XRinVET

Enhancing Digital Innovation (Web 4.0) and Attractiveness of VET through Extended Reality (VR/AR) Training for better skills-match

WP3: Training Pack for VET Trainers and Students

Activity 3.4: XRinVET Competence framework for VET students

Authors: University of Crete (UoC), DIRECTORATE OF SECONDARY EDUCATION OF PELLA (DSEP), CONFEDERACION ESPANOLA DE CENTROS DE ENSENANZA ASOCIACION C.E.C.E. (CECE)

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CONTEXT

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WEBSITE:

https://xrinvet.eu/

CONSORTIUM: PARTNER LIST

- University of Crete (UoC) - Greece
- CONFEDERACION ESPANOLA DE CENTROS DE ENSENANZA ASOCIACION C.E.C.E. (CECE) - Spain
- DIRECTORATE OF SECONDARY EDUCATION OF PELLA (DSEP) - Greece
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Contents

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1 Introduction

This document provides a summary of the XRinVET Competence Framework for VET students that will be the basis for the development of the educational pack. The syllabus will be used as part of VET school curricula, or alternatively, as an extra-curricular activity on a weekly basis (in or out of school), or in a non-formal learning setting.

The competence framework / curriculum is derived from the outcome of A3.3 (Job-Portrait for VR Simulations key jobs needs) and is in reference to the ESCO definition of skills and competencies. A3.3 describes the core skills, the training scenarios, the XR benefits and how XR can enhance training. It also took into account the job challenges, professional ethics, training availability and the needs of the selected jobs.

The competence framework for VET students includes both job-specific employability skills and soft skills, and is divided into 4 units. The first unit is common for all professions, while the next 3 units cover each **selected profession**:

- Vehicle technician/maintenance (car mechanic)
- Electrical/Electronics/IT technician
- Healthcare/Nursing Assistant

The approximate duration of the scenario-based activities is **40 teaching hours** and will contain

- XR resources and tools (interactive VR/AR applications, visual material etc.)
- lesson plans based mainly on practical exercises and presentations
- assessments for acquired skills (e.g. quizzes, different levels/difficulty, etc.)

The following sections present an overview of the topics of each unit and a description for each chapter.

1.1 Definitions

The ESCO classification (European Skills, Competences, Qualifications and Occupations) uses definitions aligned with the European Qualifications Framework (EQF).

According to the EQF, a skill is "the **ability to apply knowledge and use know-how to complete tasks and solve problems**." A skill can be **cognitive** i.e. involving the use of logical, intuitive, and creative thinking, or **practical** i.e. involving manual dexterity and the use of methods, materials, tools, and instruments. The scope of a skill typically refers to the use of methods or instruments in a particular setting and in relation to defined tasks.

A competence, according to EQF, is “the **proven ability to use knowledge, skills and personal, social and/or methodological abilities**, in work or study situations and in professional and personal development." A competence is a broader term and is described in terms of responsibility and autonomy. It typically refers to the ability of a person—facing new

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situations and unforeseen challenges—to use and apply knowledge and skills in an independent and self-directed way.

While these terms (skill vs competence) are sometimes used as synonyms, the key distinction lies in their scope. The context and focus of a skill is applying knowledge and know-how to a particular setting and well-defined tasks, while the context and focus of a competence is broader, including new situations, unforeseen challenges and combining knowledge, skills, and personal/social/methodological abilities.

2 Topics Overview

Unit 1 Basic XR Competences – common unit for all professions (4 hours)

Chapter 1.1: Introduction to XR (2 hours)

Chapter 1.2: XR Tools & Setup (2 hours)

Unit 2 Competence framework for Vehicle Technician/ maintenance (12 hours)

Chapter 2.1: Engine Systems Deep Dive (5 hours)

Chapter 2.2: Brake & Suspension Systems (3 hours)

Chapter 2.3: Electrical Systems (2 hours)

Chapter 2.4: Safety, Ethics & Communication (1 hour)

Chapter 2.5: Emerging EV/Hybrid Technologies (1 hour)

Unit 3 Competence framework for Electrical/Electronics/IT technician (12 hours)

Chapter 3.1: PC Components & Assembly (3 hours)

Chapter 3.2: System Fault Analysis, Diagnostics & Troubleshooting (3 hours)

Chapter 3.3: Network Basics & Setup (3 hours)

Chapter 3.4: Electronics Fundamentals, Circuits, Schematics & Tools (2 hours)

Chapter 3.5: Foundations & Safety (1 hour)

Unit 4 Competence framework for Healthcare/Nursing Assistant (12 hours)

Chapter 4.1: Patient Intake and Monitoring (3 hours)

Chapter 4.2: Human Anatomy (4 hours)

Chapter 4.3: Physical Exam, Clinical Assistance & Medical Equipment (3 hours)

Chapter 4.4: Hygiene, Infection Control & Ethics (1 hour)

Chapter 4.5: Emergency Response & First Aid (1 hour)

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3 Unit 1 Basic XR Competences

This unit (4 teaching hours) is dedicated to XR foundational knowledge and XR Implementation & Operational Proficiency. This is a common unit for all professions and has 2 chapters.

3.1 Learning Outcomes

The learning outcomes (LO) of the curriculum will be focused on the following areas:

a) XR Foundational Knowledge

- LO 1.1: Define and differentiate the core components of Extended Reality (XR), including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), and explain the concept of Immersive Learning.
- LO 1.2: Outline the history and evolution of XR technologies and identify the major milestones that have led to their current application in training.
- LO 1.3: Analyze the benefits, challenges, and limitations of incorporating XR technologies into the VET sector, specifically citing examples of current applications in education and training.
- LO 1.4: Recognize and describe future trends in XR and immersive learning, and discuss their potential impact on future VET methods.
- LO 1.5: Describe the role of Emerging Technologies in addressing key challenges within the current VET landscape (e.g., skill gaps, lack of modern equipment).

b) XR Implementation & Operational Proficiency

- LO 1.6: Identify and distinguish between different types of XR hardware (e.g., VR headsets, AR glasses, controllers, sensors, mobile devices) and their respective applications in VET.
- LO 1.7: Describe the basic purpose of various VR/AR software and development platforms used for creating and running immersive training content.
- LO 1.8: Evaluate the costs, accessibility, and usability of common XR tools for classroom and workshop implementation.
- LO 1.9: Demonstrate the correct basic procedures for setting up XR equipment for classroom and training use, ensuring a safe and functional learning environment.
- LO 1.10: Perform basic troubleshooting and maintenance for common XR hardware and software issues to minimize downtime during training sessions.
- LO 1.11: Explain the use of tools and techniques for implementing gamified learning experiences within the XR environment to enhance trainee engagement and retention.

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3.2 Chapters Description and Schedule

The following schedule allocates **4 teaching hours** across **2 chapters.**

Chapter overview	
Chapter ID	Chapter 1.1 Introduction to XR
Topic/Purpose	This chapter focuses on the conceptual understanding of Extended Reality (XR) and its role in Vocational Education and Training.
Goals/Objectives	Introduction to Emerging Technologies in VET, Immersive Learning, VR/AR fundamentals, benefits, history and evolution of XR technologies, benefits/challenges/limitations of incorporating XR technologies into the VET sector, current applications of immersive technologies in education and training, future trends in VET.
Duration	2 teaching hours
Difficulty level	Beginner
Expected outcomes	LO 1.1, LO 1.2, LO 1.3, LO 1.4, LO 1.5
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • XR Terminology Mastery: Ability to accurately define and differentiate core concepts: Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and Immersive Learning. • Historical Context: Understanding the evolution of XR and how it transitioned from niche technology to a relevant VET (Vocational Education and Training) tool. • Strategic Evaluation: Knowledge of the benefits (e.g., safe practice, guided learning) and limitations/challenges (e.g., motion sickness, cost) of integrating XR into technical training. • Application Recognition: Identifying current, real-world applications of immersive technologies in education, training, and the broader automotive industry. • Future Planning: Understanding future trends in VET, preparing the technician for continuous learning and adaptation.
Soft skills acquired	• Critical Thinking: Analyzing the pros and cons of various XR integration models in VET (LO 1.3). • Adaptability: Developing an open mindset toward emerging technologies and recognizing the necessity of continuous digital upskilling in the automotive field. • Conceptual Communication: Ability to clearly articulate the value and function of immersive learning to colleagues or management (LO 1.1).

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Chapter overview	
Chapter ID	Chapter 1.2 XR Tools & Setup
Topic/Purpose	This chapter focuses on the practical knowledge of the hardware, software, usability, and maintenance required to implement XR training.
Goals/Objectives	Types of VR/AR software and development platforms, overview of XR hardware (VR headsets, AR glasses, smart phones, controllers, sensors etc.), tools and techniques for implementing gamified learning experiences in VET, costs/accessibility/usability of XR tools, setting up XR equipment for classroom use, troubleshooting and maintenance basics.
Duration	2 teaching hours
Difficulty level	Beginner
Expected outcomes	LO 1.6, LO 1.7, LO 1.8, LO 1.9, LO 1.10, LO 1.11
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Hardware Proficiency: Knowledge of different types of XR hardware (headsets, controllers, sensors, AR-enabled devices) and the specific requirements for their use in automotive repair & maintenance simulation. • Software Familiarity: Recognition of the purpose of various VR/AR platforms and apps. • System Setup: Practical skill in setting up XR equipment and environment (e.g., calibrating space, configuring devices). • Troubleshooting & Maintenance: Basic operational skills to identify and resolve common XR hardware and software faults (e.g., connection issues, calibration errors) to ensure smooth training flow. • Gamification Techniques: Understanding how to use simple gamified techniques (e.g., scoring, timed challenges) within the simulations to enhance learning retention and engagement.
Soft skills acquired	• Problem-Solving: Applying systematic thinking to troubleshoot technical issues and minimize training disruption (LO 1.10). • Resource Management: Evaluating the costs and accessibility of different tools, demonstrating an understanding of efficient resource deployment (LO 1.8). • Attention to Detail: Executing precise steps for setting up and maintaining sensitive XR hardware (LO 1.9). • Digital Literacy: Developing confidence and fluency in interacting with digital simulation environments.

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4 Unit 2 Competence framework for Vehicle Technician/ maintenance

The following XR applications (VR and AR) will be developed for integration into the competence framework (curriculum) and the associated pilot training programs at VET schools:

1. [VR simulation] Introduction to basic car engine parts. All the parts are laid on a workbench, and each time a user picks up a part, a description is displayed, and the part's location is highlighted on the car engine.

2. [VR simulation] Step-by-step instructions on how to assemble a car engine from all its parts.

3. [AR mobile app for Android devices (phones/tablets etc.)] How to disassemble a car engine.

4. [VR simulation] Brake system Inspection. Identify and understand components of the brake system.

5. [VR simulation] Electrical System Diagnosis. Familiarity with the car's electrical system and basic troubleshooting.

6. [VR simulation] Suspension System Overview. Understand the suspension system components and their function.

4.1 Learning Outcomes

The learning outcomes (LO) of the curriculum for XR-enhanced Automotive Technician will be focused on the following areas:

a) Technical Expertise

- LO2.1: Diagnose and repair common faults in engine systems. Assessment method: VR Assembly/Disassembly Performance (apps 2 & 3)
- LO2.2: Troubleshoot and maintain essential vehicle electrical systems. Assessment method: VR Simulation Performance (apps 5 & 6)
- LO2.3: Perform comprehensive routine maintenance procedures safely and accurately. Assessment method: Practical Workshop Check/Simulation

b) Precision & Problem Solving

- LO2.4: Identify complex component faults and apply attention to detail. Assessment method: VR/AR Component Identification (apps 1 & 4)
- LO2.5: Select and operate specialized tools and equipment with precision. Assessment method: XR Tool Proficiency Test (e.g. torque wrench)
- LO2.6: Ensure full compliance with all safety and environmental regulations. Assessment method: Safety Case Study Review

c) Customer & Workflow Skills

- LO2.7: Communicate repair needs clearly. Assessment method: Role-Playing/Communication with customers

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- LO2.8: Manage work tasks efficiently and collaborate effectively. Assessment method: Simulated Workflow/Team Project

d) Modern Vehicle Systems

- LO2.9: Describe the architecture and high-voltage safety protocols for EV/Hybrid vehicles. Assessment method: Quiz

4.2 Blended Curriculum Description and Schedule

The following schedule allocates **12 teaching hours** across **5 chapters.**

Chapter overview	
Chapter ID	Chapter 2.1 Engine Systems Deep Dive
Topic/Purpose	This chapter focuses on developing the technical proficiency required to identify, disassemble, assemble, and diagnose faults in a typical automotive engine system.
Goals/Objectives	Engine diagnostics and mechanics, component identification & function, and maintenance. XR applications used: 1) VR component identification, 2) VR assembly, 3) AR disassembly.
Duration	5 teaching hours
Difficulty level	Advanced
Expected outcomes	LO2.1, LO2.4
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of the function and location of all major engine components (e.g., block, head, pistons, valves, timing systems). • The ability to quickly and accurately identify and label engine parts, understanding their spatial relationship within the engine. • The precision skill to follow complex, multi-step procedures for the correct assembly of an engine (or its sub-systems) in the proper sequence. • The ability to systematically and logically assemble & disassemble an engine, correctly identifying the next component to add/remove based on structural dependency. • Understanding of best practices and procedural steps for routine engine maintenance tasks (e.g., tune-ups).
Soft skills acquired	• Attention to Detail: Focus on details, correct fastener selection, and alignment marks, driven by the instant feedback of the VR environment, which is essential for the engine integrity (LO2.4) • Problem Solving: Developing a logical, step-by-step approach to fault diagnosis and repair, following defined procedures precisely (LO2.1). • Procedural Discipline: Adherence to the correct order and methodology required for complex mechanical tasks (assembly/disassembly) without skipping steps.

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	• Precision: Cultivating the ability to execute tasks with accuracy and control, which is tracked and measured within the simulation environment.

Chapter overview	
Chapter ID	Chapter 2.2 Brake & Suspension Systems
Topic/Purpose	This chapter focuses on enabling the technician to accurately inspect, identify component faults, and perform routine maintenance procedures on the vehicle's brake and suspension systems using immersive VR environments, ensuring strict adherence to safety and precision standards.
Goals/Objectives	Routine maintenance & chassis, wheels/tires, routine service, brake and suspension systems. XR applications used: 4) VR Brake Inspection, 6) VR Suspension Overview.
Duration	3 teaching hours
Difficulty level	Intermediate
Expected outcomes	LO2.3, LO2.4, LO2.5
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of the function, wear limits, and inspection points for all components in the braking system. • The precision skill to systematically inspect the entire braking system for wear, leaks, and damage, accurately measuring wear against specifications (LO 2.4). • Understanding the purpose, types, and inspection points for all components in the suspension system (shocks, struts, springs, bushings, control arms). • The ability to quickly and accurately identify components of the brake and suspension systems and determine their operational condition. • Knowledge of correct procedures for tasks like tire/wheel service, basic fluid checks, and routine chassis lubrication. • The ability to select and operate specialized tools required for brake and suspension work (e.g., torque wrench, specialty spreaders) with precision (LO 2.5). • Understanding of the strict safety protocols and environmental regulations related to brake dust and hazardous fluids (e.g., brake fluid disposal). • The ability to execute basic routine maintenance procedures (e.g., tire rotations, fluid level checks) safely and accurately (LO 2.3).
Soft skills acquired	• Safety Focus: Sense of responsibility and diligence when working with safety-critical systems like brakes. The VR environment reinforces consequences for procedural errors. • Attention to Detail: Vigilance in noticing subtle indicators of failure or wear during inspection, as required for accurate fault identification.

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	• Procedural Compliance: Follow checklists and use tools according to specifications without deviation, which is vital for vehicle integrity. • Efficiency under Time Pressure: Practicing inspection routines to achieve accuracy within a strict timeframe, a necessity in a condensed curriculum and a busy workshop.

Chapter overview	
Chapter ID	Chapter 2.3 Electrical Systems
Topic/Purpose	This chapter focuses on enabling the technician to systematically troubleshoot and repair common electrical faults using digital diagnostic tools (multimeters, scanners) within a VR environment.
Goals/Objectives	Vehicle electrical systems & workflow, wiring diagrams, circuit testing, sensor diagnostics, teamwork, and time management. XR application used: 5) VR Electrical Diagnosis.
Duration	2 teaching hours
Difficulty level	Intermediate
Expected outcomes	LO2.2, LO2.4, LO2.8
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Understanding fundamental electrical concepts: voltage, resistance, current, and series/parallel circuits. • The ability to follow a logical, step-by-step diagnostic procedure to isolate the root cause of an electrical malfunction. • Knowledge of how to read and interpret basic vehicle wiring diagrams (symbols, color codes, component locations) to trace power/ground paths. • Proficient in the use of diagnostic tools. • Understanding the basic function and output of common **sensors** (e.g., temperature) • The skill to pinpoint the exact component (e.g., bad wire, faulty sensor, blown fuse) causing a fault, demonstrating attention to detail during testing. • Familiarity with the process of connecting and interpreting information from virtual scan tools. • The ability to determine the most effective repair (e.g., replacing a fuse, repairing a wire, replacing a component).
Soft skills acquired	• Problem-Solving: Applying logical deduction and technical steps (guided by the VR app) to quickly identify and test fault points, essential for complex electrical issues. • Time Management: Practicing efficient task execution and prioritizing steps during the VR diagnosis to complete the repair within simulated time constraints. • Teamwork and Collaboration: Introduction to effective communication and task division in a simulated repair scenario (e.g., how to hand off a

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	partially diagnosed job or seek advice), fostering mutual support and shop productivity. • Patience and Persistence: Maintaining focus and discipline when tracing intermittent or complex electrical faults, avoiding premature component replacement.

Chapter overview	
Chapter ID	Chapter 2.4 Safety, Ethics & Communication
Topic/Purpose	This chapter focuses on ensuring the technician understands and adheres to mandatory safety, legal, and ethical standards in the workshop, and to provide brief training on the critical communication skills needed for professional client interaction.
Goals/Objectives	Vehicle safety, shop safety, environmental compliance, professional ethics, client communication, XR safety protocol simulation.
Duration	1 teaching hour
Difficulty level	Beginner
Expected outcomes	LO2.6, LO2.7
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of mandatory procedures for using workshop equipment, handling tools, and maintaining a clean and safe workspace. • The skill to execute immediate and safe responses to common workshop hazards (e.g., spills, fire, emergency equipment usage) practiced via XR Safety Protocol Simulation (LO 2.6). • Understanding the proper procedures for handling, storing, and disposing of hazardous materials (e.g., oils, fluids, batteries) to ensure environmental compliance (LO 2.6). • The ability to identify potential physical and environmental hazards in the workplace and take corrective action. • Understanding key principles of professional ethics including honesty in diagnosis, transparency in billing, and client data confidentiality. • The ability to clearly and professionally explain technical diagnoses, recommended repairs, and costs to a non-technical client (LO 2.7). • Basic awareness of liability and the legal necessity of adhering to manufacturer specifications and safety standards. • The skill to effectively listen to the client's description of the vehicle issue to gather accurate diagnostic information.
Soft skills acquired	• Responsibility & Integrity: Developing a strong sense of personal accountability for safety compliance, ethical conduct, and the protection of client information.

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	• Professionalism: Cultivating a respectful and clear communication style when dealing with customers, which directly affects trust and business reputation. • Situational Awareness: Enhancing the ability to scan the environment for potential risks and prevent accidents (reinforced by the XR simulation). • Conscientiousness: Performing duties with care and attention to detail, especially when protocols involve safety or legal obligations.

Chapter overview	
Chapter ID	Chapter 2.5 Emerging EV/Hybrid Technologies
Topic/Purpose	This chapter focuses on providing the technician with essential safety knowledge and foundational concepts required to work with Electric and Hybrid Vehicle (EV/Hybrid) systems, ensuring they understand the high-voltage differences and safety protocols before engaging in any maintenance tasks.
Goals/Objectives	EV/Hybrid architecture & future tech, differences between internal combustion engine (ICE) vehicles and EV/Hybrid vehicles, high-voltage battery safety, digital competencies.
Duration	1 teaching hour
Difficulty level	Beginner
Expected outcomes	LO2.9
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of the layout and function of the main high-voltage components and power flow within an EV or Hybrid vehicle. • Understanding of mandatory personal protective equipment (PPE) and the safety exclusion zones required when working on high-voltage systems. • Ability to locate and identify high-voltage cabling and safety disconnects on a vehicle structure. • Basic knowledge of the need for battery thermal management systems and the associated dangers if damaged. • The ability to differentiate between low-voltage (12V) and high-voltage systems and avoid cross-contamination.
Soft skills acquired	• Heightened Safety Consciousness: Developing a sense of caution and vigilance when encountering high-voltage components, recognizing the severity of the risks involved. • Procedural Discipline: Cultivating the discipline to never bypass or shortcut safety procedures, particularly lockout/tagout. • Future Readiness: Demonstrating intellectual curiosity and adaptability toward new technologies, acknowledging the shift from mechanical repair to electromechanical and digital servicing.

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	• Risk Assessment: The ability to quickly assess a vehicle environment for high-voltage risks before initiating any repair or diagnostic work.

4.3 XR Tool-to-Chapter Mapping

- Chapter 2.1 (Engine) → XR applications used 1, 2, 3 (VR/AR Engine)

  Learning Benefit: This sequence of component ID (VR), disassembly (AR), and assembly (VR) ensures maximum repetition and perfect procedural memory before touching a real engine. It's a safe practice for complex mechanical procedures.

- Chapter 2.2 (Chassis) → XR applications used 4, 6 (VR Brake & Suspension Systems)

  Learning Benefit: Focused on visualization and safety. Allows technicians to easily identify all components of safety-critical systems, which is difficult in a crowded real-world bay.

- Chapter 2.3 (Electrical) → XR application used 5 (VR Electrical Diagnosis)

  Learning Benefit: Troubleshooting rare faults. Allows repeated practice of systematic diagnostics on electrical faults (e.g., intermittent shorts) that are difficult to replicate in the workshop.

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5 Unit 3 Competence framework for Electrical/Electronics/ IT technician

The following XR applications (VR and AR) will be developed for integration into the competence framework (curriculum) and the associated pilot training programs at VET schools:

1. [VR simulation] PC Assembly Workshop - Identify and install PC components

2. [AR mobile app for Android devices (phones/tablets etc.)] PC builder app - Practicing basic skills related to the assembly (placing basic components like the case, the motherboard, the processor, the heat sink, the RAM, the hard drive, the power supply, and the graphics card) and maintenance of a computer.

3. [VR simulation] Network Setup Basics - Connect a basic wired and wireless network

4. [VR simulation] Troubleshooting a Non-booting PC - Diagnose common hardware and software issues.

5.1 Learning Outcomes

The learning outcomes (LO) of the curriculum will be focused on the following areas:

a) Hardware Systems & Assembly

- LO 3.1: Correctly identify, install, and assemble core computer hardware components. Assessment method: VR/AR Simulation Performance (apps 1 & 2)

b) Troubleshooting & Diagnostics

- LO 3.2: Analyze and diagnose common faults in non-booting PC systems and electronic circuits. Assessment method: VR Troubleshooting Scenario (app 4)

c) Network Installation

- LO 3.3: Configure and establish basic wired and wireless network connections. Assessment method: VR Network Setup Performance (app 3)

d) Circuit & System Fundamentals

- LO 3.4: Interpret basic schematics and understand the function of common electronic components. Assessment method: Practical Workshop/Quiz

e) Safety & Digital Protocols

- LO 3.5: Comply with essential electrical safety protocols and digital security practices. Assessment method: Safety Checklist

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5.2 Blended Curriculum Description and Schedule

The following schedule allocates **12 teaching hours** across **5 chapters.**

Chapter overview	
Chapter ID	Chapter 3.1 PC Components & Assembly
Topic/Purpose	To train technicians in the proper identification, function, and safe, precise installation of core computer hardware components. The goal is to build procedural mastery through VR/AR simulations before engaging in physical assembly.
Goals/Objectives	The primary goal is attaining installation precision and procedural confidence for system assembly. Correctly identify and describe the function of the primary PC components (CPU, Motherboard, RAM, Storage, GPU, PSU). Successfully execute the step-by-step procedure for assembling a functional PC system within the VR/AR environment, adhering to correct sequence. Correctly install the CPU and RAM onto the motherboard, applying proper seating pressure and lock mechanism handling without damage. Correctly connect all power and data cables (ATX, EPS, SATA, front panel connectors) according to system requirements and best practices for airflow.
Duration	3 teaching hours
Difficulty level	Advanced
Expected outcomes	LO 3.1
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of how each core component functions (e.g., CPU cache vs. RAM speed, PCIe lanes) and how they interact. • The ability to visually recognize and differentiate between various component form factors and connectors. • Understanding basic hardware compatibility issues (e.g., socket type, RAM generation) to select appropriate components. • The skill to correctly seat delicate components like the CPU and RAM, minimizing physical risk (reinforced by VR/AR app 1 & 2). • The ability to perform clean, functional internal cabling, optimizing for power delivery and system cooling. • Understanding the layout of the motherboard (sockets, slots, headers) and the sequential dependency of assembly steps. • The skill to follow complex, multi-step assembly manuals and successfully integrate all components into the case.

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Soft skills acquired	• Attention to Detail: Developing extreme precision and patience when handling delicate and costly components (e.g., seating a CPU or installing a graphics card), driven by the unforgiving nature of the VR simulation. • Procedural Discipline: Cultivating the discipline to adhere strictly to the required assembly sequence and safety steps (like grounding) every time, a necessity in electronics work. • Problem-Solving: The ability to diagnose and correct minor installation errors (e.g., reversed cable, unseated RAM) quickly based on instant feedback from the AR/VR tools. • Focus and Concentration: Maintaining intense focus over long assembly sequences, especially important for tasks like thermal paste application and heat sink mounting.

Chapter overview	
Chapter ID	Chapter 3.2 System Fault Analysis, Diagnostics & Troubleshooting
Topic/Purpose	To train technicians to efficiently and logically analyze, diagnose, and resolve common hardware and software failures that prevent a PC from booting. The focus is on applying diagnostic knowledge and tool use in a high-fidelity, consequence-free VR troubleshooting scenario.
Goals/Objectives	The primary goal is the competence to systematically troubleshoot and resolve a system failure. Successfully apply a structured, logical troubleshooting methodology to isolate the root cause of a non-booting scenario. Accurately identify and pinpoint the failing component causing the boot failure. Proficiently use simulated diagnostic tools to gather critical data. Successfully apply the correct fix to return the non-booting system to a functional state. Distinguish between hardware failures (physical issues) and software/firmware failures (BIOS/OS configuration issues).
Duration	3 teaching hours
Difficulty level	Beginner
Expected outcomes	LO 3.2
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of the Power-On Self-Test (POST) sequence and the role of the BIOS/UEFI, MBR, and OS loader in the boot process. • The technical skill to logically follow the system's power and data flow to isolate failures, demonstrated by removing unnecessary steps in the VR scenario. • Knowledge of the specific symptoms (e.g., beep codes, error messages, no display, fan spin) associated with common hardware failures (CPU, RAM, GPU, PSU). • Proficient simulated use of diagnostic tools, such as interpreting POST error codes or using a simulated multimeter to test power delivery.

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	• Understanding the most effective immediate fixes for non-booting issues (e.g., clearing CMOS, reseating components, checking basic cables). • The ability to find and interpret system logs or firmware messages to identify software/driver conflicts. • Knowledge of how firmware updates, driver conflicts, and OS corruption can prevent a system from booting. • The skill to apply the minimum necessary correction to resolve the fault, avoiding unnecessary component replacement.
Soft skills acquired	• Problem-Solving: Developing a disciplined, hypothesis-driven approach to troubleshooting, avoiding guesswork and following a structured diagnostic path. • Logical Reasoning: Applying deductive reasoning to analyze symptoms and narrow down the list of potential failing components efficiently. • Patience and Persistence: Maintaining focus and discipline when facing complex or intermittent faults, refusing to be discouraged until the root cause is identified. • Risk Mitigation: Practicing safe, non-destructive diagnostic steps first in the VR environment, minimizing the risk of causing new damage while troubleshooting.

Chapter overview	
Chapter ID	Chapter 3.3 Network Basics & Setup
Topic/Purpose	To train technicians in the foundational concepts of networking, including the OSI model, IP addressing, and the function of key hardware. To develop the practical skills in order to successfully configure and connect a functional small-scale wired and/or wireless network.
Goals/Objectives	The central goal is the competence to establish and test basic network connectivity. Describe the basic function and purpose of each layer of the OSI model, relating it to troubleshooting common issues. Correctly identify, configure, and verify basic IP addressing components (IP address, subnet mask, gateway) for network devices. Identify the function and connection points of key network hardware (routers, switches, wireless access points). Successfully configure both wired and wireless settings on simulated devices (PCs, routers) to achieve network connectivity. Correctly identify and apply appropriate network cabling standards (e.g., Cat 5e/6, straight-through vs. crossover) for given scenarios.
Duration	3 teaching hours
Difficulty level	Intermediate
Expected outcomes	LO 3.3
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of the purpose of protocols, standards, and services (e.g., DHCP, DNS, TCP/IP) essential for network communication.

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	• The technical skill to navigate network device interfaces (simulated) to configure wireless security (SSID, passwords) and wired settings (static/dynamic IP). • Understanding the seven layers of the OSI model and where common devices/protocols (IP, Ethernet, HTTP) operate. • The skill to perform basic network cable termination (e.g., crimping RJ-45 connectors) according to T568A/B standards. • Knowledge of the specific roles and differences between hubs, switches, and routers in directing network traffic. • The ability to use simple commands (`ipconfig`, `ping`) to verify connectivity and isolate network layer issues. • Understanding the concepts of public vs. private IP addresses and basic subnetting principles. • The ability to physically and logically connect devices to a network using appropriate media and configurations.
Soft skills acquired	• Logical Reasoning: Applying structured thinking to troubleshoot network connectivity issues, moving systematically through the OSI layers to diagnose faults. • Attention to Detail: Maintaining precision when configuring settings (e.g., avoiding typos in IP addresses or passwords) which is critical for network functionality. • Abstract Visualization: Developing the ability to mentally map the flow of data across a network even though it is invisible, aided by the component visualization in the VR environment. • Procedural Discipline: Following detailed standard operating procedures for network setup and security configurations without deviation.

Chapter overview	
Chapter ID	Chapter 3.4 Electronics Fundamentals, Circuits, Schematics & Tools
Topic/Purpose	To equip technicians with the fundamental theoretical and practical knowledge of electricity, passive electronic components, and reading circuit diagrams. This serves as the basis for analyzing power delivery in computers and understanding complex electronic systems.
Goals/Objectives	The primary goal is the competence to apply basic electrical principles and interpret technical diagrams. Successfully calculate and apply the relationships between voltage, current, and resistance in simple series and parallel circuits. Correctly identify common passive electronic components (resistors, capacitors, inductors) and describe their basic function and impact on a circuit. Accurately interpret basic electronic schematic diagrams, identifying components, connection points, and power sources.
Duration	2 teaching hours
Difficulty level	Intermediate
Expected outcomes	LO 3.4

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Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • The knowledge of electrical principles e.g. Ohm's Law • The mathematical skill to calculate unknown values (voltage, current, resistance) in a basic circuit. • Knowledge of the symbols and nomenclature for basic components (resistors, capacitors, diodes) as they appear on a schematic. • The ability to trace a signal or power path through a given electronic diagram and identify the function of different circuit blocks. • Understanding the different modes of a digital multimeter (DMM) and the correct and safe way to use each mode (e.g., measuring current vs. voltage). • The skill of safely connecting a multimeter to measure continuity, resistance, and voltage on a component or test point. • Understanding concepts like capacitance, inductance, and filtering and their relevance to stable system power. • The ability to use the multimeter to perform basic functionality tests on passive components (e.g., checking resistor values).
Soft skills acquired	• Precision and Accuracy: Maintaining meticulous accuracy when reading component values (e.g., resistor color codes) and when taking multimeter measurements, as small errors invalidate troubleshooting efforts. • Analytical Thinking: Applying logical, step-by-step analysis to theoretical circuit problems before attempting physical measurement. • Safety Consciousness: Developing a heightened awareness of electrical safety procedures when working with live circuits, even at low voltages. • Conceptual Modeling: The ability to translate a two-dimensional schematic (abstract) into a functional three-dimensional circuit (physical) and vice-versa.

Chapter overview	
Chapter ID	Chapter 3.5 Foundations & Safety
Topic/Purpose	To instill in technicians a comprehensive understanding and strict adherence to essential physical and digital safety protocols. Prevent workplace accidents (electrical shock), protect sensitive electronic hardware (ESD), and maintain data security and confidentiality.
Goals/Objectives	The primary goal is attaining compliance with safety and security standards. Demonstrate strict compliance with Electrostatic Discharge (ESD) safety measures during all simulated and physical assembly procedures. Successfully use ESD prevention tools (e.g., wrist straps, mats) and procedures to safely handle sensitive computer components. Understand and comply with basic cybersecurity protocols, including strong password management and recognizing common phishing attempts. Demonstrate adherence to policies regarding data confidentiality and proper procedures for handling client information and storage devices.

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Duration	1 teaching hour
Difficulty level	Beginner
Expected outcomes	LO 3.5
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of common electrical hazards (e.g., shock, arc flash), the dangers of working near high voltage, and the role of grounding. • The procedural skill to establish a safe work environment, including proper use of personal protective equipment (PPE) and verifying power isolation. • Understanding the cause and effect of Electrostatic Discharge (ESD) on sensitive electronics and how ESD tools mitigate risk. • The technical skill to correctly wear and test an ESD wrist strap and manage components on an anti-static mat. • Knowledge of common digital threats (malware, phishing, social engineering) and best practices for securing accounts and systems. • The ability to follow strict protocols for accessing, backing up, or destroying client data while maintaining confidentiality. • Knowledge of the immediate steps to take in the event of an electrical accident or workplace injury. • The skill of consistently applying safety protocols (electrical and digital) without deviation.
Soft skills acquired	• Safety Conscience: Developing an uncompromising mindset toward safety, always prioritizing personal well-being and equipment protection before beginning work. • Integrity and Trust: Maintaining strict confidentiality regarding client data and system configurations, which is foundational to building professional trust. • Vigilance: Practicing situational awareness in both the physical shop environment (electrical hazards) and the digital environment (cyber threats). • Procedural Discipline: Cultivating the discipline to follow established safety checklists and protocols every time, even when rushed.

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5.3 XR Tool-to-Chapter Mapping

- Chapter 3.1 (PC assembly) → XR applications used 1, 2 (VR/AR assembly of components)

  Learning Benefit: Installation and assembly precision. Component visualization and repetition allow high-fidelity, mistake-free practice of delicate assembly steps (e.g., seating a CPU/RAM) multiple times, reinforcing ESD safety.

- Chapter 3.2 (Network setup) → XR applications used 3 (VR network configuration)

  Learning Benefit: System understanding. Allows visualization and interaction with network devices and settings that are often abstract, enabling practice of IP configuration and troubleshooting connectivity issues.

- Chapter 3.3 (Troubleshooting) → XR applications used 4 (VR fault analysis)

  Learning Benefit: Safe Experimentation. Technicians can practice risky diagnostic steps or simulate rare hardware failures that cannot be replicated on real equipment without causing damage.

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6 Unit 4 Competence framework for Healthcare/Nursing Assistant

The following XR applications (VR and AR) will be developed for integration into the competence framework (curriculum) and the associated pilot training programs at VET schools:

1. [VR simulation] Patient Intake & Vitals Check - Conduct patient intake and measure vitals (blood pressure, cuff, thermometer, pulse oximeter, scale)

2. [AR mobile app for Android devices (phones/tablets etc.)] Human anatomy educational game - Digestive System: oral cavity (mouth + teeth) - pharynx, esophagus/stomach/intestine, liver/pancreas/spleen, digestive system function, overall digestive system game/quiz. Respiratory System: nasal cavity (nose), larynx, lungs, respiratory system function, overall respiratory system game/quiz

3. [VR simulation] Preparing for a Routine Physical Exam - Prepare patient and assist physician

4. [VR simulation] Medical Equipment Identification - Identify and understand basic exam tools (e.g. otoscope, ophthalmoscope, reflex hammer, stethoscope)

6.1 Learning Outcomes

The learning outcomes (LO) of the curriculum will be focused on the following areas:

a) Patient care & monitoring

- LO 4.1: Accurately conduct patient intake and measure all vital signs using standard and simulated equipment. Assessment method: VR simulation performance (app 1)
- LO 4.2: Prepare a patient and assist a healthcare provider during routine physical exams. Assessment method: VR simulation performance (app 3)

b) Hygiene & safety protocols

- LO 4.3: Comply strictly with established hygiene and infection prevention protocols (e.g., hand hygiene). Assessment method: Practical workshop/checklist
- LO 4.4: Identify and safely handle basic medical equipment and instruments. Assessment method: VR identification test (app 4)

c) Anatomy & clinical reasoning

- LO 4.5: Identify and understand the function of key components in the digestive and respiratory systems. Assessment method: AR educational game/quiz (app 2)

d) Emergency & First Aid

- LO 4.6: Provide appropriate and timely first aid in common simulated emergency situations. Assessment method: Simulated emergency scenario

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6.2 Blended Curriculum Description and Schedule

The following schedule allocates **12 teaching hours** across **5 chapters.**

Chapter overview	
Chapter ID	Chapter 4.1 Patient Intake and Monitoring
Topic/Purpose	To train the Nursing Assistants in the accurate, systematic, and standardized procedure for conducting patient intake, including gathering preliminary data and proficiently measuring the four primary vital signs (Temperature, Pulse, Respiration, and Blood Pressure) using both standard and simulated medical equipment.
Goals/Objectives	Conduct a complete patient intake in the correct, systematic order, including preparation, introduction, and data logging. Accurately measure and record Blood Pressure (BP) using both manual and simulated electronic cuffs, ensuring proper cuff size selection and placement. Accurately measure and record Pulse (rate and rhythm) and Oxygen Saturation (SpO_2) using appropriate techniques and devices (pulse oximeter). Accurately measure and record body temperature using different simulated thermometer types (e.g., oral, temporal). Demonstrate the ability to calibrate and prepare vital sign measurement equipment correctly before use.
Duration	3 teaching hours
Difficulty level	Beginner
Expected outcomes	LO 4.1
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of the normal and abnormal physiological ranges for each vital sign (BP, T, P, SpO_2) and the significance of deviations. • The procedural skill to execute a patient intake sequence flawlessly, including identity verification and initial status briefing. • Understanding the specific proper technique required for each vital sign measurement (e.g., two-step BP method, site selection for pulse). • The technical skill to manipulate and use vital signs equipment (simulated and real) to obtain accurate, repeatable readings. • Knowledge of the function, proper use, and limitations of instruments like the sphygmomanometer, stethoscope, thermometer, and pulse oximeter. • The ability to accurately and legibly record vital sign measurements, recognizing and reporting abnormal findings promptly.
Soft skills acquired	• Attention to Detail & Precision: Maintaining focus during measurements to ensure accuracy, as even small errors in vitals can lead to incorrect clinical decisions.

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	• Patient Rapport & Communication: Developing the ability to approach and interact with the patient in a calm, reassuring, and professional manner while performing intrusive procedures (practiced through VR patient interaction). • Time Management: Executing the sequence of measurements efficiently while maintaining accuracy, minimizing discomfort or delay for the patient. • Procedural Compliance: Adhering strictly to established, evidence-based protocols and techniques without deviation (reinforced by the VR guidance).

Chapter overview	
Chapter ID	Chapter 4.2 Human Anatomy
Topic/Purpose	Identify the key organs and understand the basic physiological function of the digestive and respiratory systems.
Goals/Objectives	Accurately identify the main organs of the digestive system (e.g., mouth, stomach, intestines, liver) and the respiratory system (e.g., nasal cavity, larynx, lungs), and describe their primary functions. How the digestive and respiratory systems interact to maintain overall bodily function.
Duration	4 teaching hours
Difficulty level	Advanced
Expected outcomes	LO 4.5
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of the location and structure of organs within the digestive and respiratory tracts. • The skill of rapid and accurate identification of anatomical structures during the AR gaming scenarios (LO 4.5). • Understanding the basic physiological processes (e.g., peristalsis, gas exchange) carried out by the targeted organ systems. • Familiarity with the correct medical names for organs and equipment, aiding in professional documentation and communication.
Soft skills acquired	• Cognitive Agility: Enhancing the speed and accuracy of recall and information retrieval through gamified learning and rapid-fire quizzes. • Self-Directed Learning: Taking ownership of learning anatomical concepts through an interactive, self-paced application. • Attention to Detail: Focusing on the precise terms and subtle differences between components and tools, critical for documentation and preventing errors in assisting clinical staff. • Curiosity: Fostering a deeper interest in human physiology, motivating further learning about patient health conditions.

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Chapter overview	
Chapter ID	Chapter 4.3 Physical Exam, Clinical Assistance & Medical Equipment
Topic/Purpose	To train in the procedural steps for preparing a patient for a physical examination, safely assisting the healthcare provider, and managing the patient's emotional state, ensuring the examination is performed efficiently and accurately. Concurrently, it aims to ensure familiarity and accurate identification of the basic medical instruments used in patient assessment and routine care.
Goals/Objectives	Demonstrate the ability to correctly prepare the examination room and the patient (positioning, draping, comfort) before the physician's arrival. Successfully anticipate, retrieve, and hand instruments to the healthcare provider during the examination in the correct manner. Safely and correctly handle, prepare, and put away instruments necessary for the exam. Accurately and clearly verbally report relevant patient observations or changes to the healthcare provider. Employ techniques to effectively deal with patient anxiety and maintain patient dignity throughout the process.
Duration	3 teaching hours
Difficulty level	Intermediate
Expected outcomes	LO 4.2, LO 4.4
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Detailed knowledge of the sequential steps for preparing the patient for common physical exam types (e.g., general, cardiac, abdominal). • The procedural skill to ensure the room is stocked and the patient is positioned and draped correctly for various examinations (LO 4.2). • Understanding the necessity of maintaining cleanliness and using basic aseptic techniques in the exam room and when handling instruments. • The skill to safely manage and transfer medical equipment between surfaces and personnel without contamination. • Knowledge of the SBAR (Situation, Background, Assessment, Recommendation) framework or similar methods for concise verbal reporting to the provider. • The ability to predict the physician's needs during the exam and efficiently have the correct instruments ready. • The skill to assist the patient in achieving and maintaining the required anatomical positions for the exam. • The ability to correctly associate basic medical instruments with their specific clinical purpose (e.g., knowing the ophthalmoscope is for eye examination). • The skill of visually recognizing and naming common medical equipment from different angles and contexts (app 4).

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Soft skills acquired	• Empathy & Reassurance: Developing the ability to recognize and address patient anxiety through calm demeanor, simple explanations, and supportive language. • Teamwork & Trust: Cultivating a high level of trust and efficiency with the supervising healthcare provider through smooth, anticipatory assistance (LO 4.2). • Attention to Detail: Maintaining meticulous focus on cleanliness and order in the examination room and with instruments (LO 4.4). • Non-Verbal Communication: Using appropriate body language and eye contact to convey professionalism and build rapport with the patient. • Professional Discretion: Understanding when and how to communicate information verbally, ensuring confidentiality and brevity in reporting to the provider.

Chapter overview	
Chapter ID	Chapter 4.4 Hygiene, Infection Control & Ethics
Topic/Purpose	To instill the critical knowledge and procedural discipline required to prevent the spread of disease, comply strictly with infection control and safety protocols, and adhere to the fundamental ethical and legal standards of healthcare practice.
Goals/Objectives	Describe the Chain of Infection and identify the critical points where a Nursing Assistant can effectively interrupt transmission. Demonstrate the correct, standard Hand Hygiene (washing and sanitizing) technique and proper procedures for donning and doffing Personal Protective Equipment (PPE). Comply strictly with established infection prevention protocols (e.g., handling contaminated linens, disposing of sharps) in all simulated and workshop activities. Demonstrate a clear understanding of the importance of patient confidentiality and the boundaries of the Nursing Assistant's Scope of Practice.
Duration	1 teaching hour
Difficulty level	Beginner
Expected outcomes	LO 4.3
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of the modes of disease transmission and the principles underpinning universal and standard precautions. • The procedural skill of performing hand washing and sanitizing according to the exact, time-bound protocol. • Understanding when and which specific PPE (gloves, gowns, masks, eye protection) must be used, and the correct sequence for safe application and removal. • The critical skill of safely putting on (donning) and taking off (doffing) PPE to prevent self-contamination and the spread of pathogens. • Knowledge of patient rights, confidentiality standards (legal/ethical)

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	• The ability to correctly sort, transport, and dispose of soiled materials and biohazardous waste. • Understanding the requirement for accurate documentation and reporting of infection control breaches or exposures. • The skill of applying hygiene and safety protocols consistently, even under simulated pressure (VR Ethics/Protocol Review).
Soft skills acquired	• Vigilance & Discipline: Developing a high level of procedural discipline and situational awareness to execute infection control measures flawlessly, acknowledging the risk to self and patient. • Responsibility & Integrity: Demonstrating unwavering commitment to professional ethics, especially regarding patient privacy and honesty in reporting. • Self-Correction: Using feedback from the VR protocol review to identify and correct procedural errors quickly. • Non-Verbal Communication: Conveying confidence and safety to patients through cleanliness and deliberate actions, which builds trust.

Chapter overview	
Chapter ID	Chapter 4.5 Emergency Response & First Aid
Topic/Purpose	To provide essential knowledge and practical, life-saving skills required to recognize and initiate appropriate, timely first-aid and emergency response procedures for critical situations like cardiac arrest, choking, and traumatic injuries, ensuring patient safety until advanced help arrives.
Goals/Objectives	The primary goal is the competence to initiate effective, immediate action in an emergency. Demonstrate the correct basic steps for Cardiopulmonary Resuscitation (CPR), including activating the emergency system and performing chest compressions on a manikin/simulator. Successfully demonstrate the technique for clearing an obstructed airway (choking) in an adult. Recognize the signs and symptoms of acute patient deterioration (e.g., stroke, shock, sudden decline) and initiate the correct response protocol. Provide appropriate initial care for falls and common wounds (e.g., applying direct pressure, bandaging). Execute an emergency response scenario (e.g., patient fall, sudden collapse) with speed, accuracy, and compliance with the established protocol.
Duration	1 teaching hour
Difficulty level	Intermediate
Expected outcomes	LO4.6
Knowledge & skills acquired (technical/conceptual)	Students will acquire the following knowledge and skills: • Knowledge of the standardized steps for initiating a medical emergency response (e.g., checking for responsiveness, calling for help, retrieving equipment).

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	• The technical skill to perform high-quality chest compressions (rate and depth) and basic rescue breathing on a manikin/simulator. • Understanding the immediate physical signs indicating life-threatening conditions (e.g., signs of severe bleeding, non-responsive breathing). • The ability to effectively manage the immediate environment during an emergency to ensure safety and organize assistance (LO 4.6). • Knowledge of proper methods for controlling bleeding, stabilizing limbs, and managing a patient who has fallen. • The skill to rapidly assess a situation and prioritize the most immediate life-threatening intervention needed. • Knowledge of the location and use of emergency equipment such as crash carts, Automated External Defibrillators (AEDs), and first-aid kits. • The skill to accurately report and document the events and interventions performed during the emergency.
Soft skills acquired	• Emotional Resilience: Developing the ability to remain calm, focused, and decisive under the extreme pressure of a life-threatening emergency (reinforced through VR scenarios). • Communication under Pressure: Giving clear, concise, and commanding verbal instructions (e.g., when calling for help or directing a colleague) during a crisis. • Rapid Decision-Making: The capacity to quickly assess a changing situation and choose the correct immediate intervention without hesitation. • Accountability: Taking immediate responsibility for initiating the correct response and ensuring the safety of the patient and self.

6.3 XR Tool-to-Chapter Mapping

- Chapter 4.1 (Patient Intake & Vitals Check) → XR applications used: 1 (vitals measurement, patient interaction)

  Learning Benefit: Practice highly sensitive measurement techniques until mastery without disturbing real patients.

- Chapter 4.2 (Human Anatomy) → XR applications used: 2 (AR Human Anatomy Game)

  Learning Benefit: Understanding of internal structures, making abstract anatomy concrete and interactive.

- Chapter 4.3 (Physical Exam, Clinical Assistance & Medical Equipment) → XR applications used: 3, 4 (VR Preparing for a routine physical exam and VR Medical Equipment Identification)

  Learning Benefit: Practice the exact sequence of steps for patient preparation and maintain sterility in a low-stress environment. Rapidly identify and understand the function of specialized tools, reducing errors in the clinic.

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7 Learning activities duration

Approximately **40 hours** of teaching material for blended learning activities

Lesson plans	Duration (teaching hours)	Mode & Key Activity
Chapter 1.1: Introduction to XR	2	Theory, classroom lecture, group discussion; VR experience demo
Chapter 1.2: XR Tools & Setup	2	Practical VR/AR setup and troubleshooting workshop
Chapter 2.1 Engine Systems Deep Dive	5	VR assembly & AR disassembly simulation, workshop practice
Chapter 2.2 Brake & Suspension Systems	3	VR brake & suspension simulations, workshop practice
Chapter 2.3 Electrical Systems	2	VR electrical diagnosis simulation, workshop practice
Chapter 2.4 Safety, Ethics & Communication	1	Theory, role play, XR safety protocol simulation
Chapter 2.5 Emerging EV/Hybrid Technologies	1	Classroom lecture, EV high-voltage safety simulation
Chapter 3.1 PC Components & Assembly	3	Theory, VR/AR guided practice & assembly repetition
Chapter 3.2 System Fault Analysis, Diagnostics & Troubleshooting	3	Case studies, VR fault diagnosis and correction scenarios
Chapter 3.3 Network Basics & Setup	3	Theory, VR wired/wireless network configuration practice
Chapter 3.4 Electronics Fundamentals, Circuits, Schematics & Tools	2	Examples, Workshop: e.g. multimeter use, circuit testing simulation

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Chapter 3.5 Foundations & Safety	1	Theory/discussion, safety setup, safety protocol review
Chapter 4.1 Patient Intake and Monitoring	3	Theory, VR Simulation Practice, Workshop Practice
Chapter 4.2 Human Anatomy	4	Theory, AR Anatomy Game Play, Quiz
Chapter 4.3 Physical Exam, Clinical Assistance & Medical Equipment	3	Theory/Role Play, VR Simulation Practice, VR Equipment ID Practice
Chapter 4.4 Hygiene, Infection Control & Ethics	1	Theory/Discussion, Workshop Practice, Ethics & Protocol Review
Chapter 4.5 Emergency Response & First Aid	1	Theory, Workshop Practice, Emergency Response Scenarios
Total	40	

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