugal).

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1 European Qualification Framework
2 Portuguese denominations for Information, Communication and Electronic Technologies competences
3 Translated from 0000600032.pdf (dre.pt)

Sectors with low digitization and low automation potential must prepare for an evolution. Sectors such as education, healthcare, arts, and finance are not facing a drastic change in the form of high automation potential. Nevertheless, given their low starting point in terms of digitization, they should prepare to adopt more technology and not underestimate the effort required. According to McKinsey Global Institute (source: Eurostat; McKinsey analysis), only 21% of these sectors have adopted digitalization. Despite several initiatives to digitalize the education system, the need to improve the acquisition of digital skills remains high.

In 2015, Romania adopted a national strategy on the Digital Agenda setting out actions until 2020 in key areas that included the use of information and communication technologies (ICT) in education. However, the degree to which the commitments of the strategy were met is unknown (source: European Commission report, 2020). Although Romania has progressively integrated elements of digital technology in its policies, school curricula and training programmes, and despite some major investments at the national level, a lack of monitoring and support mechanisms has resulted in many of these initiatives not being sustainable (source: Balica M et al., 2018). To date, the results remain limited (European Commission, 2020a).

At the same time, the private sector, especially tech companies, has started a number of projects with schools and universities focusing on teacher training and development of digital learning resources1, as well as the provision of digital equipment. Overall, only 57% of young Romanians aged 16-19 have basic or above basic digital skills (EU average: 82%). The gap with the EU average is particularly evident in problem-solving and software skills, which include making decisions about digital tools and using them, purchasing online, creating content and coding.

ICT is an optional subject in primary grades and, since 2017, a compulsory subject in lower secondary education. However, schools in rural areas, which provide schooling to 43% of students, are less able to offer digital education due to having fewer qualified teachers and poorer digital infrastructure. In upper secondary education, students' digital competencies are evaluated as part of the baccalaureate exam through a fail/pass practical test, which can be equated with the European Computer Driving Licence.

Several areas of teachers' digital skills require strengthening. Romanian teachers feel confident about certain aspects of their digital skills, in particular about communication and collaboration, but less so when it comes to digital content creation, information and data literacy (source: European Commission report, 2019).

Similarly, the OECD's 2018 Teaching and Learning International Survey (source: OECD report, 2019) showed that almost 70% of lower secondary teachers believe they are well or very well prepared for the use of digital methods in teaching, while 21% reported a high need for professional development in ICT skills (EU average: 18%). Despite a large number of training courses being available for digital skills, their quality, coverage and relevance are lower than expected (source: ISE report, 2018).

NATIONAL PLANS ROMANIA

At the same time, teachers often feel exposed and do not know how to react to the expectations and demands of their students related to the use of technologies for learning. In addition, more than half of the teachers surveyed had insufficiently developed competencies for the effective use of online learning platforms. The CRED project (Relevant Curriculum, Open Education for all), co-financed by the European Social Fund, has been supporting the development of teacher competencies, including during the COVID-19 school closure.

Digital infrastructure in schools lags behind, especially in rural areas. Compared to the EU average, substantially fewer schools are highly digitally equipped and connected. Only 14% of Romanian students in primary education (EU average: 35%), 16% in lower secondary (EU average: 52%) and 31% in upper secondary education (EU average: 72%) study in such schools (European Commission, 2019). Available data shows that, in 2017, 1 in 5 schools were not connected to the internet at all, of which only 5% were in urban areas and 24% were in rural areas (Ministry of Education and Research, 2018). The number of computers per school is 60% higher in urban areas than in rural areas, illustrating the broader rural-urban gap in education.

However, the latest developments have shown investments in digital tools such as computers, tablets, software education or simulators. For example, more than 1000 km representing 30% of the length of the Danube is in Romania. Therefore, the inland navigation sector is an important one for the economy. Nowadays, due to the Ukraine crisis, cereals are transported on the Danube River from Galati Port to Western Europe. In order to meet the increase in demand for crew personnel on board vessels, education and training institutes started to invest in inland or maritime simulators. CERONAV Constanta has invested in Full Mission Engine Room Simulator and the University of Craiova is implementing an Inland Waterway Simulator
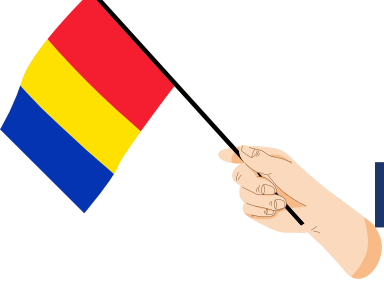
ROMANIA FUTURE PLANS

According to the latest developments, Romanian Government proposes a call to action for closer cooperation with all stakeholders to generate a Modern, Accessible School based on Digital Resources and Technologies - "SMART-Edu" starting from the following priorities:

Accessibility	• ensuring digital infrastructure and emerging technologies for access to inclusive and quality education
Connectivity	• the development of digital skills for the digital transition towards a competitive society, centered on sustainable development, social equity and resilience; digital literacy and combating disinformation; use of open educational resources
Community	• consultation • involvement of the stakeholders
Digital education ecosystem	• creating a high-performance digital educational environment respecting digital ethics, personal data protection, cyber security, data analysis
Innovation	• using all resources and digital/emerging technologies, stimulating creativity and entrepreneurship
Sustainability	• ensuring medium and long-term predictability through cross-sectoral cooperation for quality education and a green and digital economy

Directions of action of the SMART-Edu Strategy:

1 The development of digital skills at all levels of cross-curricular education, through specialized subjects, through formal and non-formal activities

2 Supporting the initial and continuous digital training of teachers

3 Improving the digital infrastructure to reduce connectivity gaps (connecting to the Internet, creating internal networks, providing equipment, providing technical support)

4 Stimulating educational units and institutions for educational offers with specializations and digital qualifications suitable for the jobs of the future

5 Creating digital educational tools, encouraging innovation to adapt creative, interactive, student-centred educational solutions

6 Creating attractive Open Educational Resources

7 Developing and multiplying public-private partnerships by participating in digital networks, including with European and international bodies

8 Exchange of best practices on local, and national e-learning educational platforms, respectively on international platforms (SELFIE, e-Twinning, etc.)

9 Encouraging and promoting initiatives on online safety, data protection, cyber hygiene, IT ethics

10 Developing the strategic foresight framework for the green economy and adapting to the jobs of the future

NATIONAL PLANS SPAIN

In Spain, we have searched for information on the national plans for the implementation of technology in education.

In this sense, we have only found one national plan, which, in line with European strategies, develops the lines of improvement of our educational system, listing the actions that will be carried out at both national and regional levels to achieve this.

Two decades have passed since the European Council in March 2000 adopted a relevant **"strategic goal"**. It stated that by 2010 the European Union should **"become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"**. This objective was interpreted by many as an attempt to adopt an economistic view of education. Two years later, another European Council in Barcelona in March 2002 adopted the Education and Training 2010 (ET 2010) work programme. And a year before its conclusion, in 2009, the Council, faced with the failure to achieve the planned objectives, agreed on a strategic framework for European cooperation in education and training, Education and Training 2020 (ET 2020). The renewed strategy also set new common objectives, with the intention of improving national education and training systems. To this end, **general complementary instruments were established, as well as mutual learning and exchange of good practice through the open method of coordination.**

Thus, with the second decade of the European agenda on education and training also recently concluded, the Council recognises that, although some progress has been made, **"substantial challenges" remain if Europe is to achieve the goals set.**

The achievement of a European Education Area is the backdrop to these strategic frameworks, and measures were also formulated last September 2020 to reinforce it with a view to 2025, without taking any risks by venturing to extend it. This is also the aim of the renewal of the strategic framework up to 2030, as stated in the agreement adopted by the European Council: *Council Resolution on a strategic framework for European cooperation in education and training for the European Education Area and beyond (2021-2030),* published on 26 February. Thus, in addition to supporting the definition of such a European Area, the main objective of European cooperation in education and training aims, with the characteristic grandiloquence of such declarations, to support the development of Member States' education and training systems so that they ensure, on the one hand, the personal, social and professional fulfilment of all citizens, while promoting democratic values, equality, social cohesion, active citizenship and intercultural dialogue; and, on the other hand, sustainable economic prosperity, ecological and digital transitions and employability. An ambitious agenda for which a decade, against this background, may be too short.

Five strategic priorities are therefore made explicit. They are highlighted:
1. to increase quality, equity, inclusion and success for all in education and training.
2. making lifelong learning and mobility a reality for all,
3. improving skills and motivation in the teaching profession,
4. strengthening European higher education,
5. supporting green and digital transitions in and through education and training.

In order to monitor the achievement of these priorities, "EU-wide targets" are also set as reference levels of European average performance in education and training. However, given the expected mismatch and differences between the Member States, "these should not be specific targets that each country would have to achieve by 2025 or 2030", but "Member States are invited to consider setting equivalent targets at the national level".

NATIONAL PLANS SPAIN

Specifically, one of these targets is formulated with the intention that, by 2030, the percentage of low achievers in reading comprehension, mathematics and science among fifteen-year-olds should be less than 15%. The same percentage and within the same timeframe is expected for pupils in the eighth year of schooling with regard to "computer literacy". The percentage of early school leavers should be below 9%. Or that in five years' time, by 2025, the percentage of recent vocational training graduates entering apprenticeships during their education and training should be at least 60%. Of course, somewhat solemn declarations of lofty aims are not superfluous, but they must be accompanied by measures and resources that transform the persuasiveness of rhetoric into a favourable and evident account of achievements.

Work is already underway to establish a Strategic Framework for European cooperation in education and training beyond 2021-2030.

In Spain, the Strategic VET Plan for the Education System 2019-2022 has been approved and will serve as a framework so that the administrations responsible for VET in the educational sphere can develop their own policies in this field that will set in motion the transformation and renewal of training offers in accordance with their economic context. The Council of Ministers approved the 1st Strategic Plan for Vocational Training in the Education System.
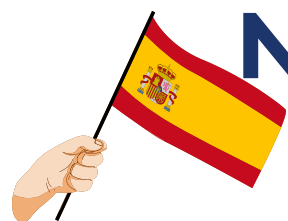
I Plan Estratégico de Formación Profesional del Sistema Educativo

2019-2022

2019-2022 which aims to consolidate the modernisation of this training stage.

- The strategy designed by the Ministry of Education and Vocational Training seeks to update the catalogue and expand the offer, improve accessibility and make these courses more flexible, as well as the accreditation of basic and professional competencies for adults.
- The text provides for teacher training through innovation projects and teacher placements in companies and leading VET centres in different autonomous communities.
- The government is also working on drafting of a law on the general organisation of vocational training and the regulation of dual vocational training.
- The plan includes a commitment to public-private collaboration between educational administrations and companies in all of the country's productive sectors. The approval of this strategic plan 2019-2022, the implementation of which aims to update this training stage, has been supported, among others, by the Ministry of Economy and Business, the Ministry of Industry, Trade and Tourism, the Ministry of Ecological Transition and the Ministry of Labour, Migration and Social Security.

With the implementation of this strategy, the government aims to improve employability and meet the needs of the labour market, as well as to consolidate the flexibility of these courses, which allow students to obtain high qualifications and guarantee quality work experience that serves to promote a competitive professional curriculum.

The **main priorities of the** plan are the collaboration and participation of companies and openness to the participation bodies of all sectors, as well as speeding up the response of VET to the qualification needs of each productive sector.

This plan follows on from the work developed between the Government and the social partners and the business sector and incorporates the Sustainable Development Goals of the 2030 Agenda and the European Commission's New Skills Agenda for Europe which includes actions to ensure that EU citizens benefit from adequate training, skills and support.

NATIONAL PLANS SPAIN

The approved Plan is based on five fundamental levers to carry out the modernisation of Vocational Training in our country.
A catalogue that meets the needs of the productive fabric

1. New formations

The renewal of the Catalogue of VET qualifications involves the design of new training and the updating of all existing qualifications. In this chapter, it is worth noting the Government's interest in the development of professional profiles related to digitalisation, Industry 4.0, big data, artificial intelligence, ecological transition and the circular economy, among others.

2. A more flexible VET system with a greater number of places

Another of the main axes of this roadmap is the extension of the offer, the improvement of accessibility and the recognition of basic and professional competencies.

In this section, the document envisages the design of a VET Map in order to improve the training offered adapted to these courses. This tool will serve to identify the situation of Vocational Training, the training needs of each territory and each productive sector.
It also **emphasises making training more flexible** in order to make it accessible to the working population by promoting the distance learning modality in collaboration with the educational administrations. To this end, the Ministry of Education and Vocational Training, through the Centre for the Innovation and Development of Distance Education (CIDEAD), will open up the modular offer of Vocational Training qualifications.

This chapter also includes the implementation of a **basic skills accreditation** procedure for adults, as more than 50% of the Spanish population between 16 and 65 years of age lacks formal accreditation of their professional skills, according to data from the Programme for the International Assessment of Adult Competencies (PIACC).
In addition, the plan reflects the expansion of the non-formal training offered by the Ministry of Education and Vocational Training (Aulas Mentor) to bring it closer to small and medium-sized municipalities to reach a total of 3,000 rural areas and modular training that is adapted to each student, considering it as a shocking measure to prevent depopulation in rural areas.

3. Teacher training based on knowledge exchange

Another key element of the strategy is the training of teachers at this educational stage, which aims to bring the innovation of each of the productive sectors closer to the teaching staff.

Other actions include innovation projects in vocational training between vocational training centres in different autonomous communities, companies and other institutions, as well as calls for teacher placements in companies and in leading vocational training centres to facilitate the transfer of knowledge.

4. New Law on Vocational Training and promotion of Dual Vocational Training.

The document includes the modification of the regulations of the VET education system through the Law on the General Organisation of Vocational Training and a Royal Decree regulating the basic characteristics of the Dual Vocational Training system.

The text also highlights the need for the internationalisation of vocational training through initiatives such as alliances between national centres and those in neighbouring countries that consolidate the global vision of this educational stage, as well as double degrees that allow students to obtain valid certifications in both countries.

5. Professional Orientation

Finally, vocational guidance is an essential element of quality in vocational training, guaranteeing the individualised accompaniment of students in order to enhance their talents and design successful training and professional itineraries.

The *1st Strategic VET Plan for the Education System 2019-2022*, approved today, will serve as a framework so that the administrations with competence in the field of VET in the educational sphere can develop their own policies in this field to implement the transformation and renewal of training offers in accordance with their economic context.

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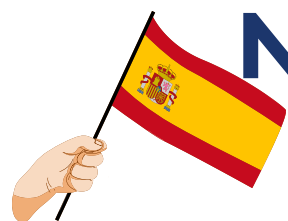
NATIONAL PLANS SPAIN

Work is already underway on the Second National Plan, which, according to the report, will have another ten years of continuity. In a complementary way and in accordance with the regional decentralisation of competencies in Education that we have in Spain, **the Government has approved in June 2021 the distribution to the Autonomous Communities of more than 300 million euros from the Recovery, Transformation and Resilience Mechanism for the promotion of Vocational Training.**

- Some 115 million will be allocated to the accreditation of professional competencies, 93 million to the creation of bilingual cycles, almost 73 million to the creation of vocational training places and 12 million to the digitalisation of classrooms, among other actions.
- The funds correspond to the financial year 2021 and the autonomous communities have until December 2023 to comply with the objectives set.
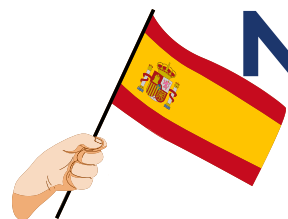
The distribution among the Communities is carried out through an Extraordinary Territorial Cooperation Programme, according to various criteria related to the active population, geographical dispersion, number of companies or demographic profile, among others.

IMPULSO A LA FORMACIÓN PROFESIONAL

PLAN DE RECUPERACIÓN, TRANSFORMACIÓN Y RESILIENCIA

El Gobierno aprueba la distribución a las CCAA de más de **300 M€** del Plan de Recuperación, Transformación y Resiliencia

- ✓ 115 M€ para acreditación de competencias
- ✓ 93 M€ para creación de ciclos bilingües
- ✓ 72 M€ para creación de plazas de FP
- ✓ 12 M€ para digitalización de las aulas
- ✓ 4,7 M€ para aulas de emprendimiento
- ✓ 2,4 M€ para formación en digitalización del profesorado

MINISTERIO DE EDUCACIÓN Y FORMACIÓN PROFESIONAL

#CMin

The distribution among the Communities is carried out through an Extraordinary Territorial Cooperation Programme, according to various criteria related to the active population, geographical dispersion, number of companies or demographic profile, among others.

Among the objectives for which these funds are earmarked is the development of the **new system for the permanent evaluation and accreditation of basic and professional competencies,** for which 115.71 million euros have been earmarked. The plan is to accredit the skills of around 450,000 workers this year and to reach three million by 2023.

Currently, according to the Labour Force Survey, 46% of the population lacks professional accreditation, even though they work on a daily basis, which hinders their access to better jobs and better working conditions.

In addition, the agreement includes funds earmarked **for the conversion of intermediate and higher education into bilingual education.** For the current financial year, it provides for the training of some 20,700 students in bilingual cycles, with a total investment of 93.285 million euros.

72.72 million euros will also be earmarked for the **resizing of the vocational training** offer, with the creation of 38,789 places, to reach 135,000 in a period of three years, which will be added to the more than 60,000 places created last year.

The approved distribution of funds also includes the conversion of classrooms into applied technology spaces with an investment of 12.14 million euros this year. This year, 220 classrooms will be converted, with the aim of reaching 638 in three years.

The Ministry of Education and Vocational Training is also allocating a further 4.76 million euros this year to the creation of 457 entrepreneurship classrooms, thus boosting the resources necessary for students to create their own business projects by providing them with the means and professional guidance to help them achieve their projects. These will be added to the 496 classrooms already created with funds from the previous year.

2.43 million euros have been allocated to training in digitalisation and sustainability applied to the productive sectors for the training of almost 25,000 teachers this year.

With these funds, which will be submitted for approval at the Sectoral Conference on Education, the **Modernisation and Vocational Training Plan** presented in July 2020 will be given continuity and impetus.

The Ministry of Education and Vocational Training is carrying out a major transformation of Vocational Education and Training (VET) towards a quality, flexible and integrated education, bringing together Vocational Education and Training (VET) in the education system and Vocational Training for Employment (VET) in a single system.
Work is already underway on a Plan for vocational training, economic and social growth and employability in Spain.

3. Future plans:
Vocational Training is an essential part of a productive model that intensifies the processes of value creation and quality employment. The need to rethink the future in a large part of the economic sectors for economic and social growth makes this a moment of opportunity, in a climate of public-private collaboration.
One of the great challenges after the de-escalation of the confinement will be the gradual reactivation of the different sectors, so far paralysed, in order to curb the impact of the economic crisis. The scenario through which the country is passing has made it possible to identify the strengths and weaknesses of the country's productive sectors and business organisations. Threats and opportunities have also been identified.

The dynamism of Vocational Training has been evident in the many actions that have arisen during this crisis, from the design of one of the first models of protective screens certified by the certifying laboratory, whose plans and matrix was made available to all educational administrations for manufacture in all Vocational Training centres in the country equipped to do so, to two models of surgical mask type IIR with different materials.

Vocational Training, which in the last period has been presented as one of the strategic areas of government policies, has shown its capacity to incorporate innovation with the agility that the productive sectors need and with their support. Hence, vocational training is now also proving to be of essential importance as **one of the driving forces behind economic and social growth in the wake of this crisis.**

The ambitious 1st Strategic Plan for Vocational Training, launched in the fourth quarter of 2018, must be intensified and adapted to respond to the qualification and requalification needs of future and current workers, at the individual and collective level of each company, at a time when a new economic growth model is being created.

A 2nd phase of the Strategic Plan for Vocational Training is proposed which, in view of the new situation, incorporates a **PLAN FOR VOCATIONAL TRAINING, ECONOMIC AND SOCIAL GROWTH AND EMPLOYABILITY,** the aim of which is **TO CREATE AN ECONOMIC RELANCHISING ECOSYSTEM FROM A BET ON HUMAN CAPITAL AND TALENT.**

This document contains this **Plan for Vocational Training, designed both for the education system and for vocational training for the unemployed and employed**, derived from the **2030 Agenda and its Sustainable Development Goals**, which the Government of Spain has assumed in order to develop a modern project for the country and which requires a new global social contract, more necessary now than ever.

This Plan also incorporates the approaches of Communications from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, such as **A New Skills Agenda for Europe: Working together to strengthen human capital, employability and competitiveness (10/6/2016), and of the Recommendations of the European Parliament and the Council of the European Union on Vocational Training and Key Competences for Lifelong Learning.**

NATIONAL PLANS SPAIN

1. Mission of the plan :

CREATE AN ECOSYSTEM FOR ECONOMIC RELAUNCH BASED ON A COMMITMENT TO HUMAN CAPITAL AND TALENT.

To this end, it shall provide :
- at the individual level, entry, retention and progression in the labour market,
- at the societal level, support for equity of educational opportunities, and
- at the economic level, the coverage of the qualification and talent needs to be required by the productive sectors.

This training will incorporate, in addition to solid technical training, skills such as creativity, digital competencies, analytical and predictive capabilities and proactive attitudes.

2. Principles of the Plan:

This Plan starts from the following principles:
- Ongoing **public-private partnerships.**
- The implementation of a new, effective and efficient **single system of Vocational Training,** guarantees Vocational Training and lifelong learning for students and the working population.
- The generalisation of **procedures for the recognition and accreditation of the professional competence** of the active population, in particular of people expelled from the labour market during this crisis COVID 19.
- Support for people expelled from the labour market during this COVID 19 crisis through vocational training plans that are absolutely flexible and adapted to the exceptional circumstances, complementing the accredited skills.
- The resizing of vocational training provision Plan for vocational training, economic and social growth and employability 31
- The creation of a collaborative and specialised ecosystem in Vocational Education and Training.

The Plan for Vocational Training, Economic and Social Growth and Employability, in the framework of the 1st Strategic Plan for Vocational Training, proposes **to turn Vocational Training into a LEVER FOR GROWTH through three steps:**

1st recognition and accreditation of professional competencies,

2. flexibility and improved accessibility of vocational training and vocational guidance, and

3rd incorporation of digitalisation, innovation and entrepreneurship in the Vocational Training system.

3 . - Strategic areas of the plan

Eleven areas are identified on which actions will be focused:

1. Recognition and accreditation of basic and professional competencies acquired through work experience
Flexibility and accessibility of training for a single system of vocational training.
3. Digitalisation and Vocational Training
4. Innovation and Vocational Training
5. Entrepreneurship and Vocational Training
6. Renewal of the training catalogue. Definition of strategic sectors 7. Redimensioning of the Vocational Training offer.
8. Strengthening dual vocational training
9. Vocational Training Centres as organisers of applied technology. Networks of centres for innovation and applied creativity in Vocational Training. Integral support structures for the system
10. Career guidance
11. Evaluation and quality of the system

Although they are all important, we will focus on strategic line 3, which refers to digitalisation, the focus of this study.

 3. DIGITALISATION AND VOCATIONAL TRAINING

 State of play: From Vocational Education and Training, the strategic line of action is the promotion of **digitalisation for economic and social growth,** aimed at creating and maintaining a **knowledge-based workforce**. It is necessary to intensify the transformation of vocational training to facilitate the **transition to a digital economy**, the importance of which has become evident in this crisis.

For several years, numerous studies have identified a strong correlation between GDP per capita and a country's level of digitisation. See for example the joint analysis by COTEC and McKinsey, Digital reinvention: an opportunity for Spain (2017), which estimates the impact that digitalisation could have in Spain at up to 1.8% of GDP per year until 2025.

We are aware that the limitation in training levels lies in the rate of population with medium studies (24%), compared to 45% in the EU, and with low studies (35%), compared to 17.2% in the EU. To improve this situation, it is necessary to **relaunch vocational training both in the education system and in the continuing vocational training of citizens** (before entering the labour market, during their stay in it and for their reincorporation in the event of job loss or reorientation of their professional itinerary). To this end, **new technologies** are a very effective tool, as is the need for training in them for teachers and students, which has become essential at a time when education and training systems have had to shift towards technological resources.

We have to intervene in two areas, Vocational Training in the education system and Vocational Training for employment, which are now beginning a process of integration, in accordance with the assumption of competence by the MEFP. In both areas, we face a common problem, the low rate of Vocational Training in Spain, both in the choice of these teachings as a training itinerary, as well as in the investment of companies in training and individual participation in training and professional updating.

The Digital Economy and Society Index (DESI) identifies the "human capital" dimension as the poorest in Spain among the five dimensions considered in its index.

In the human capital dimension, Spain ranks 17th out of the twenty-eight EU countries, below the EU average, something that is also corroborated by the World Economic Forum's "Degree of Preparedness for the Productive Future" Report 2018. As an example, the comparative position of Sweden and Spain in relation to human capital is as follows: our country is in 61st place in terms of on-the-job training, while Sweden is in 9th place. In Spain, we are moving in a training volume of 17 40 hours per worker per year (in descending progression in the last three years), while in Germany 50 hours are invested, and the leading companies in the world dedicate between 80 and 85 hours per worker.

Levels of basic digital skills, according to the study "Spain 4.0. The challenge of the digital transformation of the economy", are still below the EU average:

- Only 55% of 16-74-year-olds have basic digital skills (57% in the EU as a whole).
- The share of ICT specialists in the labour force is lower than in the EU (2.9 % compared to 3.7 % in the EU).
- ICT graduates in Spain represent 3.9% of the total.
- Women ICT specialists account for only 1% of total female employment.

In this situation, 20% of companies do not offer any digital training and in 62% of the companies that have offered it, less than 40% of their employees have received a course. Advanced skills such as digital literacy (13%), web search optimisation (11%) or open innovation (11%) are in the minority.

A high degree of skills and qualification mismatch among firms' staff limits their ability to innovate and make the most of innovation. Increasing the number of ICT specialists, reducing the gender gap and retraining **the professional skills of human capital is of vital importance if Spain is to realise the full potential of the digital economy.**

One of the **lessons learned in this crisis is the relevance of digitalisation**, of the digital training of professionals, and how this modifies the capacity of companies to adapt and, in turn, their capacity to remain active in the productive fabric, with greater guarantees of job stability in changing situations. This crisis has revealed a hyper-connected and globalised world, where new technologies play a fundamental role in everyday life, but, above all, in the dynamism of business processes.

Digitalisation was already necessary for any company, but the arrival of Covid-19 has made it indispensable. Virtual classes, videoconferencing, e-commerce, social networks, SEO strategies for positioning and/or optimisation in Internet search engines, web search engines, as well as intelligent manufacturing, 3D printing and cybersecurity are issues whose relevance has been demonstrated over the last few months. The life of some companies will be able to continue thanks to connectivity. Therefore, **training in digitalisation will be the solution for small businesses to overcome this crisis**, thus avoiding the closure of many of them. Hence the role of vocational training for small businesses and micro-SMEs to join the economic and social growth.

NATIONAL PLANS SPAIN

We are at a decisive moment to concretise the integration of Vocational Training for employment together with the Vocational Training of the educational system to give birth to a single Vocational Training system, under the principles set out in the 1st Strategic Plan for Vocational Training. The union of both subsystems will allow **a multiplier effect of profitability of training resources and the adjustment of training to the real needs, "à la carte", of the business sector,** which must play an essential role in the economic growth of each productive sector, its reconversion when necessary, and the reconstruction of social welfare. This must take place within the framework of policies that promote the continuous training of their workers by the government and companies. Growth requires the training of all human capital, in addition to the technological aspects of each sector and each company, in digitalisation.

Actions: The incorporation of digitisation in the Catalogue of Vocational Training qualifications already in progress acquires, in this new scenario, a decisive role.
This incorporation is proposed at two different levels of action: the digitisation of the analogue economy and the digital economy.

Digitisation of the analogue economy

We will focus on training for the automation of some production processes related to the processing, transport and storage of information in sectors in which these activities are not at the heart of the business. In these cases, the main objective of digitisation is to increase productivity, which is essential in the process of economic and social growth. In these sectors, exponential innovation can take place if the appropriate training contents are proposed to all students, basic technicians, technicians and senior technicians, and, at the same time, the appropriate instruments of worker participation are established to undertake processes of retraining and relocation of workers within the company. It is true that not all workers, especially those who are older and less qualified, can be "re-qualified" for the new jobs required, which usually require very different training, skills or competencies, but many of them can be re-employed in other activities within the company. These staff adjustments are crucial to making economic reconstruction compatible with the social reconstruction of the country after the Covid 19 crisis.

Line 3.1. Incorporation of a training module on Digitalisation applied to the productive sector in all the qualifications in the Vocational Training Catalogue, guarantees the "added value" of the technician or senior technician in the company in this area.

Line 3.2. Training offer of the Digitalisation module applied to the productive sector for unemployed and employed people, within the framework of the new Vocational Training for Employment competence. Action is proposed that will train 125,000 people annually for 4 years, through a module of 30 hours of digitisation applied to their occupation.

Line 3.3. "On-demand" training plans for the digitalisation of company staff. This "on-demand" vocational training offer and the joint work with sectoral business associations will be essential to get this training to companies and their professionals immediately.

Digital Economy

It will include the productive part in which the main product exchanged is information. Digitalisation implies a profound transformation in processes and ways of doing business, giving rise to disruptive technologies and new ways of producing in a fully digitalised environment. In this area:

Line 3.4. The offering of digital degrees in the next academic year 2020-2021, will begin to offer the labour market, in the short term (less than one year), a relevant number of professionals trained in these subjects.
o Intelligent manufacturing
o Digitisation of industrial maintenance
o Cybersecurity in production environments
o Cybersecurity in IT environments
o Railway Signalling and Telecommunications o Video Games Line

3.5. Design of new digital degrees.
Among other degrees, those already under design will be published during 2020 and 2021:

o **Additive manufacturing -3D**
o **Implementation of 5G infrastructures**
o **Composite materials**
o **Artificial intelligence and big data**
o **Electric vehicles**
o **Installation and maintenance of electrical infrastructure**
o **BIM (Building Information Modelling)**

Line 3.6. Modular offer of these specialisation courses to the entire active population (unemployed and employed), linking it with training and support for entrepreneurship and innovation.

Line 3.7. Design of a new Vocational Training plan for employment (as far as MEFP competencies are concerned), in the medium and long term, coordinated and assessable, with the social partners, public administrations, companies, universities and Vocational Training institutes and centres.

In its design and implementation, of maximum relevance in this period of economic and social reconstruction, all **the actors involved** (administrations, social partners, companies, trade unions, teachers, academics, ...) will participate and the combination of public and private funding will be promoted, as far as possible.

Line 3.8. Training in digitisation applied to the productive sector (specific to vocational training teachers).
The improvement of Vocational Education and Training has teachers as an essential lever.

The implementation of training courses must involve the business community and social partners. The participation of companies is essential in order to bring **cutting-edge technological aspects** closer to the teaching staff in charge of teaching courses corresponding to the qualifications of each productive area. In this sense, the training of teachers and trainers through placements **in companies** must acquire a relevant weight.

In addition, it is desirable that part of the training can take place outside the

school itself, both inside and outside our country, in places where technology or service provision is more advanced in a particular sector. It is also in this sense that companies, especially those with a multinational presence, play a very important role as partners in teacher training.

It is planned to train all 50,562 vocational teachers in public schools in a 30-hour training module.

Digitalisation and Vocational Training
A) Digitisation of the analogue economy

Line 3.1 Incorporation of a training module on Digitalisation applied to the productive sector.

Line 3.2 Training offer of the Digitalisation module applied to the productive sector for unemployed and employed people.

Line 3.3 "On-demand" training plans for the digitisation of the business workforce

A) Digital economy

Line 3.4 Offering of digital degrees in the next academic year 2020-2021.

Line 3.5 Design of new digital degrees.

Line 3.6 Modular offer of these specialisation courses to the entire active population (unemployed and employed).

Line 3.7 Design of a new plan for Vocational Training for employment.

Line 3.8 Specific training in digitisation for vocational training teachers.

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