Scenario title

Facilitating the understanding and reading of technical drawings with the help of digital equipment and devices.

Target audience

VET teachers working in the field of engineering (in this case – installation of renewable energy devices).

Problem to solve - Learning Situation

VET teachers in the field of engineering very often face situations when VET students at the beginning of a course struggle in understanding and reading technical drawings, schedules and specifications. Using digital technologies and devices can be very helpful in coping with this problem.

Overview of scenario

EQF levels 3 and 4

This scenario of VET teacher training deals with the problem of how to help VET students to develop the know-how and skills for reading and understanding technical drawings and schemes.

Competencies covered from DigCompEdu

02	**Digital resources**

	2.2 Creating and modifying digital resources	To modify and build on existing openly-licensed resources and other resources where this is permitted. To create or cocreate new digital educational resources. To consider the specific learning objective, context, pedagogical approach, and learner group, when designing digital resources and planning their use.	
	C1 Leader	Creating, co-creating and modifying resources according to the learning context, using a range of advanced strategies.	*I create and modify digital resources and activities adapted to the learning context and the group of trainees, using innovative strategies such as online assessment sheets, online surveys, thematic games, collaborative platforms.*

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			I use tools like h5p, Padlet, Mentimeter, Kahoot, and others to create interactive activities for my graduates.

03	**Teaching and Learning**	
	3.1 Teaching	To plan for and implement digital devices and resources in the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction.

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	B1 Integrator	Integrating available digital technologies meaningfully into the teaching process	*I can integrate the use of several different digital technologies and tools in the theoretical lesson and in supporting the independent learning of students.*
			I can integrate several different digital technologies and tools in practical training and work based-learning environments.
	3.3 Collaborative Learning	To use digital technologies to foster and enhance learner collaboration. To enable learners to use digital technologies as part of collaborative assignments, as a means of enhancing communication, collaboration and collaborative knowledge creation.	

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	B2 Expert	Using digital environments to support collaborative learning	*I can use online (Internet) learning environments to support collaborative learning of the VET students in the classrooms.*
			I can apply digital environments used for the collaboration and communication in the work processes for the purposes of collaborative learning.

05	**Empowering Learners**

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	5.3 Actively engaging learners	To use digital technologies to foster learners' active and creative engagement with a subject matter. To use digital technologies within pedagogic strategies that foster learners' transversal skills, deep thinking and creative expression. To open up learning to new, real-world contexts, which involve learners themselves in hands-on activities, scientific investigation or complex problem solving, or in other ways increase learners' active involvement in complex subject matters.

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	B2 Expert	Using digital technologies for learners' active engagement with the subject matter.	*I can explain and demonstrate to VET students and apprentices the advantages of using digital technologies for the active and effective acquisition of vocational knowledge, skills and transversal skills in the classrooms and practical training environments.*
			I can initiate and implement the training projects which involve using of digital technologies for the active engagement of the VET students and apprentices in the acquisition of vocational

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			knowledge, skills and competence.
	C2 Pioneer	Innovating digital strategies for active learning.	*I can design the new methodical-organizational approach of active learning for the VET students and apprentices based on the application of digital technologies.*
			I can develop new technological solutions of digital applications for the active learning for the VET students and apprentices.

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Curriculum Construct(s)

According to Revised Bloom's Taxonomy (Anderson and Krathwohl, 2001)
https://www.researchgate.net/publication/264675976_Transitioning_from_Teaching_Lean_Tools_To_Teaching_Lean_Transformation/figures?lo=1

Level	**Description**	**Coverage**
Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing	FL
Evaluating	Making judgments based on criteria and standards through checking and	FL
Analyzing	Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through	FL

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Applying	Carrying out or using a procedure through executing or implementing	LP
Understanding	Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining	LP
Remembering	Retrieving, recognizing, and recalling relevant knowledge from long-term memory	LP
LP = Learning Prerequisites, FL = Focus of the Learning Scenario		
Source: Anderson & Krathwohl (2001)		

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Scenario description

Lack of the ability of VET students to understand and read electric installation drawings, schedules and specifications present a major obstacle for successful learning of vocational subjects in the fields of electronics and requires a lot of teaching time for teachers to deal with this. Therefore, VET schools very often face the didactic challenge on how to ensure fast, effective and sustainable acquisition of this knowledge and skills, especially, when the traditional “classroom” teaching methods from the books are not so effective and attractive for the students.

Here the orientation of teaching and learning to the work practice and usage of digital solutions can create a real difference and provide a trustful measure to deal with this deficit of knowledge and skills. The VET teachers of Alytus VET centre successfully and effectively use the digital solutions for developing of skills needed to understand and read electric circuit drawings, schedules and technical specifications. This scenario is based on their experience and didactic approaches and seeks to disseminate effective practice in the different contexts of training and learning. This approach can be effectively used both in the school-based and work-based learning environments.

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Scenario Objectives

This scenario aims to develop the professional and methodological competences of vocational teachers needed to teach students how to read, interpret and produce electric control installation drawings, schedules and technical specifications by using digital tools. Here the responsibility of tutor is to train the VET teachers and trainers in applying the described didactic approach.

Requirements

Teaching/learning infrastructure and technology: mechatronics laboratory equipped with computers, CAD-CAM or equivalent software, platforms for programming/controlling the microcontroller and monitoring its processes, Festo FluidSIM Pneumatics simulators , CADeSIMU or equivalent.

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Outline plan

Activity	Reading prepared electrical schemes and drawings.
Timing	3 hours
Methods	Lecturing, presentations, questions-answers, execution of independent/group tasks.
What the tutor is doing	The tutor discusses with VET teachers the training strategy on how to teach students to read electrical schemes and drawings.
What the learners are doing	The teacher explains to the students the principles, elements, symbols and meanings of electrical control diagrams and drawings, using concrete examples.

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	The students read and interpret the diagrams and drawings independently or with the teacher's help.
Equipment and Support	Computers with CAD/CAM or equivalent software, word-processing software, printed wiring diagrams or drawings.
Reference to DigCompEdu	03 Teaching and Learning - 3.1 Teaching 03 Teaching and Learning - 3.1 Collaborative Learning 05 Empowering Learners - 5.3 Actively engaging learners
Assessment of/for learning	Observation of the teaching process and communication between the VET teachers and students.
Resources/links/relevant content/Examples	Examples of electric circuit drawings, wiring diagrams, schedules and technical specifications (printed). Powerpoint presentations used by teachers.

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Activity	Independent redrawing and checking of wiring diagrams of the renewable energy units by using simulators.
Timing	3 hours
Methods	Demonstration, independent execution of tasks
What the tutor is doing	Discusses with the teacher the execution of training activity and observes the process of training.
What the learners are doing	The teacher explains and demonstrates how to use the simulator and its main functions, and shows how to redraw and check the circuit diagram on the simulator. Students redraw the circuit diagram of the task on the simulator, check its operation and compare it with the description.
Equipment and Support	A renewable energy laboratory equipped with computers, CAD-CAM or equivalent software, CADeSIMU simulator, FESTO FluidSIM or equivalent.

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Reference to DigCompEdu	01 Professional Engagement - 1.3 Reflective practice 02 Digital resources - 2.2 Creating and modifying digital resources 03 Teaching and Learning - 3.1 Teaching 03 Teaching and Learning - 3.1 Collaborative Learning 05 Empowering Learners - 5.3 Actively engaging learners
Assessment of/for learning	Methods used to assess learning outcomes: - Theoretical testing of knowledge (multiple choice test). - Practical test of knowledge. Computer aided design of the drawing provided and printing of the model.
Resources/links/relevant content/Examples	CAD-CAM usage instructions and specifications.

Activity	Preparation of a new electrical schematic for the electrical part of a real renewable energy installation according to the provided task.

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Timing	5 hours
Methods	Independent execution of tasks
What the tutor is doing	Discusses with the VET teacher /trainer the execution of training activity and observes the process of training providing necessary support to teachers in case of need.
What the learners are doing	Using the diagram given earlier and tested in the simulator, the students assemble a real electrical installation.
Equipment and Support	A renewable energy laboratory with computers, CAD-CAM or equivalent software, CADeSIMU, Festo FluidSIM or equivalent simulators, and the equipment specified in the principle diagram for the assembling of the actual unit.
Reference to DigCompEdu	01 Professional Engagement - 1.3 Reflective practice 02 Digital resources - 2.2 Creating and modifying digital

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	resources 03 Teaching and Learning - 3.1 Teaching 03 Teaching and Learning - 3.1 Collaborative Learning 05 Empowering Learners - 5.3 Actively engaging learners
Assessment of/for learning	Methods used to assess learning outcomes: - Cumulative. Cumulative grading is a convenient way to motivate students by monitoring and recording their motivation, initiative and progress, as well as their independent learning. Cumulative assessment is used throughout the process. - Formal assessment can be used to assess the results achieved. Formal assessment is used at the end of each of the following three stages (cumulative principle applied): a mark for describing and verifying the operation of the scheme in the simulator, and a mark for assembling and testing the actual scheme.

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Resources/links/relevant content/Examples	Panel with two DIN rails, contactors with additional contact blocks, connecting wires, single-phase power cable, automatic switches, control buttons with NO (normally open) and NC (normally closed) contacts, electrician's tool kit, multimeter, laboratory with three-phase and single-phase power supplies. In addition, a smart screen and a computer are required for the presentation of the teaching material.

Our notes from practice/Method

At the beginning of the training activity information is provided on the management and operation of electrical equipment and controls.

This is followed by the task of using the principle diagram to design a working electrical circuit according to the requirements, in accordance with the activities below.

Activity 1. After receiving the task, the students analyse the task by identifying, either orally or in writing, the devices and their connections in the diagram, distinguishing the controlled device and the power circuit from the control circuit and describing the operation of the whole system.

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Activity 2: After the analysis of the scheme, the scheme shall be further modelled in the simulator. The student accurately redraws the scheme on the computer and runs the simulation. During the simulation, the circuit, if connected correctly, will operate in the right way and the algorithm of the circuit (i.e. the sequence in which the devices must operate) becomes clear. The student checks that he/she has analysed the circuit well in Activity 1.

Activity 3: Once the student has worked out how the circuit works in the simulator, he/she needs to build a real circuit by selecting real components, connecting them, checking the quality of the connections with a multimeter, and then, after connecting the power supply, checking that the circuit is working properly. When the circuit is not working properly, the student performs it's diagnostics.

The student is assessed in this scenario on:

- neatly describing the circuit diagram for the task;

- creating the circuit in the simulator, checking it;

- constructing and operating a real circuit.

This scenario encourages analytical thinking, problem solving, communication and cooperation (students can consult with each other and solve the problems related to the tasks together).

Below are: a task with a description of how it works (Figure 1), a simulation of a redrawn diagram (Figure 2) and a real-life assembled unit (Figure 3).

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Tiesioginis variklio paleidimas panaudojant kontaktorių

Schemos veikimo aprašymas:

Schemos veikimo aprašymas:

Schemą sudaro galios grandinė (sugludintų kampų kvadratas) ir valdymo grandinė (stačių kampų kvadratas). QF – abi grandines saugantis automatinis išjungiklis – apsaugo valdymo ir galios grandines nuo viršsrovių, taip pat atlieka ir pagrindinio jungiklio funkciją. Galios grandinę sudaro valdomas galios įrenginys – trifazis variklis (M), kurį įjungia/išjungia valdymo grandinės kontaktorius (K1), sujungdamas galios kontaktus ir variklio perkrovos apsauga – šiluminė relė (T).

Valdymo grandinę sudaro nutraukiamo kontakto mygtukas „STOP“, sujungiamo kontakto mygtukas „START“ ir su juo lygiagrečiai sujungtas kontaktoriaus K1 sujungiamas kontaktas, toliau – kontaktoriaus ritė K1.

Įjungus automatinį jungiklį QF, maitinimo įtampa atsiranda galios kontaktų K1 viršutinėje dalyje; iš ašakos, per STOP mygtuką, pasiekia START mygtuką. Paspaudus START mygtuką, įtampa užmaitina kontaktorių K1 ir galios kontaktai galios grandinėje bei papildomas kontaktas K1 užsidaro. Papildomas kontaktas K1 sukuria naują kelią srovei, aplenkiant START mygtuką ir atleidus mygtuką, kontaktorius pats save užmaitina.

Veikiant kontaktoriui ir užsidarius galios kontaktams, įtampa maitina variklį per sujungtą šiluminę apsaugą T ir variklis pradeda suktis.

Kad sustabdyti variklio darbą, reikia išjungti valdymo grandinėje esantį kontaktorių (nuspaudus STOP mygtuką, atjungiama įtampa valdymo grandinei ir kontaktoriui. Kontaktorius išsijungia ir atjungia variklį galios kontaktais K1 nuo maitinimo įtampos).

Valdymo ir galios grandines galima išjungti QF automatiniu išjungikliu.

Figure 1. Task with description of actions

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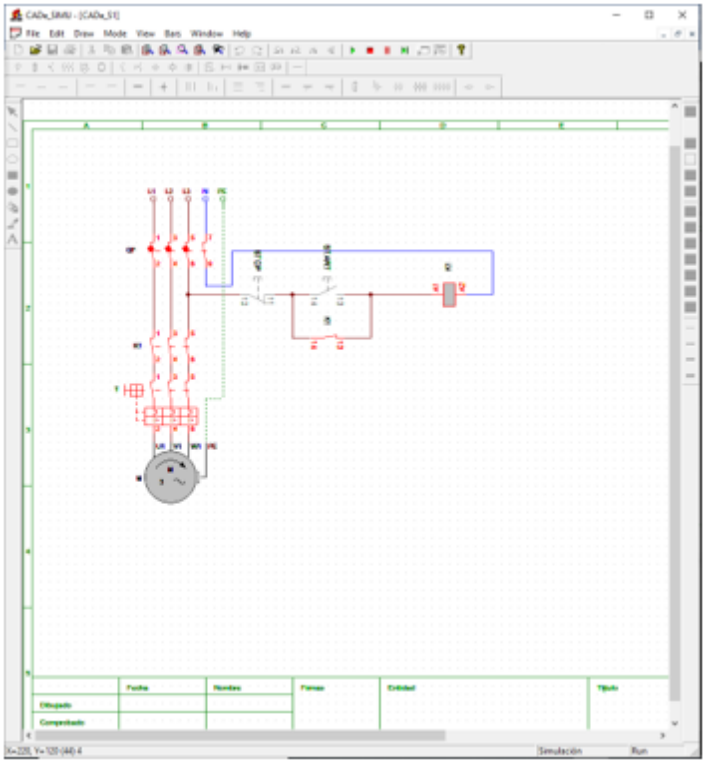

Figure 2. Re-drawn and checked scheme (in the simulator)

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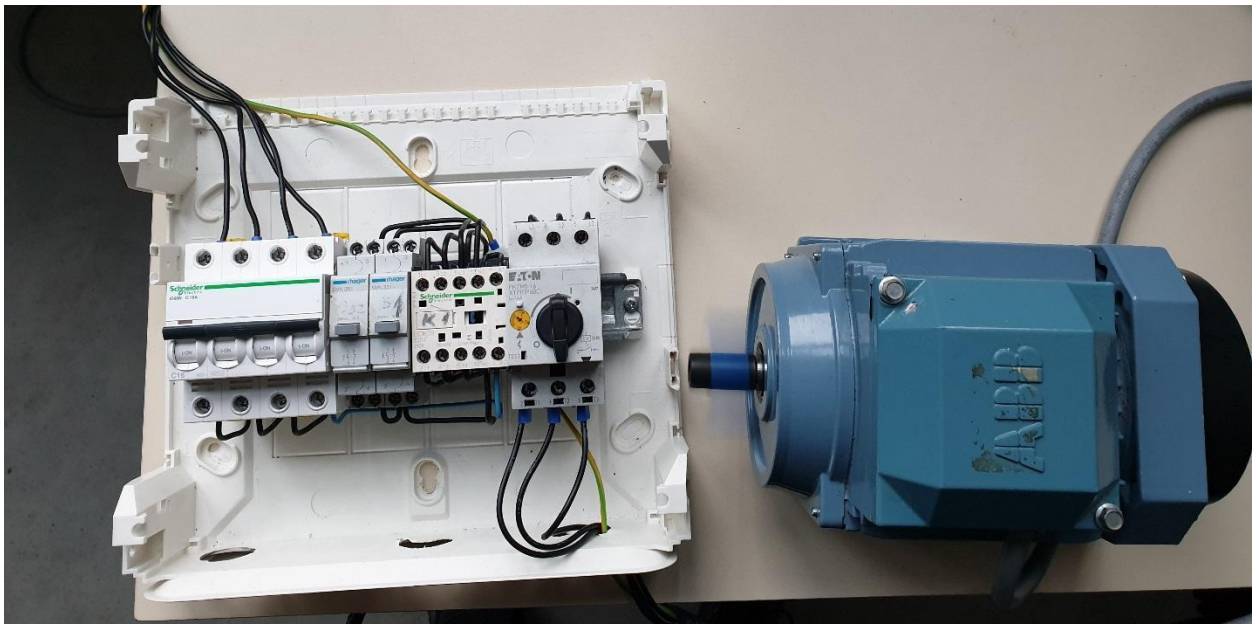

Figure 3 pav. Assembled functionning installation

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