# Introduction

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| Agile Mindset and Values  In this learning scenario, agile values such as self-organization, responsibility, and flexibility are actively embodied. Learners take responsibility for their learning process by setting their own learning goals and pursuing them independently. They decide how to use the VR welding simulation to achieve the desired results. Through the iterative Design Thinking process, creative problem-solving is promoted, as learners continuously develop, test, and improve their ideas.  Active Participation and Responsibility: Learners are actively involved in the entire learning process from the beginning. They plan their approach in teams, set goals, and provide feedback to one another.  Promoting Creativity and Problem Solving: The scenario encourages creative problem-solving, as learners must develop innovative approaches to optimally integrate the VR welding simulation into training. Open-ended problem statements and the independent development of solutions foster a creative mindset.  Learning Process and Methods  The learning process is divided into short, iterative cycles structured by the Design Thinking approach. Each phase of the process is accompanied by clearly defined tasks and feedback loops to ensure learning progress. Learners work both collectively and peer-to-peer, exchanging ideas in small teams, developing prototypes, and supporting one another.  Agile Learning Methods: Methods such as brainstorming, prototyping, and peer reviews are central elements of the learning process. Digital tools like the VR welding simulation and collaborative platforms such as Edkimo or Kahoot are used to facilitate collaboration and enhance the learning experience.  Collaborative Learning: Learners work in teams and support one another in completing tasks. Through discussions and the incorporation of feedback, they learn from each other and collaboratively develop solutions.  Role of Teachers  The role of teachers in the Design Thinking learning scenario shifts from being a knowledge provider to a learning facilitator or coach. Teachers offer support when needed and promote learners' independence. They provide advice, give feedback, and guide learners through reflection.  Teacher as a Coach: Teachers ensure that learners have access to the necessary resources, support group dynamics, and ensure the iterative process progresses. They encourage learners to work independently and help each other.  Learning Objectives and Content  The learning objectives are aligned with the practical demands of the learners’ vocational daily tasks and are flexible to adapt to the learning process. In addition to acquiring technical knowledge of welding techniques, learners also develop digital skills, teamwork abilities, and problem-solving competencies.  Learning Objectives:  Confident use of the Soldamatic VR welding simulation.  Transfer of comprehensive knowledge of welding techniques and workplace safety.  Development of a user manual and a training concept.  Promotion of self-organization and teamwork.  Content can be adjusted if new requirements emerge during the project or learners identify specific needs.  Framework Conditions  The organization supports agile learning by providing flexible learning environments equipped with digital tools and VR technology. The learning spaces are designed so that learners can access the necessary infrastructure (e.g., Smartboards, tablets, computers) at any time, enabling self-organized learning.  There is room for self-organized learning through the use of VR technology and the flexible design of learning schedules. Learners can work at their own pace and independently decide which tasks to tackle and when.  Learning Culture and Leadership  The learning culture fosters lifelong learning and a positive error culture. Learners are encouraged to make mistakes, learn from them, and continuously make improvements. Leadership supports agile learning by providing resources and allowing learners the freedom to work independently.  Support from Leadership: Supervisors support learners by providing the Soldamatic VR technology and fostering the development of competencies necessary for workplace practice.  Results and Effectiveness  Regular feedback elements such as daily reflection rounds and the use of digital platforms like Edkimo ensure that learners review their progress and support one another. The transfer of learning to practice is ensured through the practical application of the welding simulation.  Practical Transfer: The learning content can be directly applied in vocational practice. Apprentices not only learn the technical aspects but also the safety standards they will need in their future careers. |

# Teaching and learning objectives

In vocational training, trainees often need to learn complex welding techniques in a safe environment. Traditional welding training poses high risks, such as injuries from UV radiation, fire hazards, and a lack of safety experience. Additionally, tools to practice and correct mistakes safely are often unavailable, leading to uncertainty and fear. The VR welding simulation Soldamatic provides a solution by enabling learners to practice welding in a risk-free, virtual environment. The challenge for the learners is to figure out how to optimize the use of this system and ensure that VR technology enhances welding training by making it safer and more effective, without losing the practical connection to real-world tasks.

## Teaching objectives

1. Promote self-directed and creative work through the use of the VR welding simulation.
2. Teach in-depth knowledge of various welding procedures and related safety precautions.
3. Support learners in applying the simulation to meet the requirements of vocational practice.

## Learning objectives

* Learners should feel confident in using the Soldamatic VR welding simulation and recognize its advantages over real-world welding.
* Learners should understand the key welding techniques (e.g., MIG, MAG, TIG) in a safe environment and deepen their skills.
* Learners develop the ability to create an instruction manual for the Soldamatic VR, covering technical details and safety guidelines.
* Promote teamwork, communication, and critical thinking to collaboratively solve welding-related problems.

## Design Thinking phases

### Understand core problem and Build empathy

Learners begin by putting themselves in the shoes of apprentices who are learning to weld in reality and encountering common problems such as safety risks. They explore the challenges of learning different welding techniques in a hazardous environment, identifying the psychological and physical barriers (e.g., fear of injury).

Activity: Interviews with experienced welders about the challenges of learning welding techniques.

Goal: Understand the needs and requirements of learners using the Soldamatic VR welding simulation.

### Concretising the customer's wishes

Learners clearly articulate the needs of the apprentices using the Soldamatic VR. What do they expect from the simulation? What specific features or safety aspects are particularly important?

Activity: Group discussions on the requirements for the VR welding simulation.

Goal: Define detailed requirements for the functionality and safety aspects of the VR welding simulation.

### Collecting ideas

Learners develop creative approaches to how the Soldamatic VR can be optimally used in training. They brainstorm ideas on how to improve the simulation to make it more realistic and maximize the learning effect.

Activity: Brainstorming on improving and expanding the VR welding simulation, such as through gamification elements or additional safety features.

Goal: Generate ideas to improve the usability and safety of the VR welding simulation.

### Build prototype

Based on the collected ideas, learners build a prototype of an instruction manual for the Soldamatic VR, describing the best use of the simulation. They also create safety guides and step-by-step instructions to support the learning process.

Activity: Create a prototype of an instruction manual and training plan for the VR welding simulation.

Goal: Develop a prototype that covers both technical operation and safety aspects of the simulation.

### Test prototype

Learners test the instruction manual and training plan with their peers. They receive feedback and check whether the instructions are understandable and can be practically applied.

Activity: Test run of the instruction manual with other apprentices.

Goal: Gather feedback and improve the prototype to meet the real needs of the learners.

### Review and feedback

Based on the feedback, learners optimize their prototype and adjust the instruction manual and training plan. The process is iterated until the manual and plan fully meet the requirements.

Activity: Feedback session and subsequent optimization of the prototype.

Goal: Ensure that the final prototype helps learners make the most of the VR welding simulation and enhances safety and effectiveness in welding training.

# Core problem or customer problem

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| Time | Topic / content | Goal | Method | Media / material | remarks |
| 20 min | Introduction to Design Thinking and problem identification | * Understand the Design Thinking process and the customer problem | * Plenary session, discussion | * PowerPoint, Whiteboard | * Overview of phases and rules |
| 15 min | Discussion on the safety risks in real-world welding | * Recognize the safety challenges in real welding | * Brainstorming in small groups | * Flipchart, markers |  |
| 20 min | Introduction to the Soldamatic VR welding simulation | * Understand the advantages of VR technology | * Presentation, exchange | * Soldamatic VR, presentation, Smartboard |  |
| 10 min | Defining customer needs | * Clearly define customer expectations | * Plenary session, discussion | * Whiteboard, moderation cards |  |

# Building empathy

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| Time | Topic | Goal | Method | Media / material | remarks |
| 15 min | Introduction to the concept of empathy | * Understand the importance of empathy in the learning process | * Plenary session, brief discussion | * PowerPoint, Whiteboard |  |
| 20 min | Interviews with welders on welding training challenges | * Build empathy by exploring real-life training challenges | * Interview, group work | * Interview guides, Flipchart | * Document the interviews |
| 15 min | Discussion of insights from interviews | * Deepen understanding of the learners' needs | * Group discussion, plenary session | * Whiteboard, markers |  |
| 10 min | Creation of a mind map to visualize challenges | Visualize the key challenges in learning welding safely | * Group mind map | Mind map tool, Whiteboard |  |

# Concretising the customer's wishes

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| Time | Topic | Goal | Method | Media / material | remarks |
| 10 min | * Defining customer needs (e.g., safety, user-friendliness) | * Clearly define the needs and features for the VR technology | * Brainstorming, plenary session | * Whiteboard, moderation cards |  |
| 20 min | * Discussing specific requirements for the VR welding simulation | * Create a list of key features and safety aspects | Group discussion | * Whiteboard, Flipchart, markers |  |
| 10 min | * Presenting group results to the class | * Review and evaluate customer requirements with peers | Group presentation | * Beamer, PowerPoint, Whiteboard |  |

# Collecting ideas

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| Time | Topic / key questions | Goal | Method | Media / material | remarks |
| 30 min | * Brainstorming ideas for the optimal use of the Soldamatic VR | * Develop creative ideas to enhance the welding simulation | * Brainstorming in groups | * Flipchart, markers, Whiteboard | * Document group discussions |
| 20 min | * Discuss and evaluate generated ideas | * Prioritize and select the most promising ideas | * Group discussion, evaluation | * Whiteboard, markers |  |
| 10 min | * Selecting three main ideas for VR improvements | * Final decision on ideas to further develop | * Plenary session | * Whiteboard, markers |  |

# Build prototype

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| Time | Topic / key ideas / key questions | Goal | Method | Media / material | remarks |
| 30 min | * Prototype of a user manual for the VR welding simulation | * Draft an initial version of the user manual | * Group work, document creation | * Laptops, word processing software, Smartboard |  |
| 20 min | * Incorporating safety aspects into the manual | * Include safety guidelines in the instruction | * Group discussion, group work | * Laptops, VR headsets, safety guidelines |  |
| 30 min | * Developing a training plan for the Soldamatic VR | * Create a step-by-step training guide | * Group work | * Laptops, word processing software |  |

# Test prototype and final review

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| Time | Topic | Goal | Method | Media / material | remarks |
| 40 min | * Testing the prototype (instruction manual and training plan) | * Validate the prototype by testing it in practice | * Group testing in teams | * VR headsets, user manual, training plan | * Gather feedback from peers |
| 20 min | * Feedback session | * Collect feedback on the user manual and training plan | * Plenary session, feedback round | * Whiteboard, moderation cards |  |
| 10 min | * Adjustments based on feedback | * Improve the prototype based on feedback | * Group work | * Laptops, word processing software |  |
| 30 min | * Final presentation of prototypes | * Present the improved user manual and training plan | * Group presentations | * Beamer, PowerPoint, VR headsets |  |
| 15 min | * Reflection and feedback session | * Group reflection on the process and results | * Plenary session, group discussion | * Whiteboard, markers | * Focus on lessons learned |