Factcheck

Adapting quality of VET offer to the need of industry – manufacturing sector

Metal & Electro Qualifications

Skills required by companies

Erasmus+

Agenda – Day 1

01 Introduction

10:00

- Welcome and Opening

10:20

- Short introduction to the project and its objectives

02 Skills demand - METAL

10:20

- Overview of company feedback

11:00

- EU-wide and national properties

11:30

03 Skills demand - ELECTRO

12:00

- Overview of company feedback

12:40

- EU-wide and national properties

13:10

04 Discussion

13:10

- Conclusion

14:00

- Challenges for vocational education: EU and national issues

1. Introduction

Project partner organisations and its profile

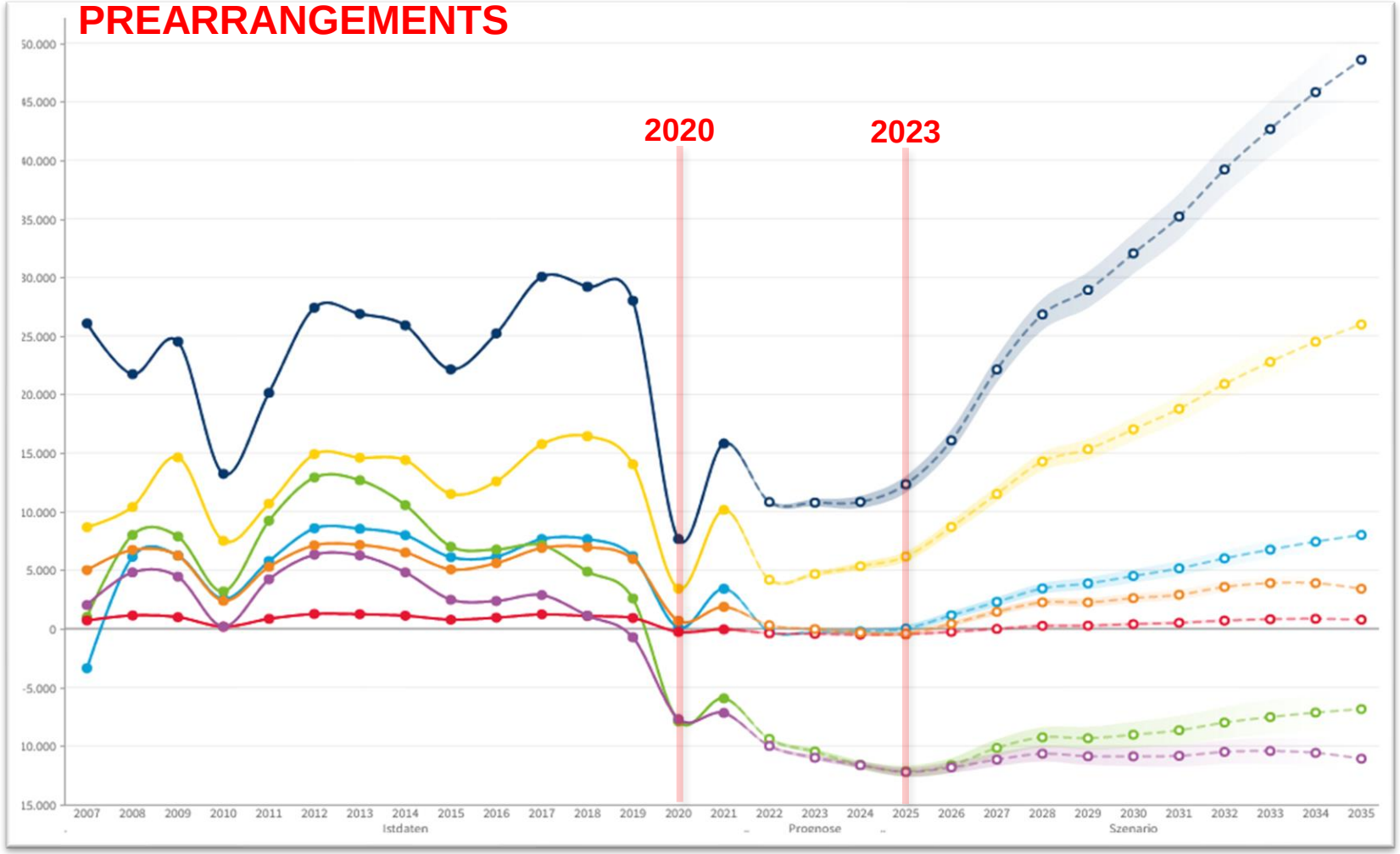
Short summary about the project's objectives, milestones and results

01	02	03	04	05	06
BSW Bildungswerk der Sächsischen Wirtschaft	**Formac** Spolka z organiczona odpowiedzialnoscia SKA	**Center** of Education and Innovation	**Asociacion** de empresarios del comercio e industria del metal de Madrid	**Panepistimio** Thessalias	**Sdruzhenie** Bulgarska targovsko-promishlena palata

1. Project FactCheck

Pre-research: professional skills and labour market Networking: á 30 companies	**Skills Survey of 150 companies** Outcome: two documented analyses on skills demand in occupational profiles in metal and electro sector	**RESULT 1 Company survey**
Occupational profiles in two professions	**Analysis of an occupational profile** Curricular adaptation of survey results in two relevant professions	**RESULT 2 VET specified report**
Learning platform	**European Training Module** Training for VET teachers and workplace trainers in terms of innovative learning strategies, tools, and contents	**RESULT 3 Train-the-trainer**
Updating, sharing and communication platform	**Tools case for digital learning** Integration of innovative and/or digital tools for VET in schools and in companies	**RESULT 4 Digital JODALab**
Companies in metal and electro sector	**Networking** Participation, feedback and evaluation of project steps according to industry's demands	**constantly**

1. Occupational profiles



Mechanical and production engineering

Metal production

Metal construction and welding technology

Electrical engineering

Mechatronics and automation technology

Automotive, aeronautical and shipbuilding engineering

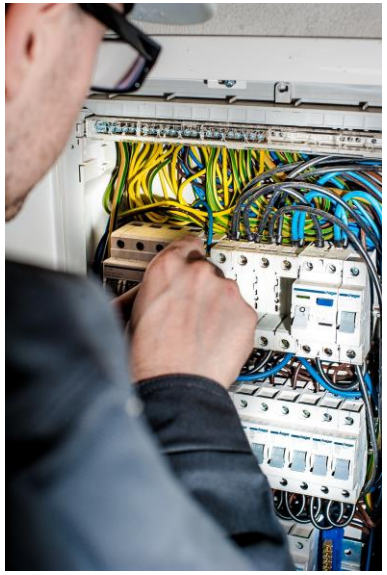
Power engineering

Skilled workers monitor – Pilot region in Germany, November 2022

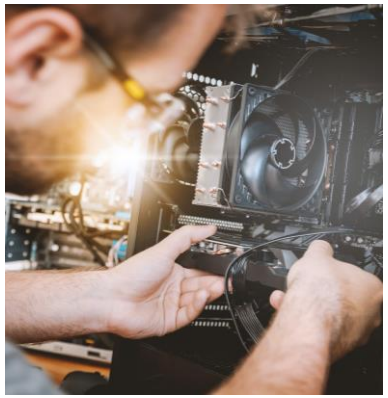
1. Occupational profiles

PREARRANGEMENTS

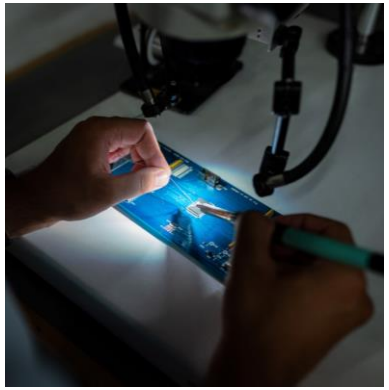
Industrial electrician for industrial engineering



Electronics technician for industrial engineering

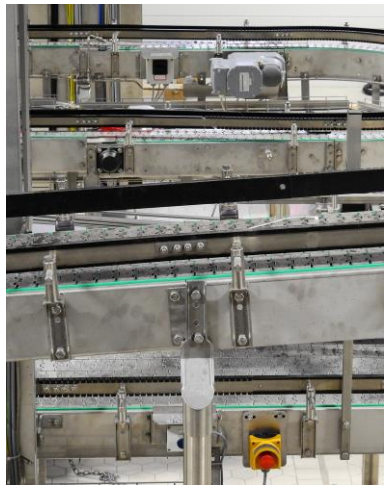


Electronics technician for devices and systems

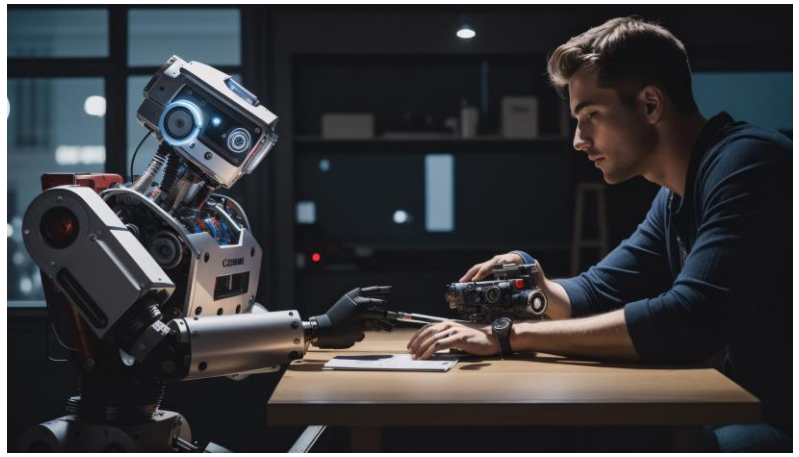


Industrial electrician for devices and systems

Machine and systems operator



Industrial mechanic



Mechatronic engineer

Specialist in metal technology

Tool mechanic

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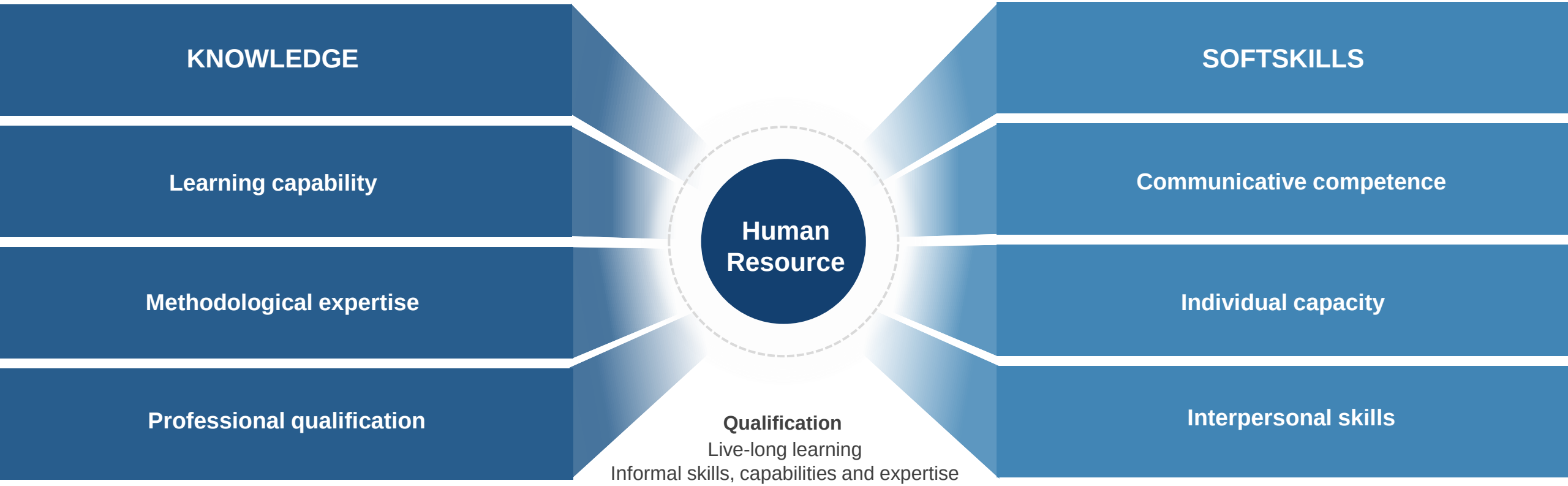
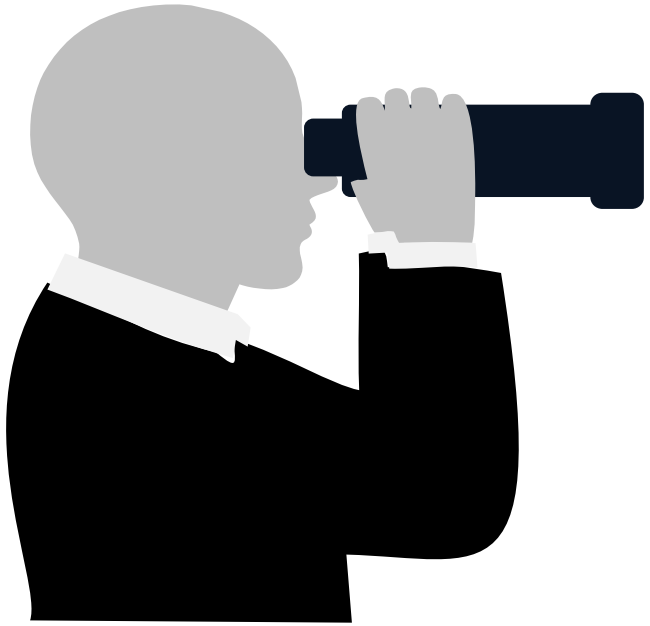
1. Occupational profiles



Factcheck

1. Company survey



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Extended view
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Current demands
Advanced qualification, most wanted profiles and skills

Adaptation in VET
Requirements to human resources: trainer and students

Erasmus+

Factcheck

1. Company survey

Company feedbacks:

National overview

Appropriate analysis:

EU-wide comparison

40	30	32	35	31
Germany	Poland	Greece	Spain	Bulgaria

Erasmus+

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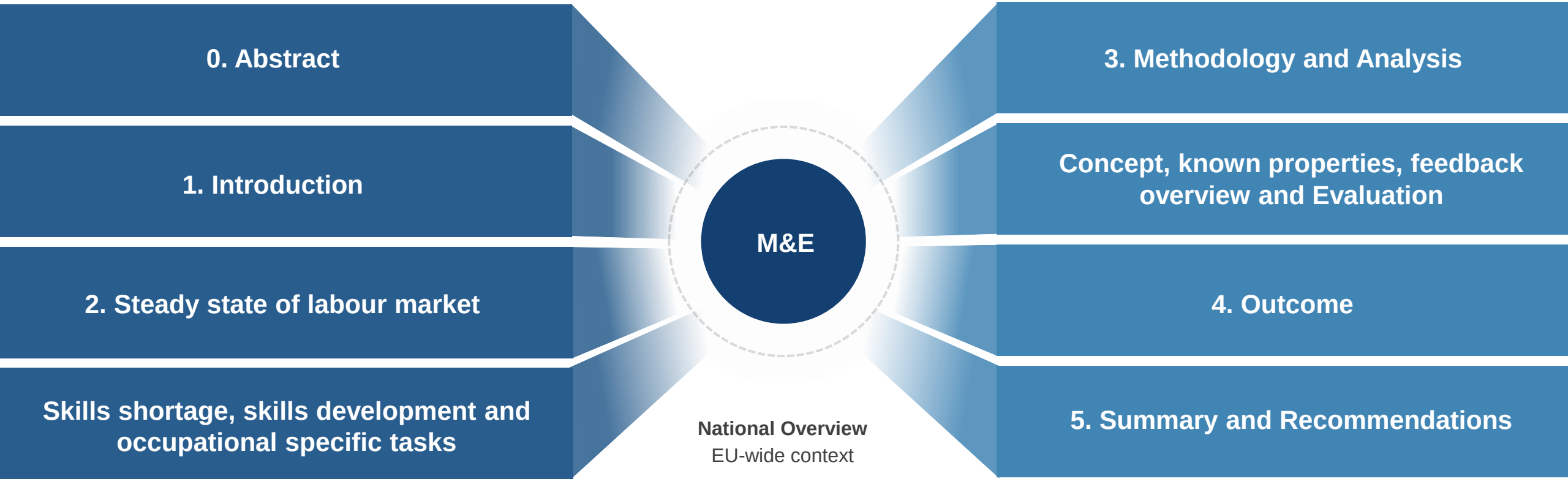

Reports on skills demand in occupational profiles of metal and electro sector

Expectations

Mentimeter

What VET-related topics are you interested in?

Mentimeter

How precisely do you know professional competences in metal and electrical occupations?

Mentimeter

How do you establish contact between companies and vocational schools?

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- Challenges for vocational education: EU and national issues

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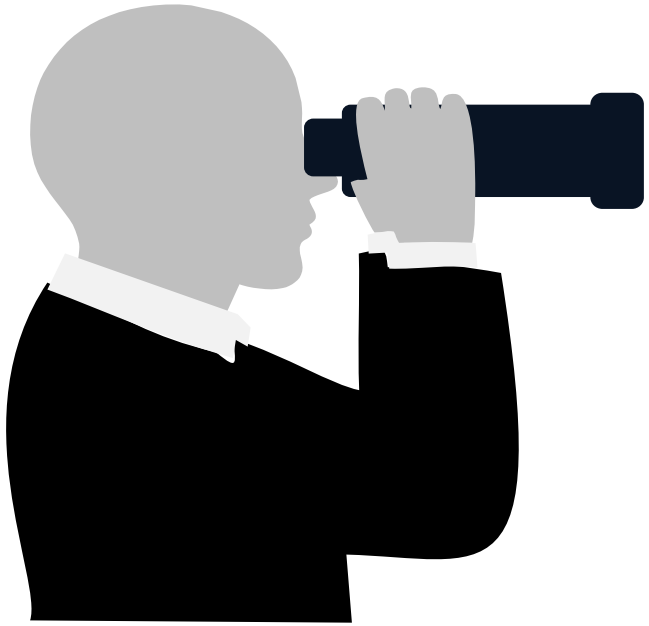

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+1.000

contacted

154

Feedback received

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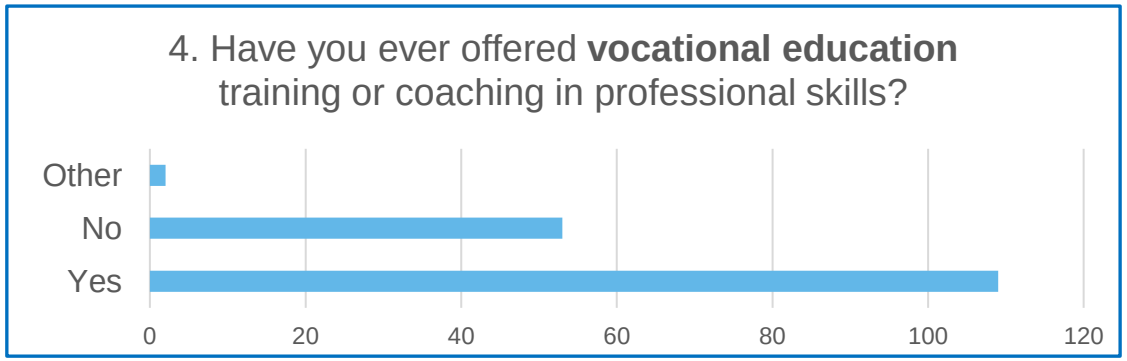

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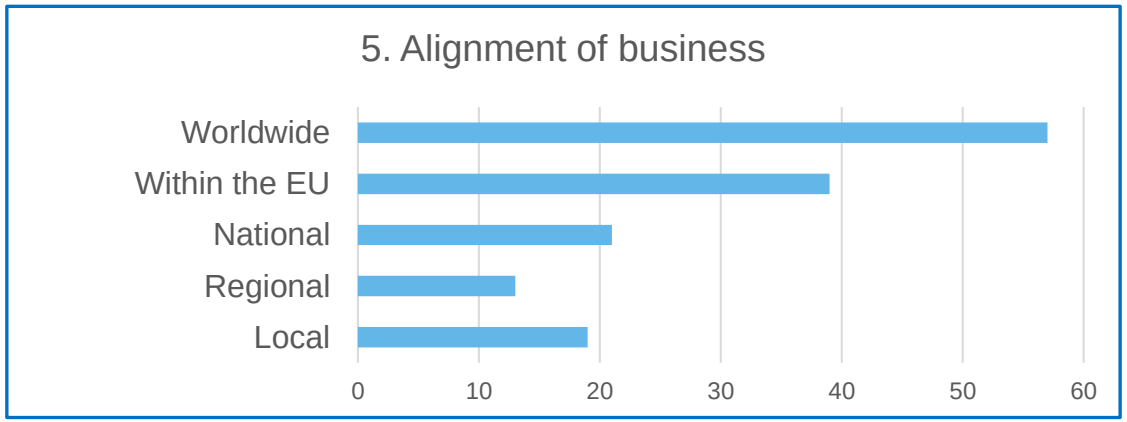

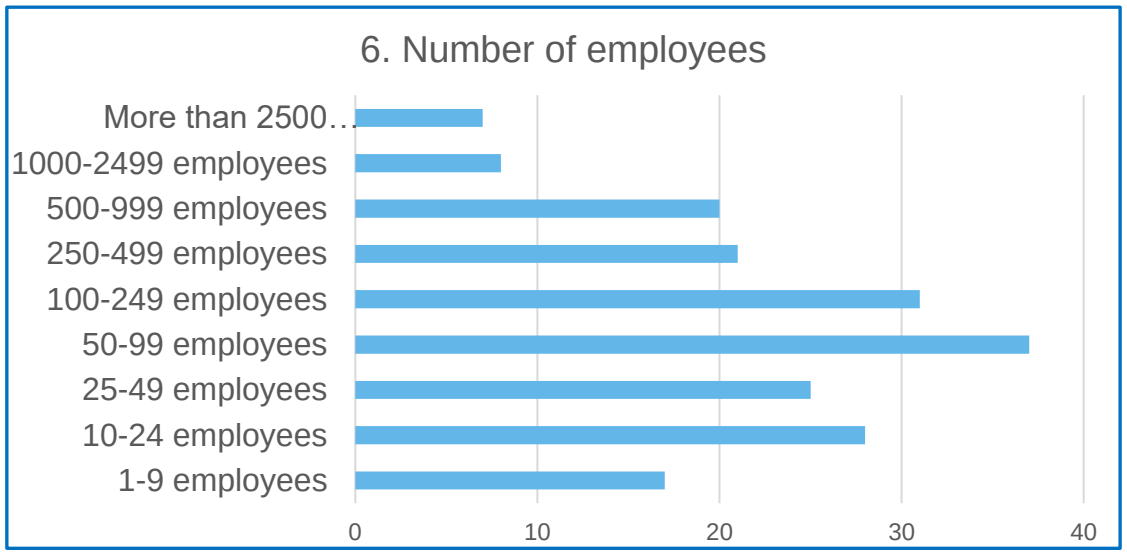

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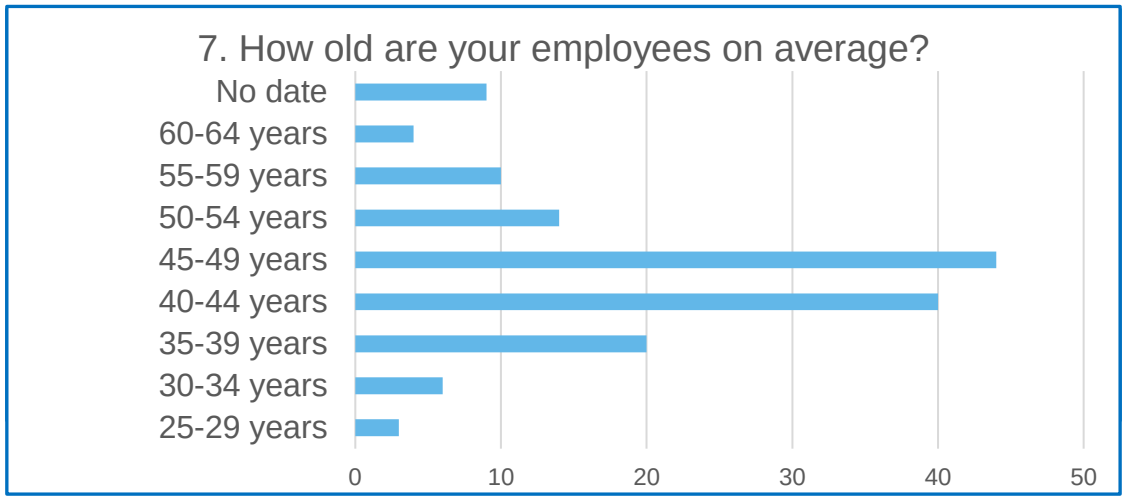

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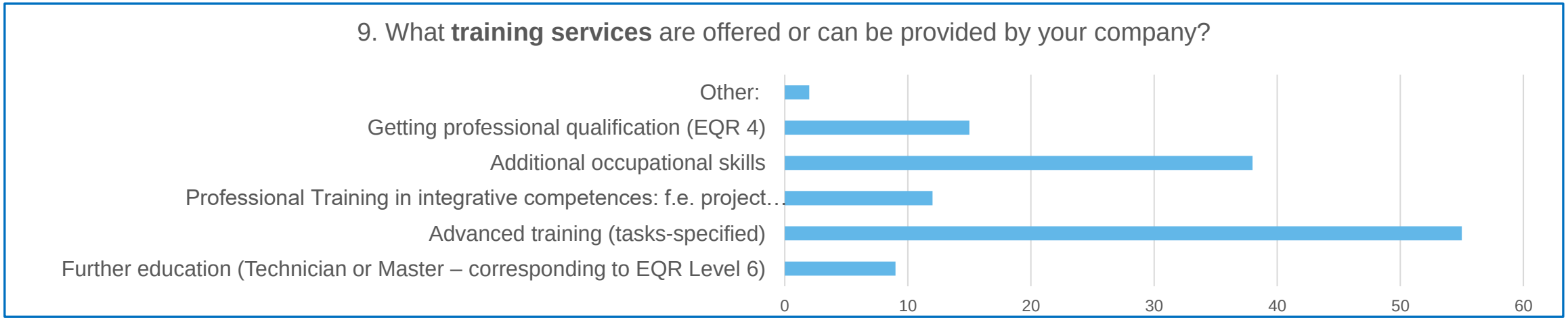

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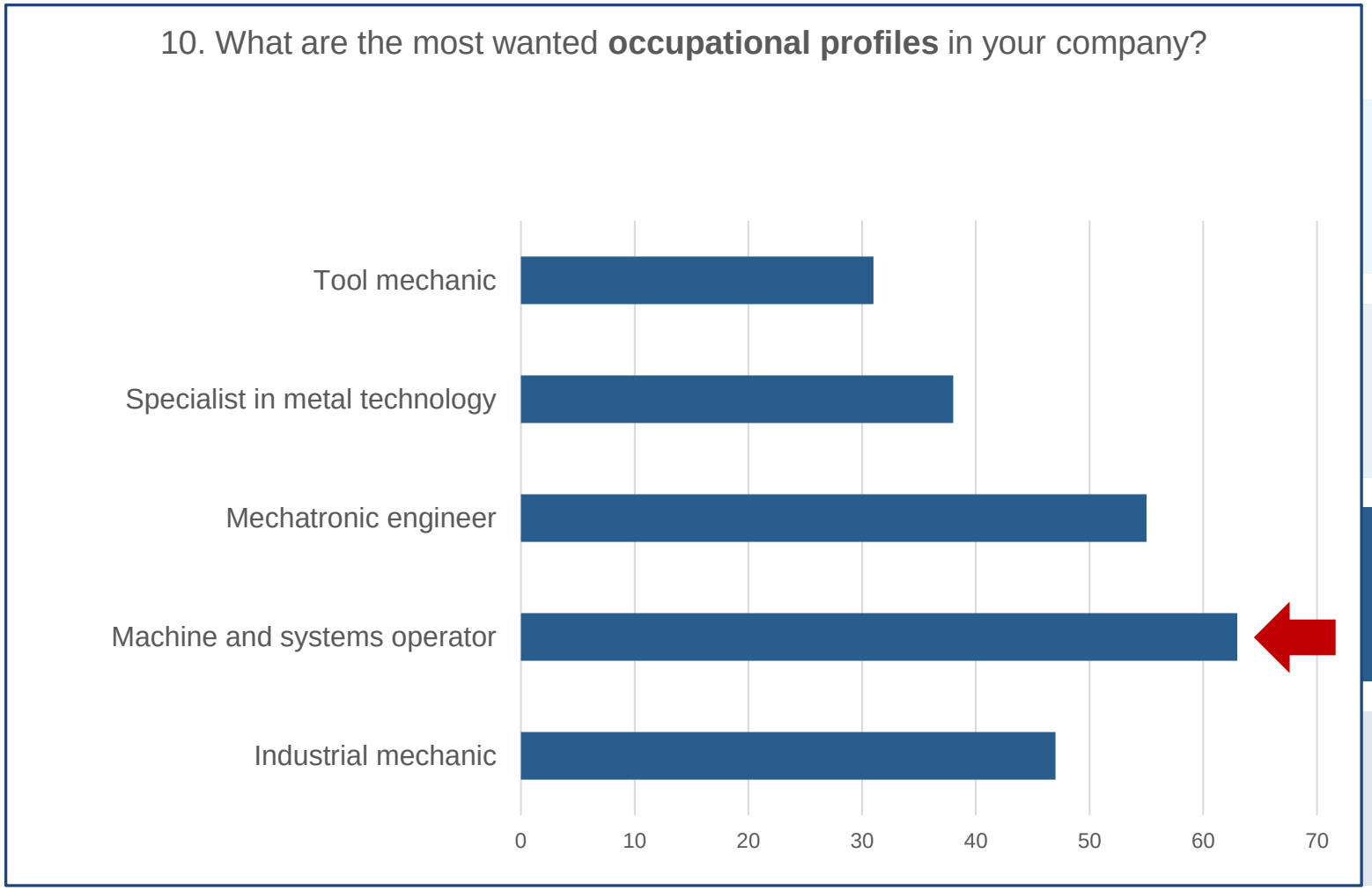

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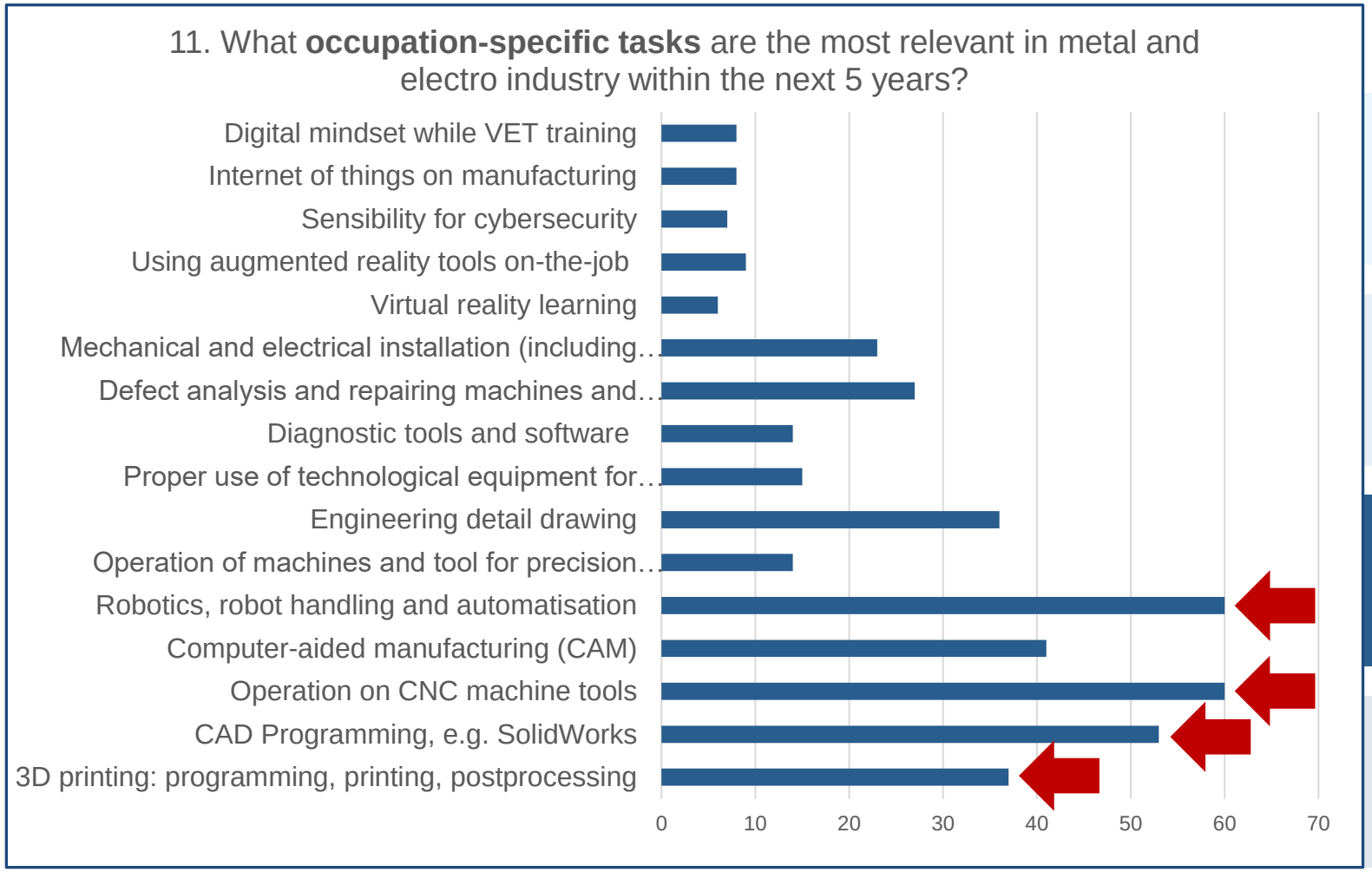

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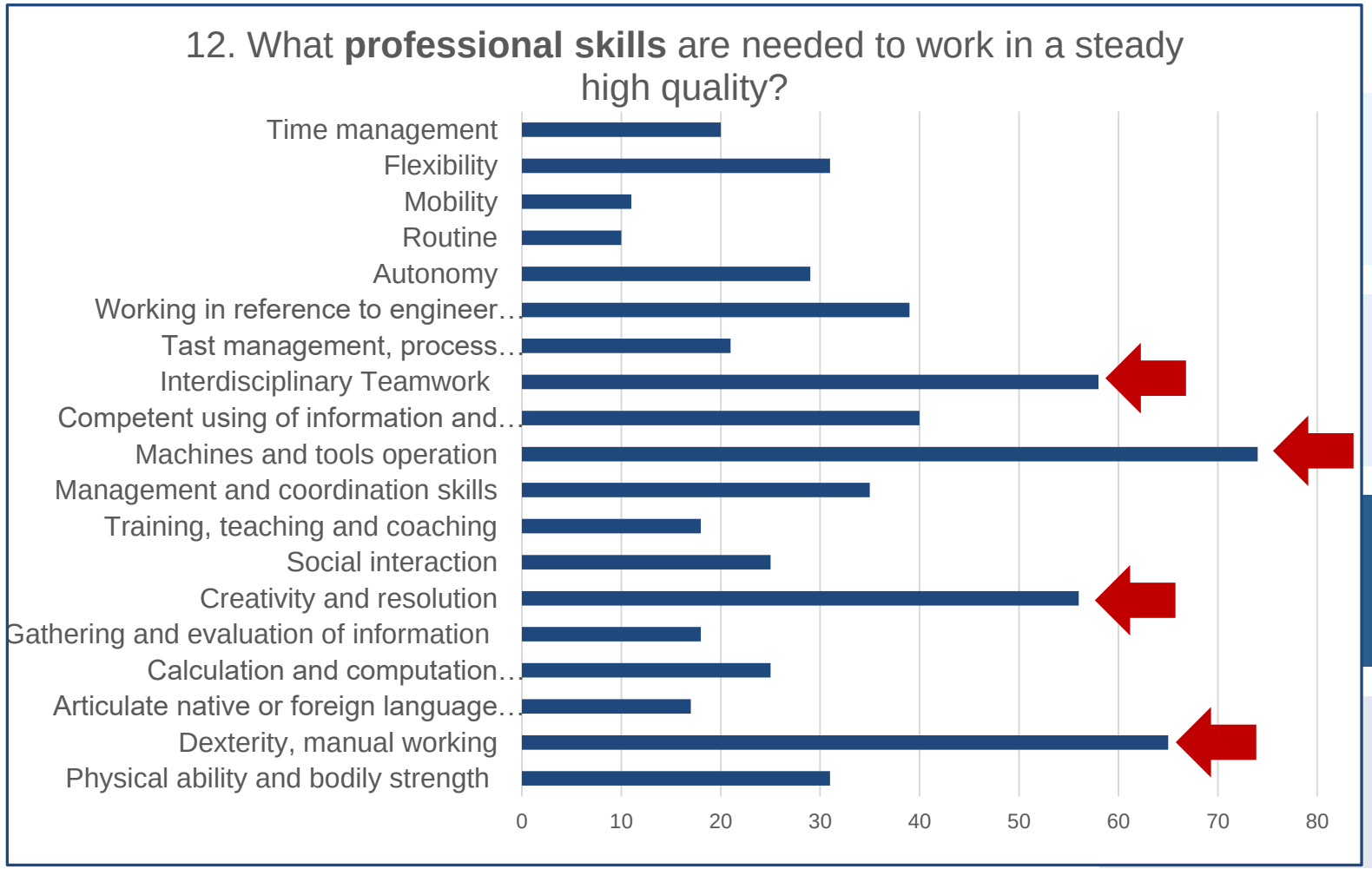

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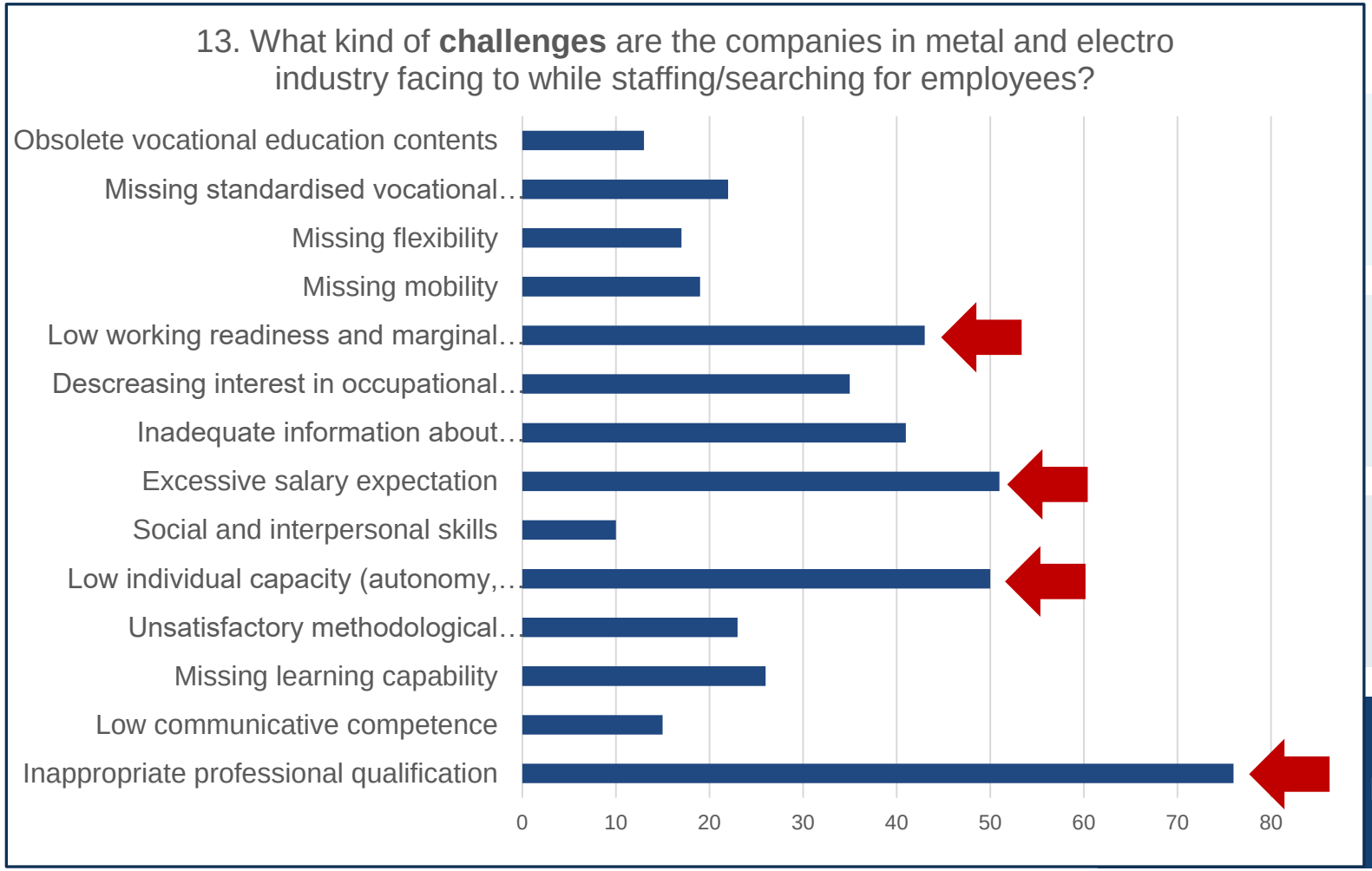

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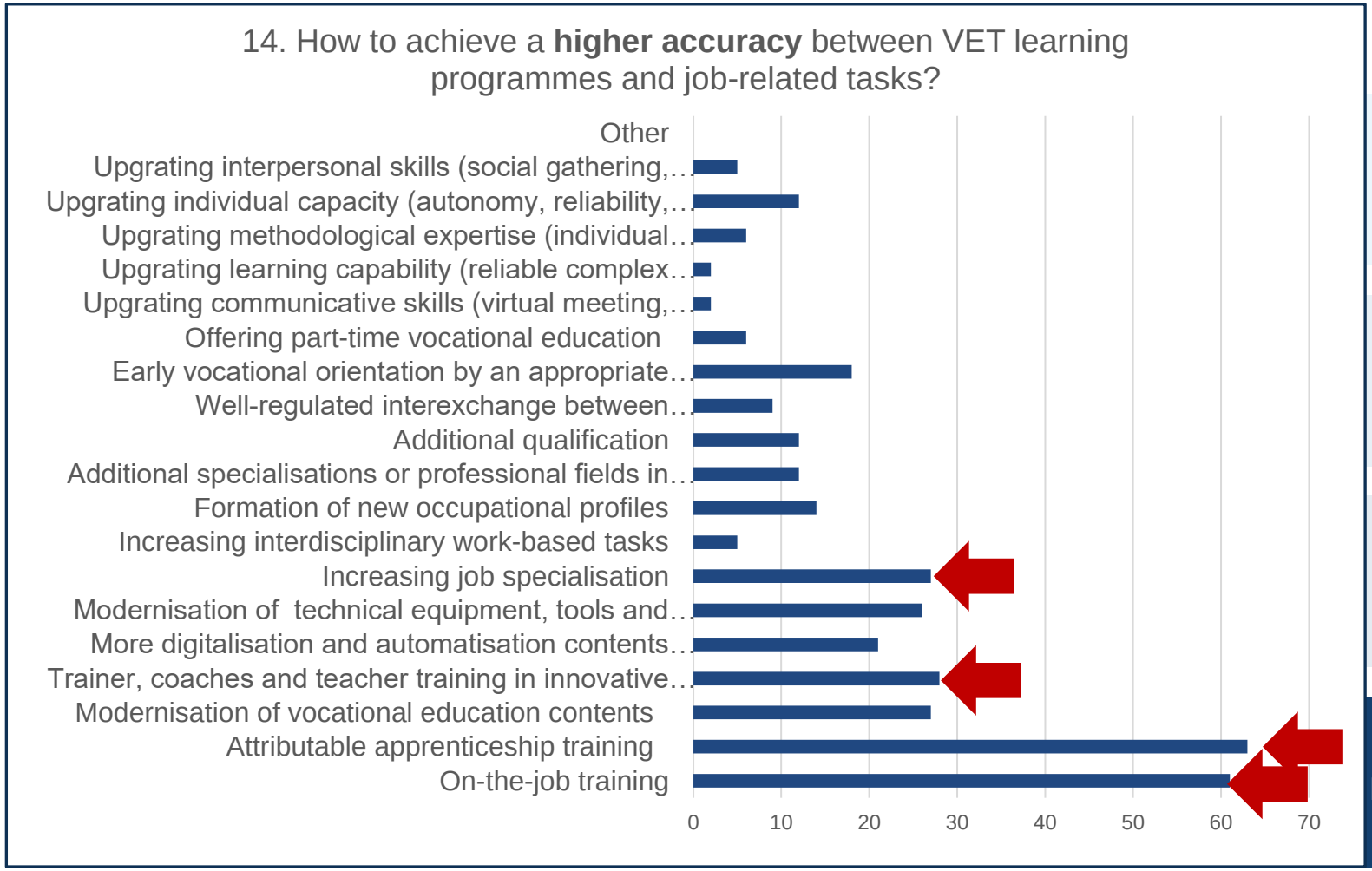

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2. Skills demand: National

Please join: rb.gy/rdpp1

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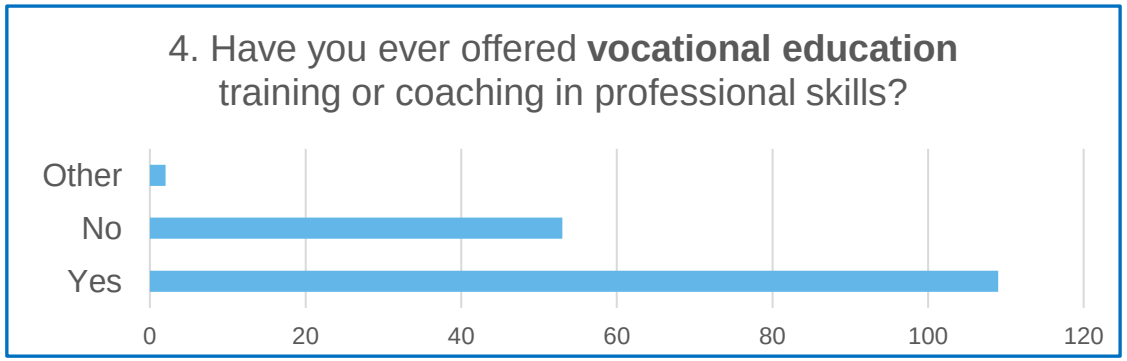

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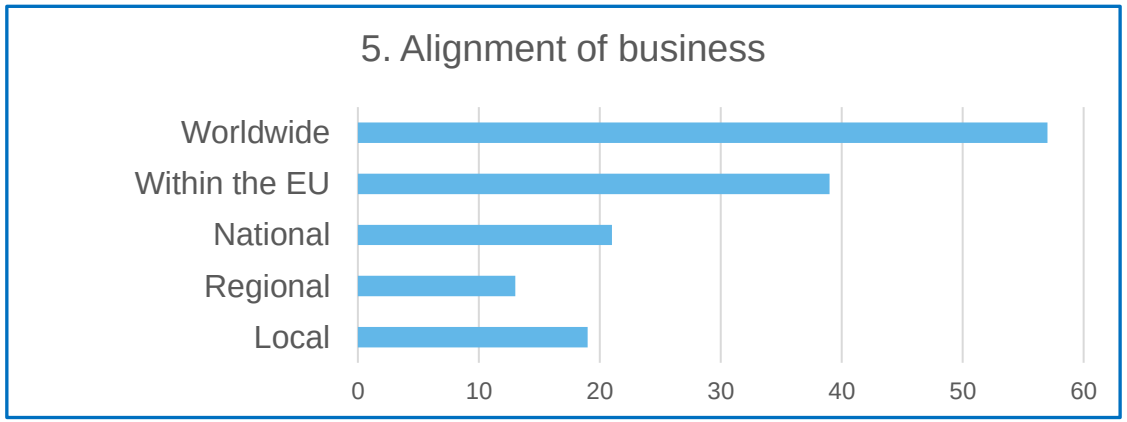

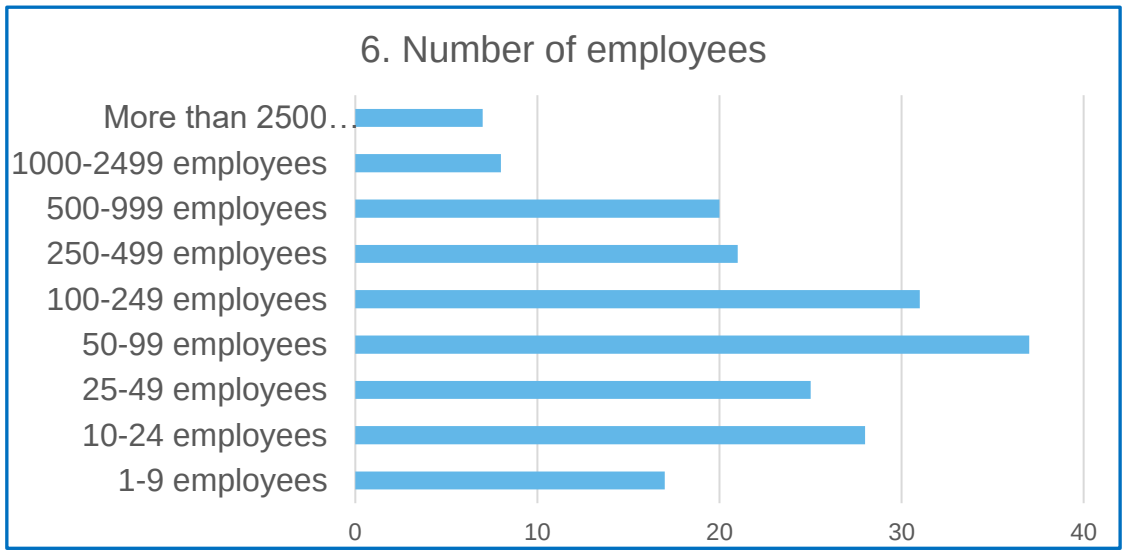

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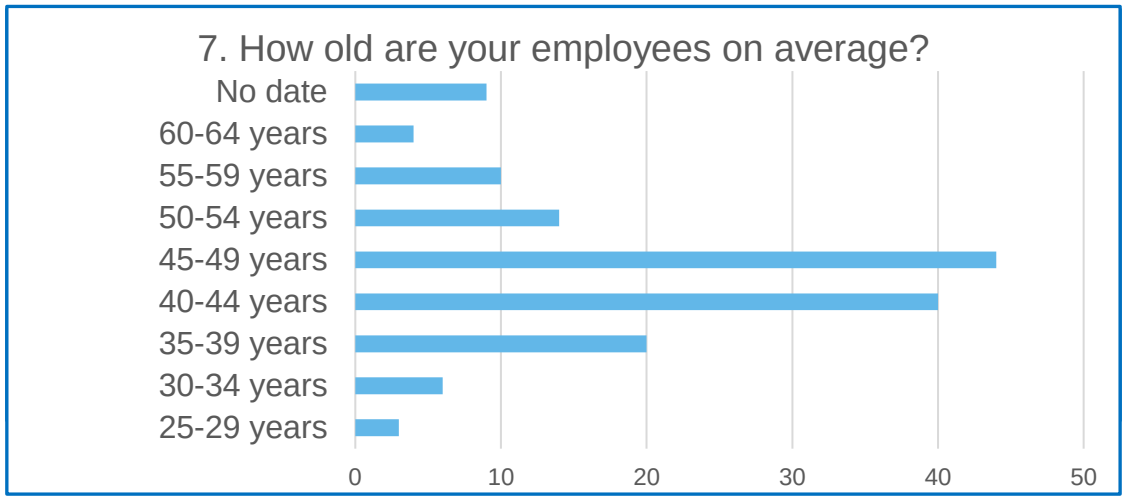

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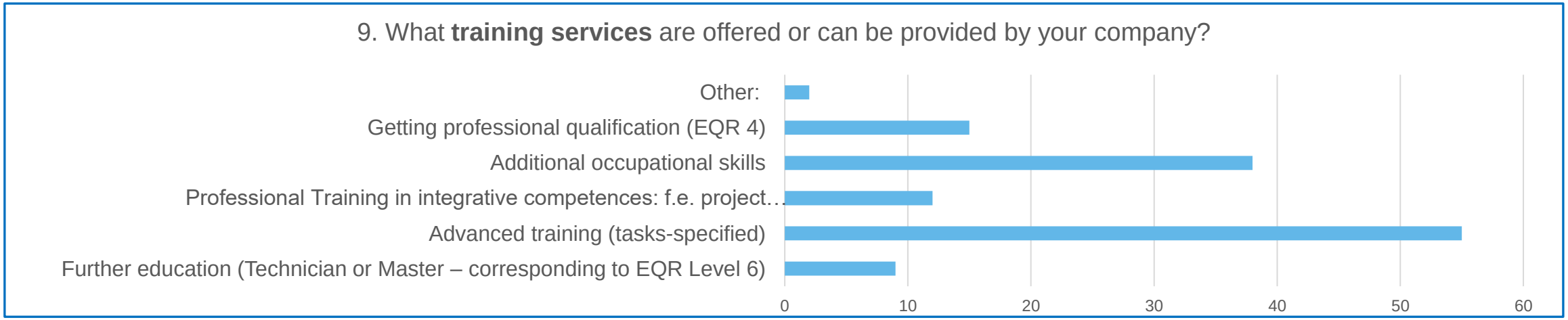
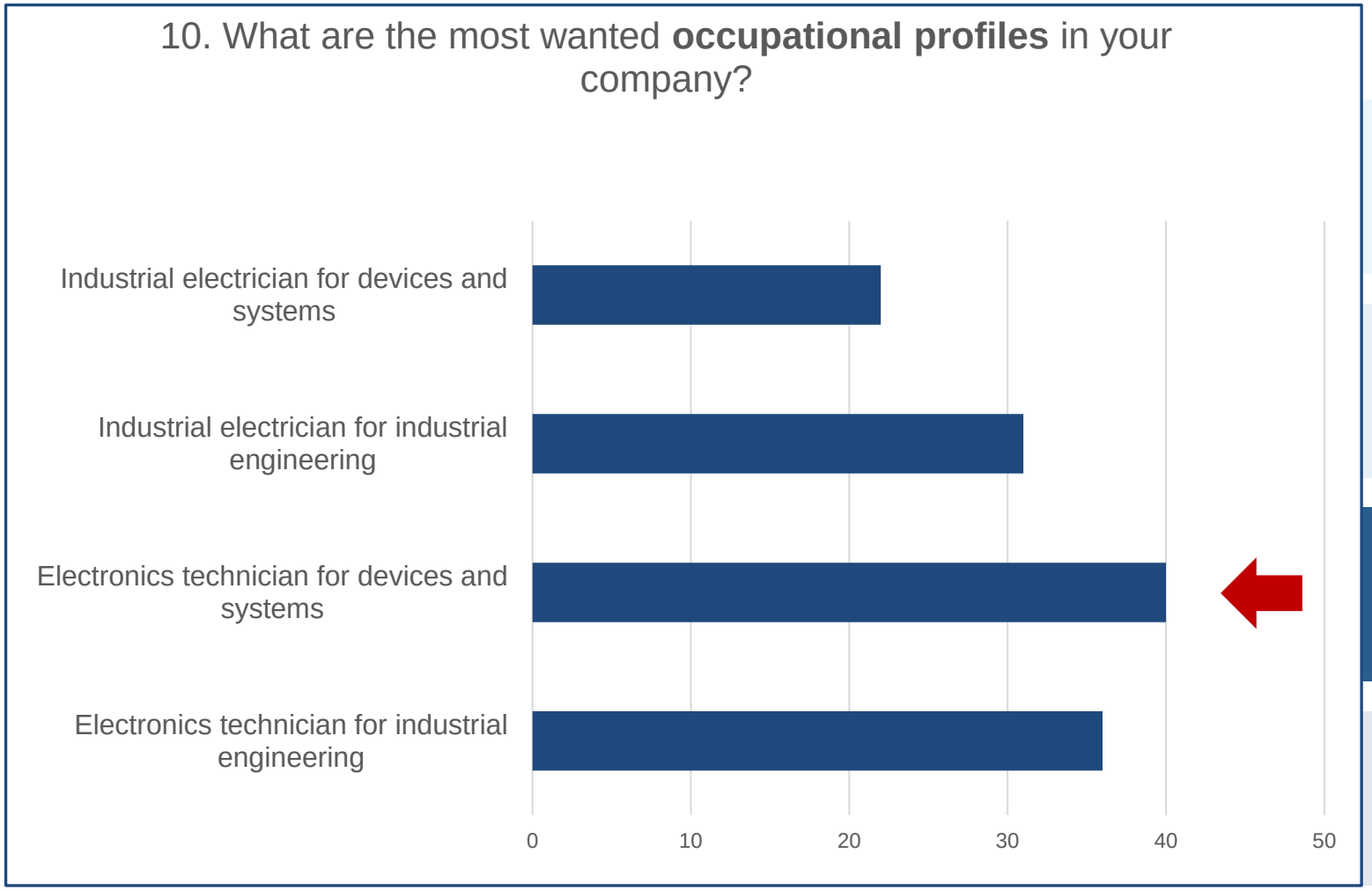


3. Skills demand - ELECTRO



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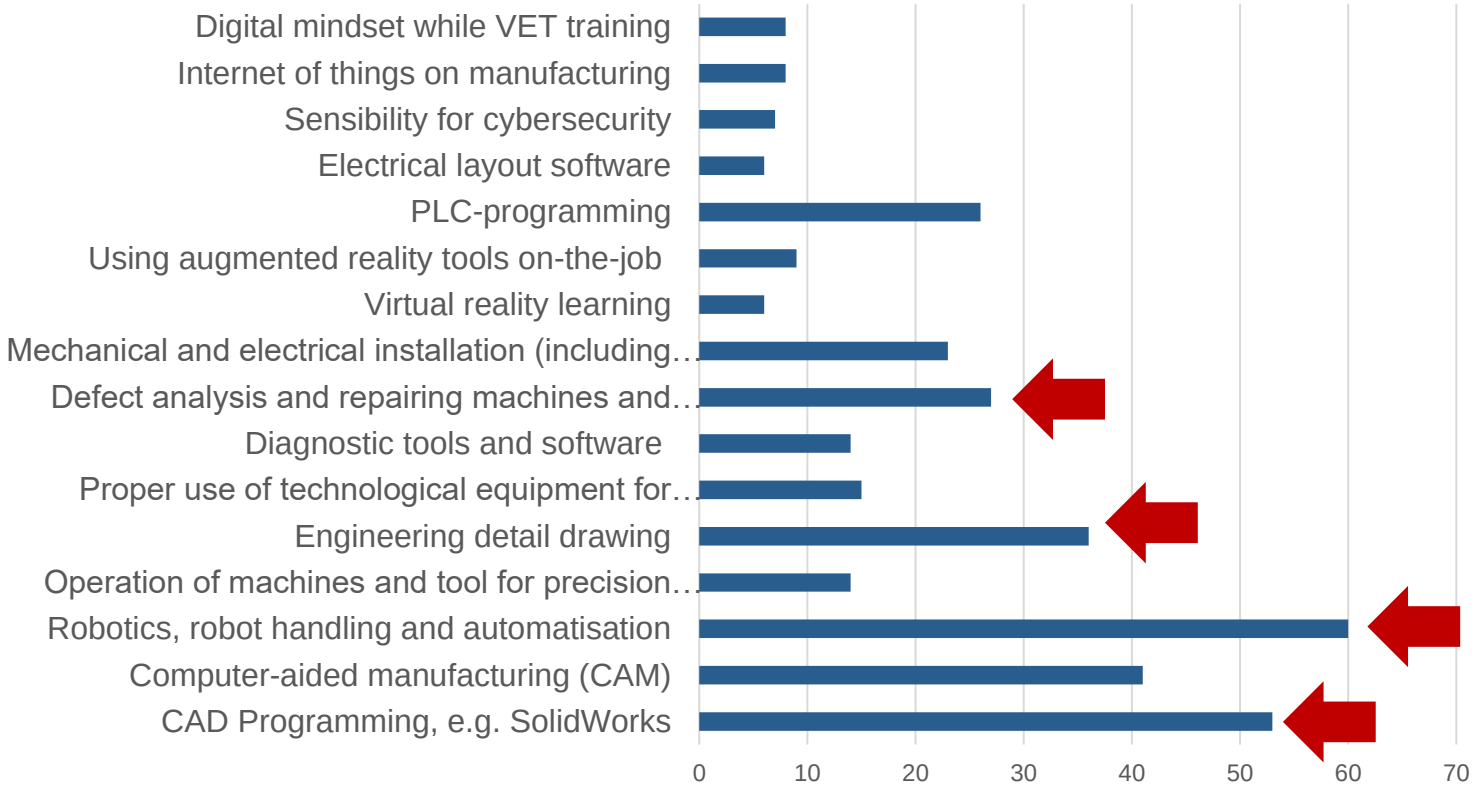
3. Skills demand - ELECTRO

11. What **occupation-specific tasks** are the most relevant in metal and electro industry within the next 5 years?



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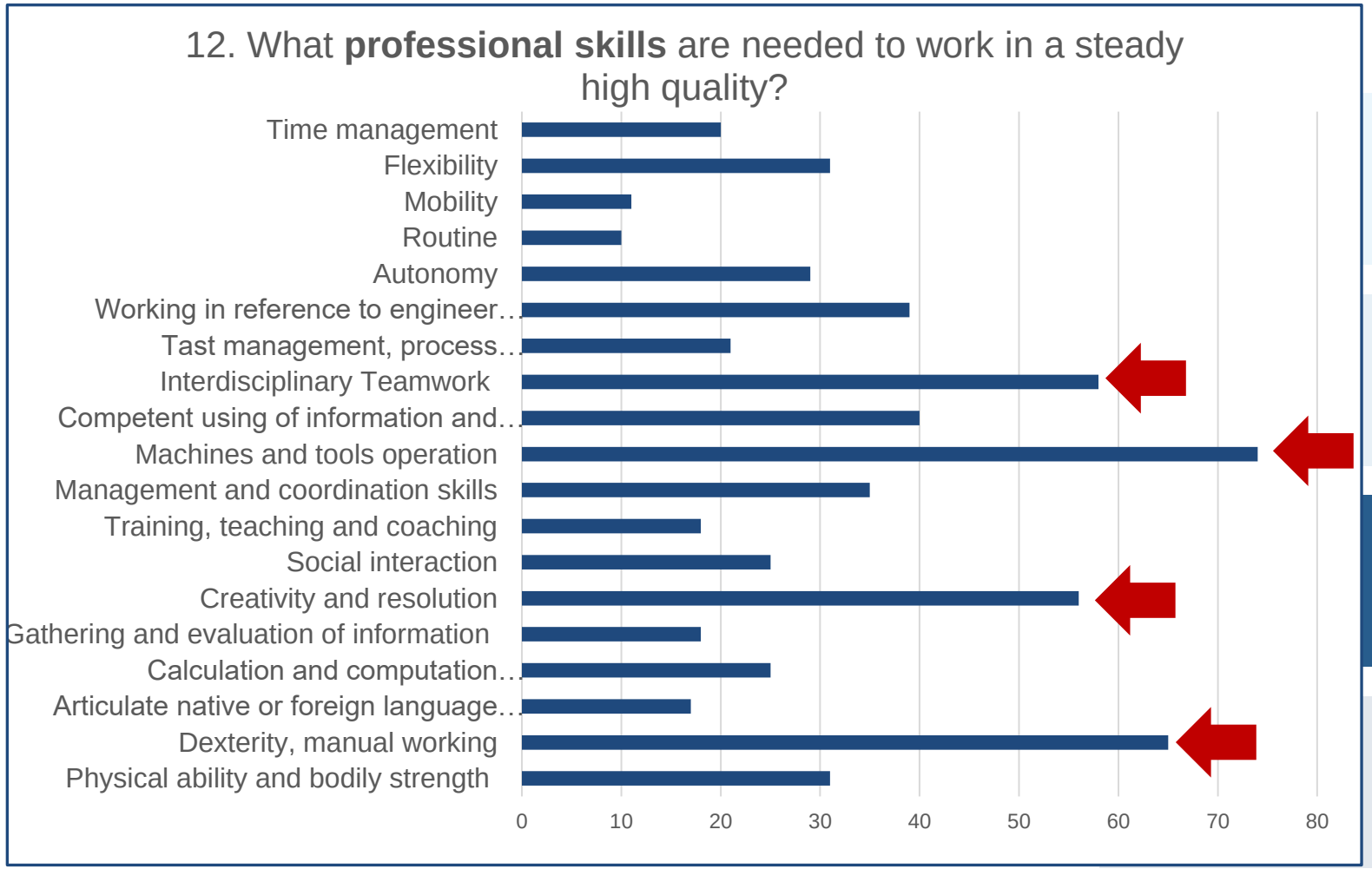

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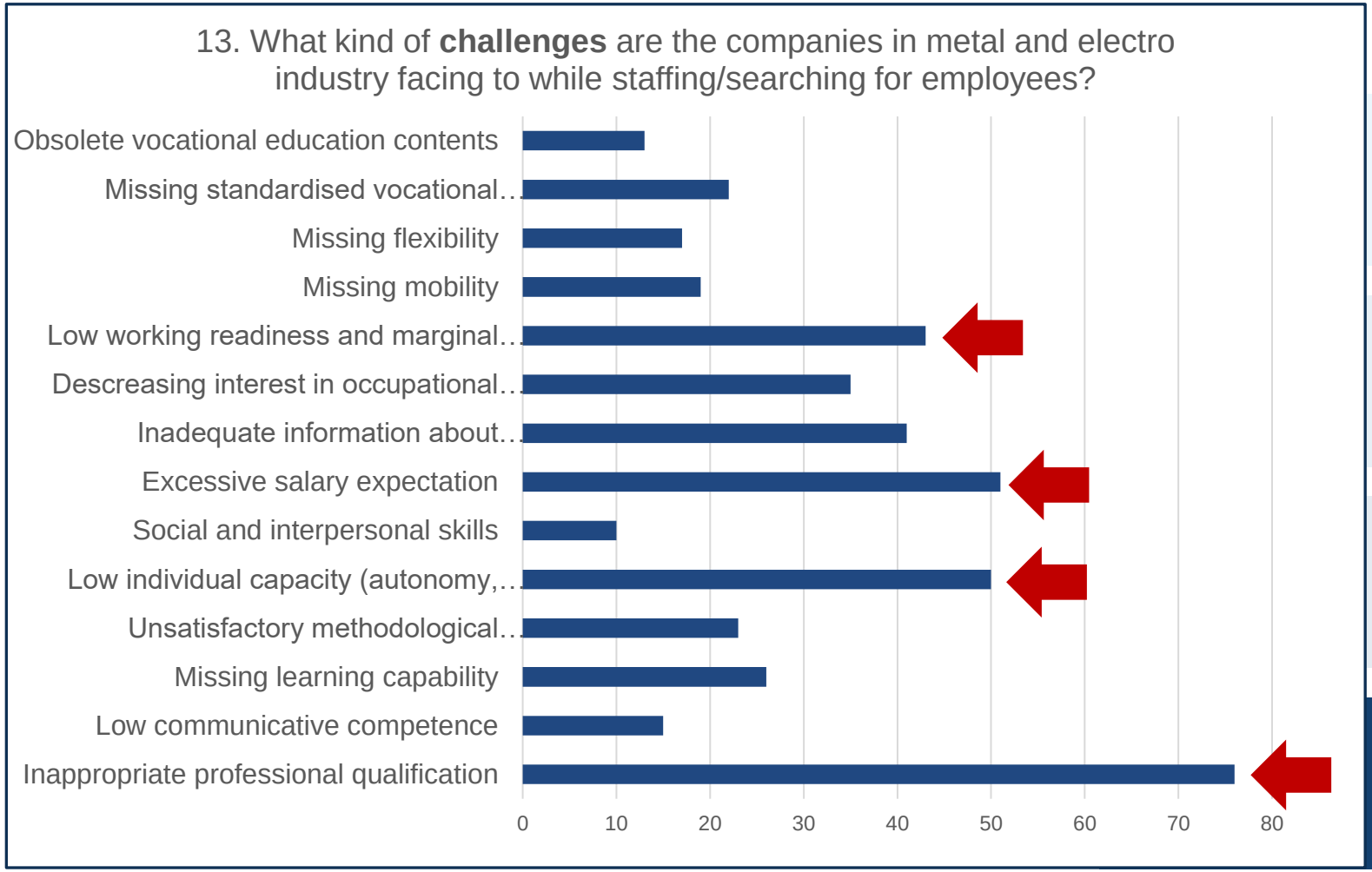

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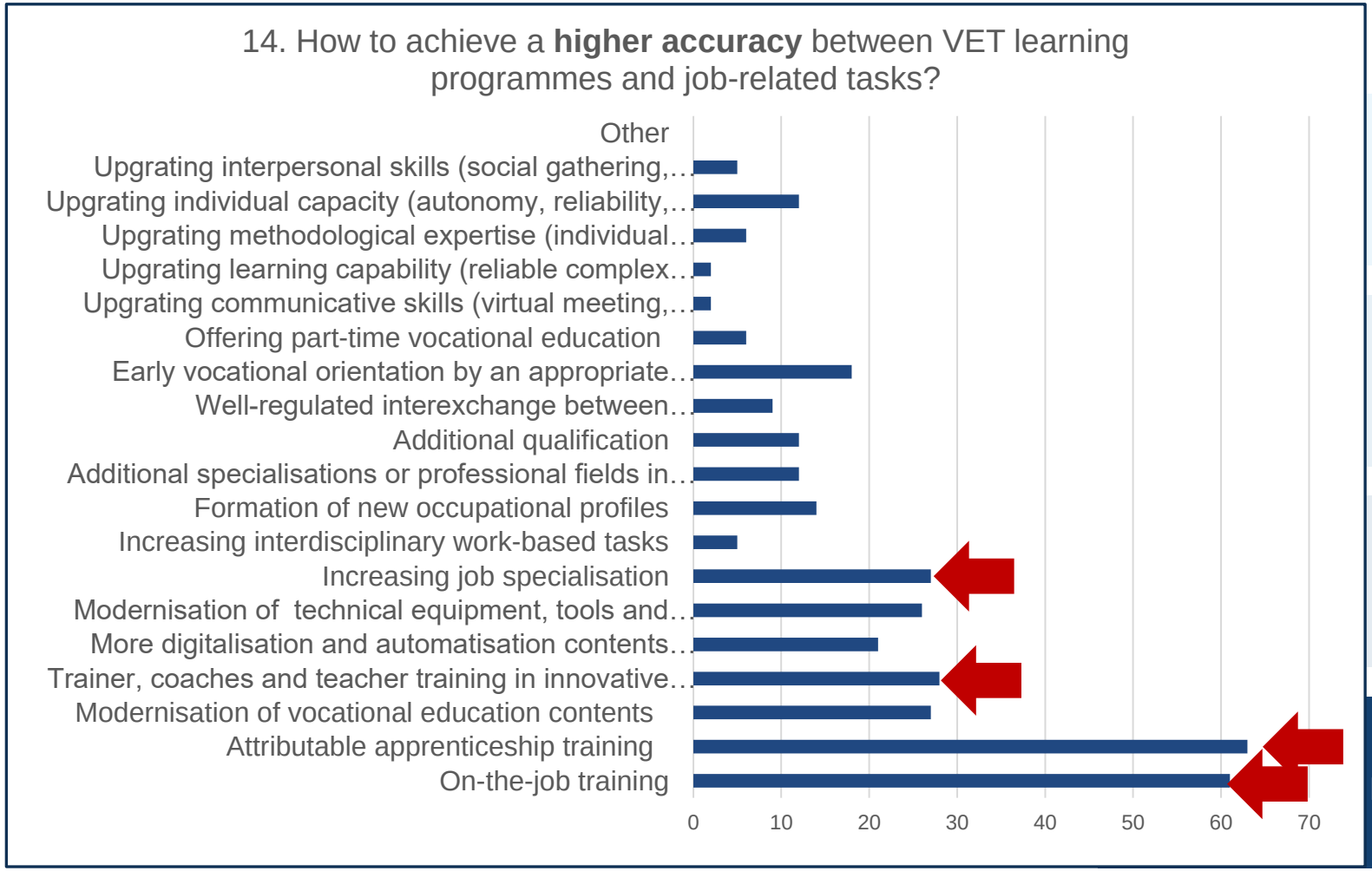

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DAY 1 – Wednesday 4 oct

Skills required by companies

1.1 METAL SECTOR — Skills and competences needed by companies

National characteristics:

Germany

- Occupational profiles: formal instructions forVET school and in-firm training
- Complexe occupational profiles - Tool mechanics
- Metal construction for renewable energies
- Low operational readniss
- Common skills vs. specified tasks
- On-the-job training

Spain

- Machinery operators (CNC)
- Welders
- Metal T…ing
- Specialised expertise for a particular task (e.g. programming of numerical control machines)
- Assemblers and adjusters (mechanical components)
- Know how to read plans (CAD)
- detection of occupational risks
- Know about ERP use or processes automatization
- Integration of transversal competencies
- For the Training Module:
  - Training on specific technical knowledge (reading CAD plans)
  - Training on digital tools (3D design)
- Regulations that regulate the installation, assembly and maintenance of facilities

Greece

- Robotics
- Machine and tool operation
- Specialist in metal technology and Machine
- Managment skills
- CAD programming
- Computer-aided manufacturing (CAM)
- Operation on CNC machine tools

Bulgaria

- Machine & tools operation
- Interdisciplinary teamwork
- Competence to use IT and information
- numeracy skills
- manual dexterity
- management skills

Poland

- Robotics casting
- Prototyping
- VET work condition
- Automation
- Digital learning tools
- Ecology - optimization
- DUAL VE… teaching
- to keep the balance between training in practice and theory
- the way of financing

1.2 ELECTRICAL SECTOR — Skills and competences needed by companies

Germany

- Occupational profiles: formal instructions for VET school and in-firm training
- Huge demands on skilled workers in renewable energies (solar installation)
- Specialisation of solar not covered by VET-instructions
- Manufacturinng vs. Industrial electronics
- Missing comprehension in complex tasks
- Career changer (worldwide)
- On-the-job training
- Networks for advanced qualification - financed by the government

Spain

- Hybrid system
- Personal initiative to contribute to the company
- Teamwork skills
- Continuous learning initiative
- Social skills
- Basic electrical knowledge + specific training
- Promote dual training (practical side of VET)
- Promotion of VET courses on social media (need of graduates, too much demand from companies)
- Electromechanical profiles: designing, installing, maintaining and repairing systems and devices
- Automation and energy efficiency
- Soft Skills. Responsability
- Training automation systems an…sis
- Regulations that regulate the installation, assembly and maintenance of facilities

Greece

- Management and coordination skills
- Continuius learning
- Teamwork
- Competent using of information and communication technology
- Digitization and automation skills
- Increasing job specialisation
- Early vocational orientation by an appropriate information strategy and practical experience
- Optimizati of Industey 4.0
- On the job training

Bulgaria

- critical thinking
- technological knowledge
- active learning
- interpersonal skills
- organizational skills
- complex problem solving skills
- math &physics skills
- Innovative thinking

Poland

- Digital learning tools
- Digitalization of all aspects
- Optimization of INDUSTRY 4.0
- Progress in Automotive require change in VET
- learning new technologies
- autmation and robotics
- Automotive cars more comples
- Share your idea here
- DUAL VET teaching
- to keep the balance between training in practice and theory
- the way of financing

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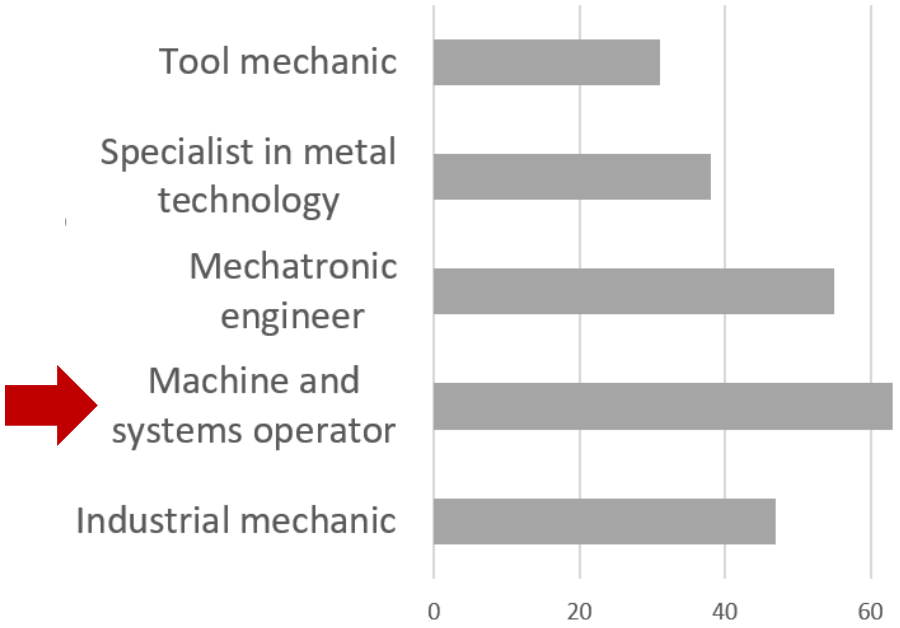
4. Discussion: Overview

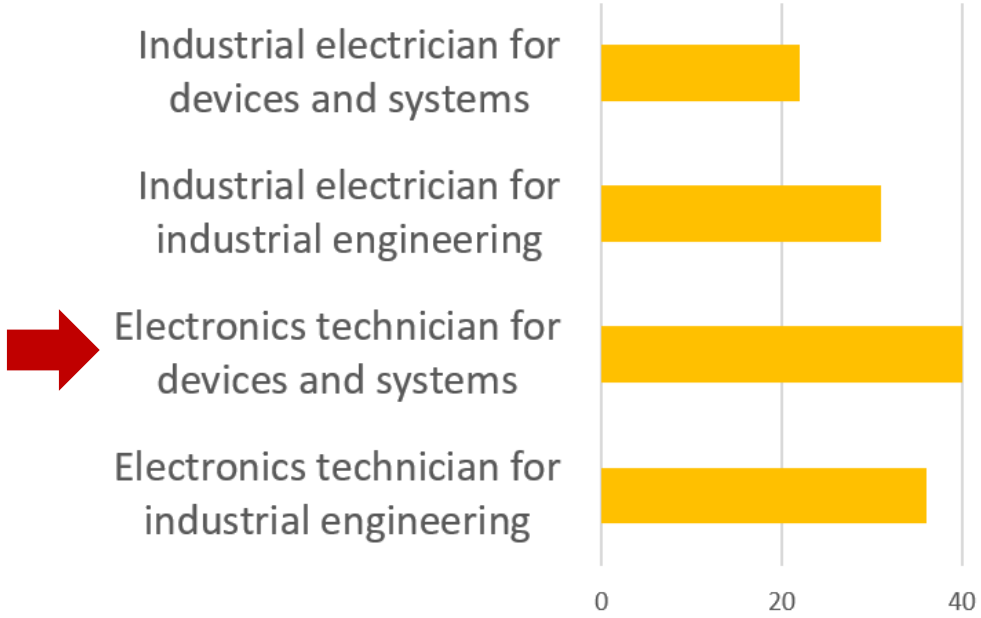
METAL

Machine and systems operator

ELECTRO

Electronics technician for devices and systems



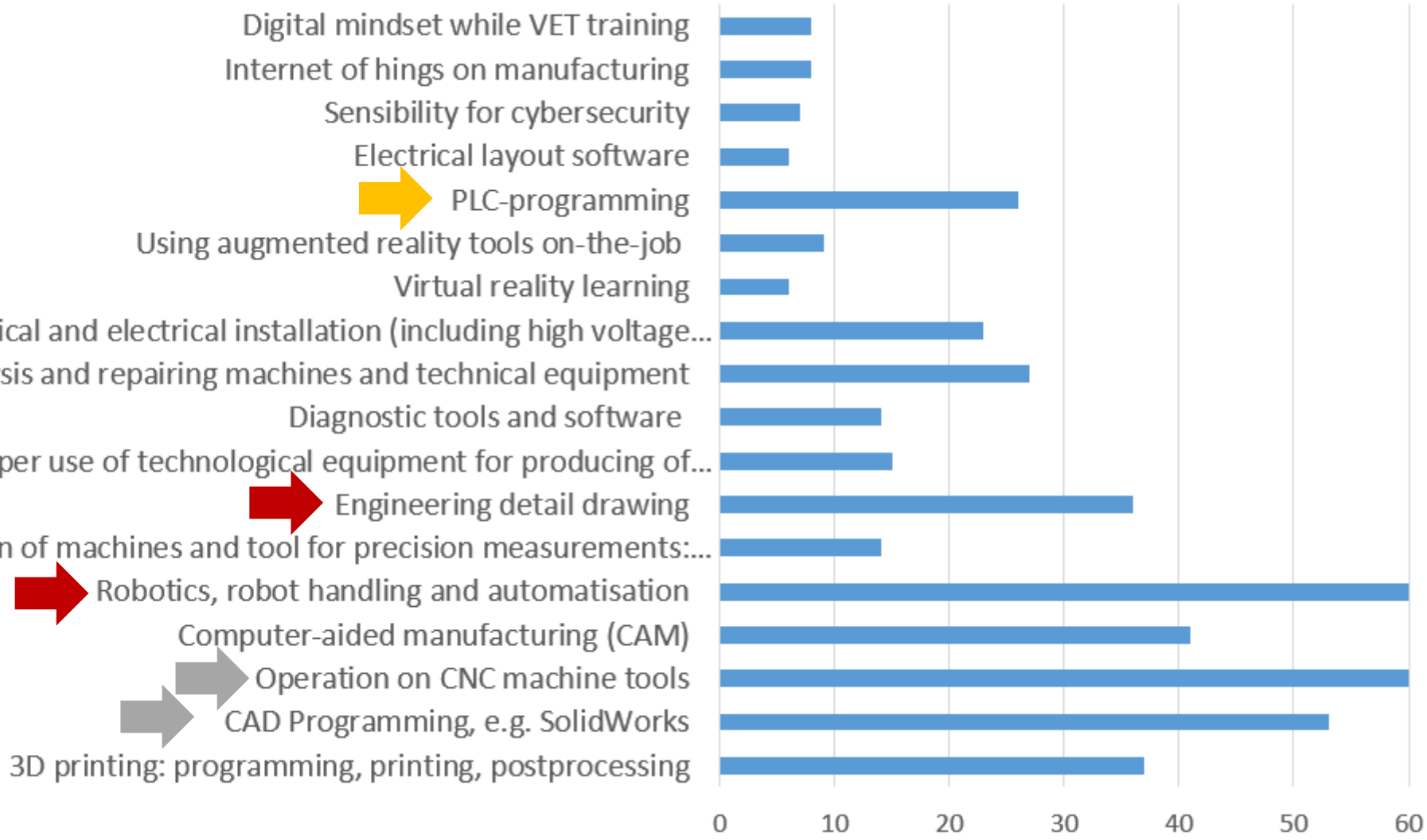


4. Discussion: Tasks

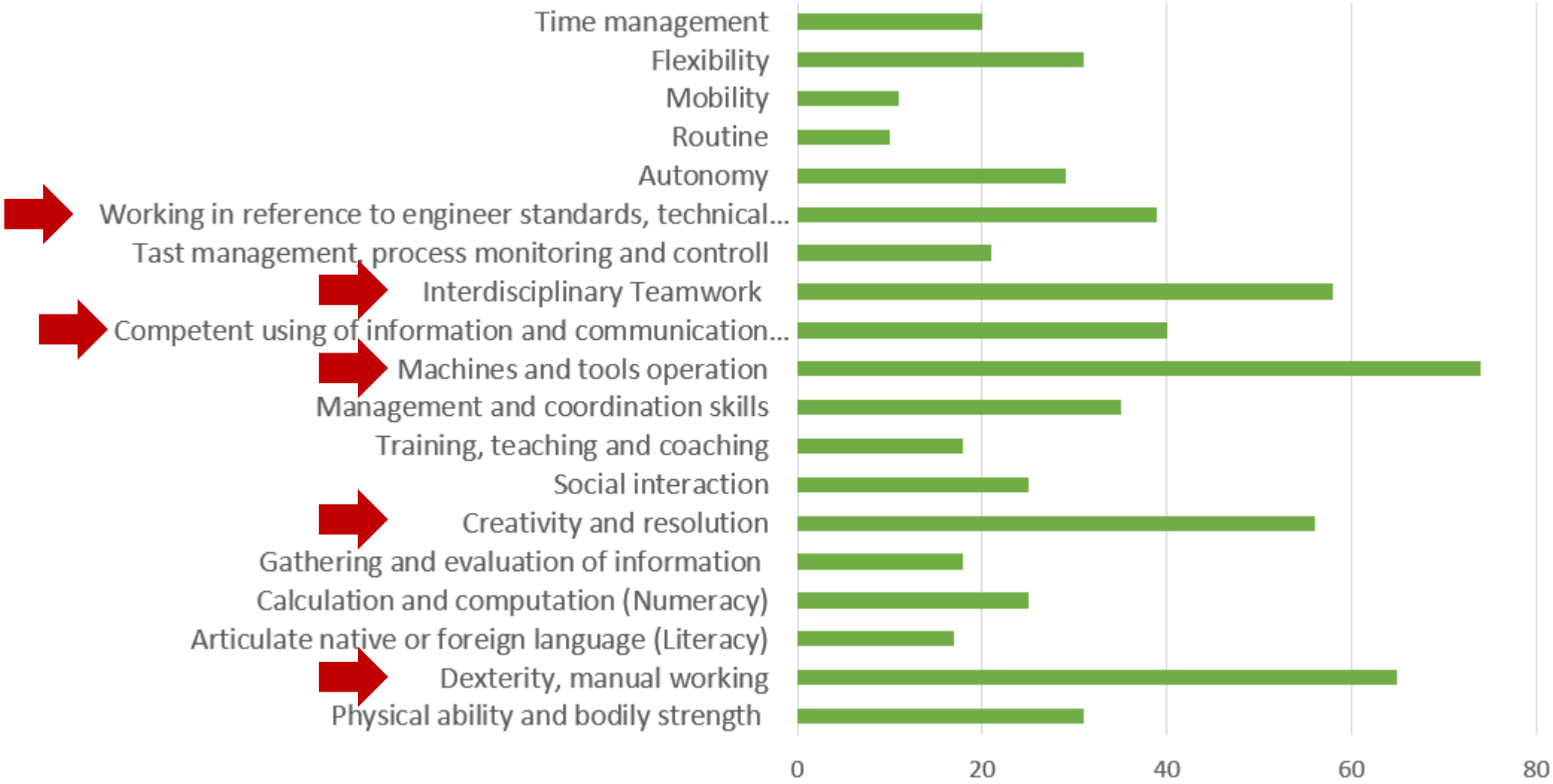
Common tasks

ELECTRO-specific tasks

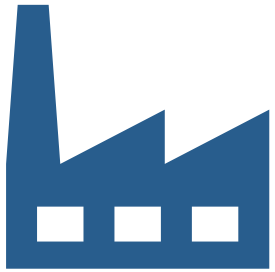
METAL-specific tasks



4. Discussion: Competences



4. Discussion: Competences



Dexterity

Professional qualification

Guided speed-training

Teamwork

Communicative skills

Digital team meetings

Creativity/Resolution

Individual capacity

Interdisciplinary tasks

Competent use of information

Learning capability

Using technical documentation

Engineer standards

Methodological expertise

Spatial sense and orientation

Machines and tools

Professional qualification

Digital twin

4. Discussion: Competences

Please join: rb.gy/rdpp1

Day 2

PREVIEW

Considerations for occupational training

01 Introduction

- Relevant preliminary considerations of vocational education
- Role of the trainer, prerequisites of the trainees (Generation Z)

02 Training in general

- General and spesific competences and objectives

03 Occupational training

- Topic, brief content, goals
- Metal and Electro

04 Implementation

- Methods in discussion
- Feedback

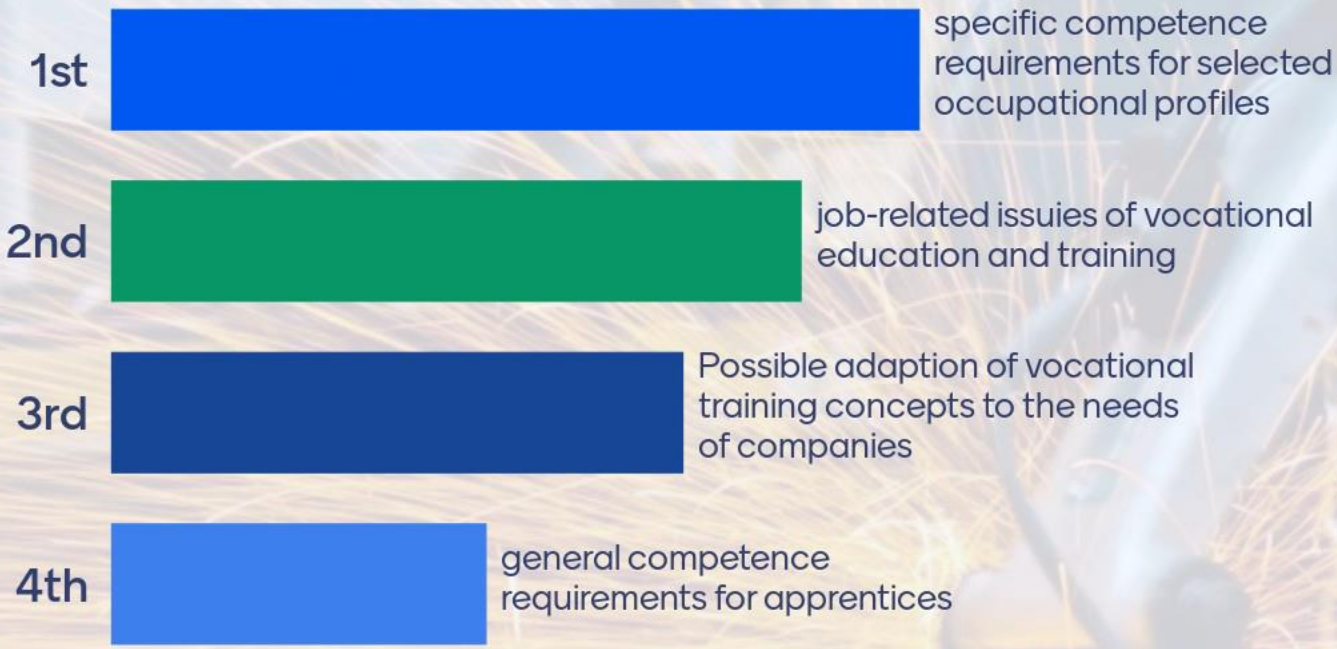
Mentimeter
Feedback

Mentimeter

What VET-related topics you were today well informed in?

Mentimeter

What did you experience today about occupational profiles in metal and electro sector?



Mentimeter

How can you use the findings of today's event?

Thank you!

Erasmus+

Factcheck

Adapting quality of VET offer to the need of industry – manufacturing sector

Metal & Electro Qualifications

Considerations for occupational training

Erasmus+

Agenda – Day 2

01 Introduction

10:00 – 10:20

- Key findings from Day 1
- Skills required by companies

02 Vocational education

10:20 – 11:30

- Role of the trainer, prerequisites of the trainees
- Initial design of European Training Modules

03 Occupational training

12:00 – 13:30

- Topics, brief content, goals
- Electro and Metal in particular

04 Discussion

13:30 – 14:00

- Conclusion
- Implementation methods: EU and national issues

Factcheck

1. Introduction: Profiles

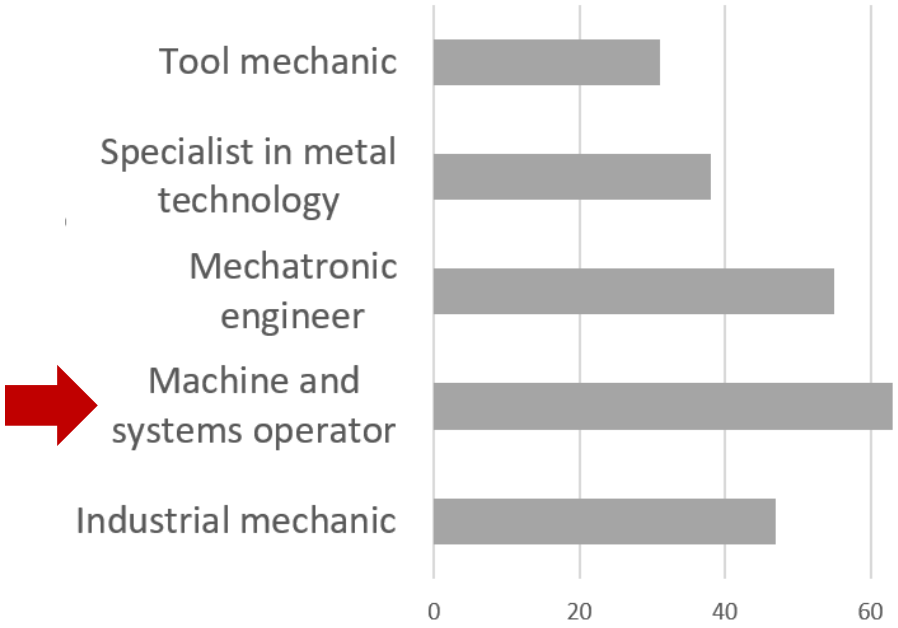
REVIEW: Day 1

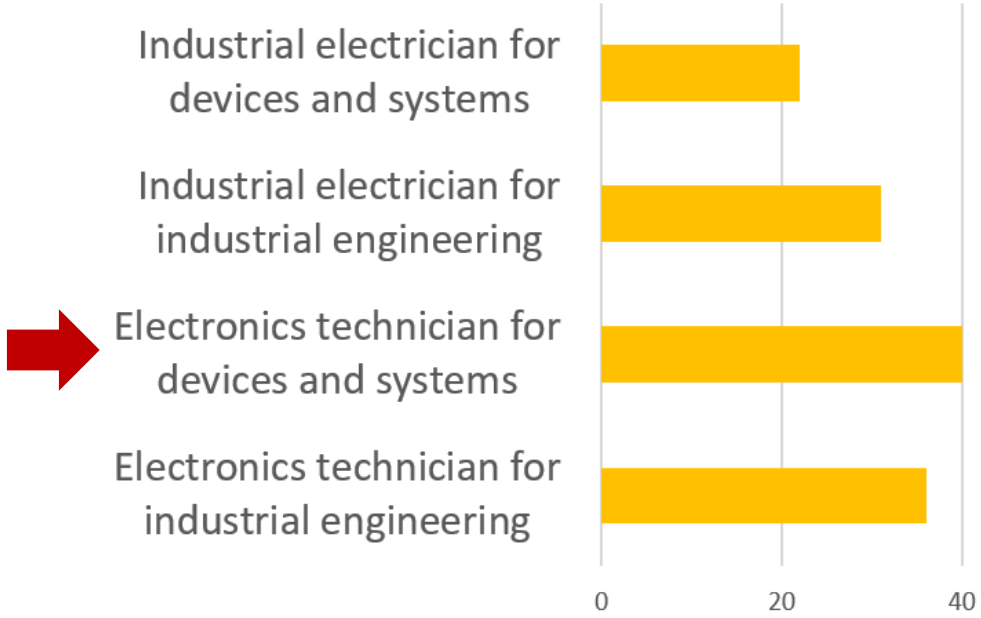
METAL

Machine and systems operator

ELECTRO

Electronics technician for devices and systems





Erasmus+

Factcheck

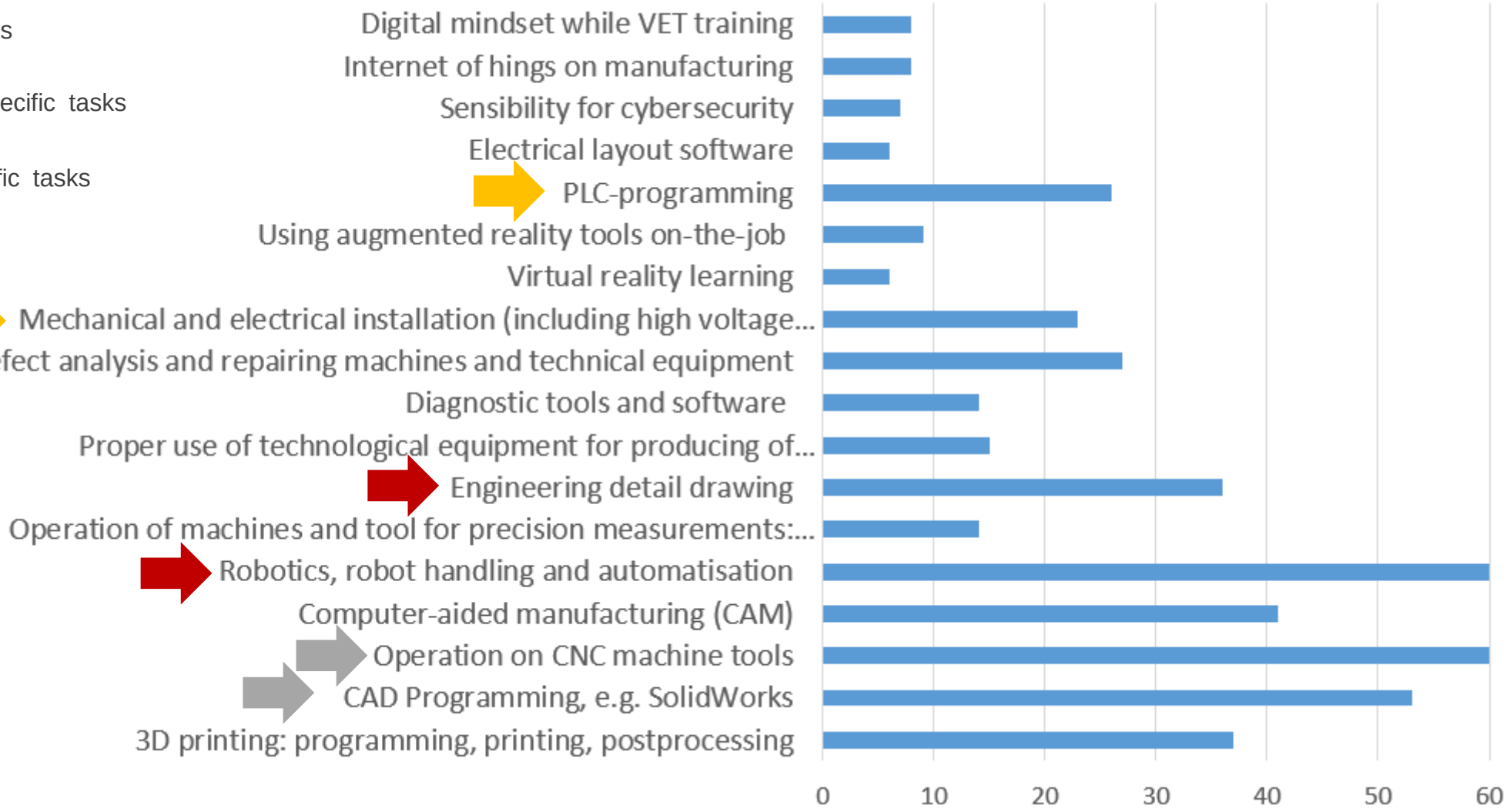
1. Introduction: Tasks

REVIEW: Day 1

Common tasks

ELECTRO-specific tasks

METAL-specific tasks



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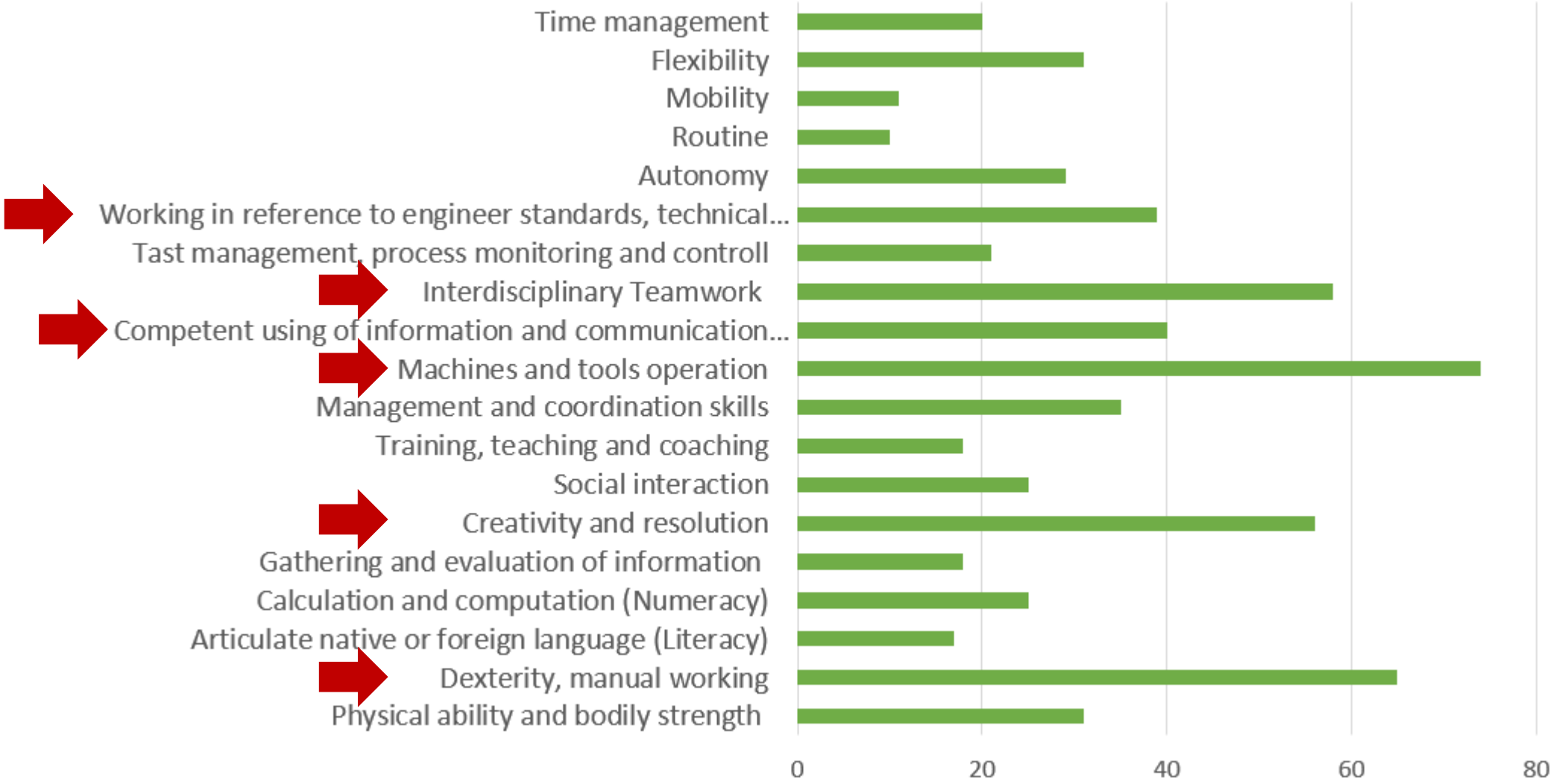
Factcheck

1. Introduction: Competences

REVIEW: Day 1



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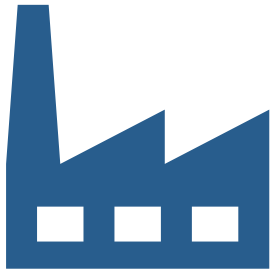
Factcheck

1. Introduction: Competences

REVIEW: Day 1



Dexterity

Professional qualification

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Creativity/Resolution

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Engineer standards

Methodological expertise

Spatial sense and orientation

Machines and tools

Professional qualification

Digital twin

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Expectations

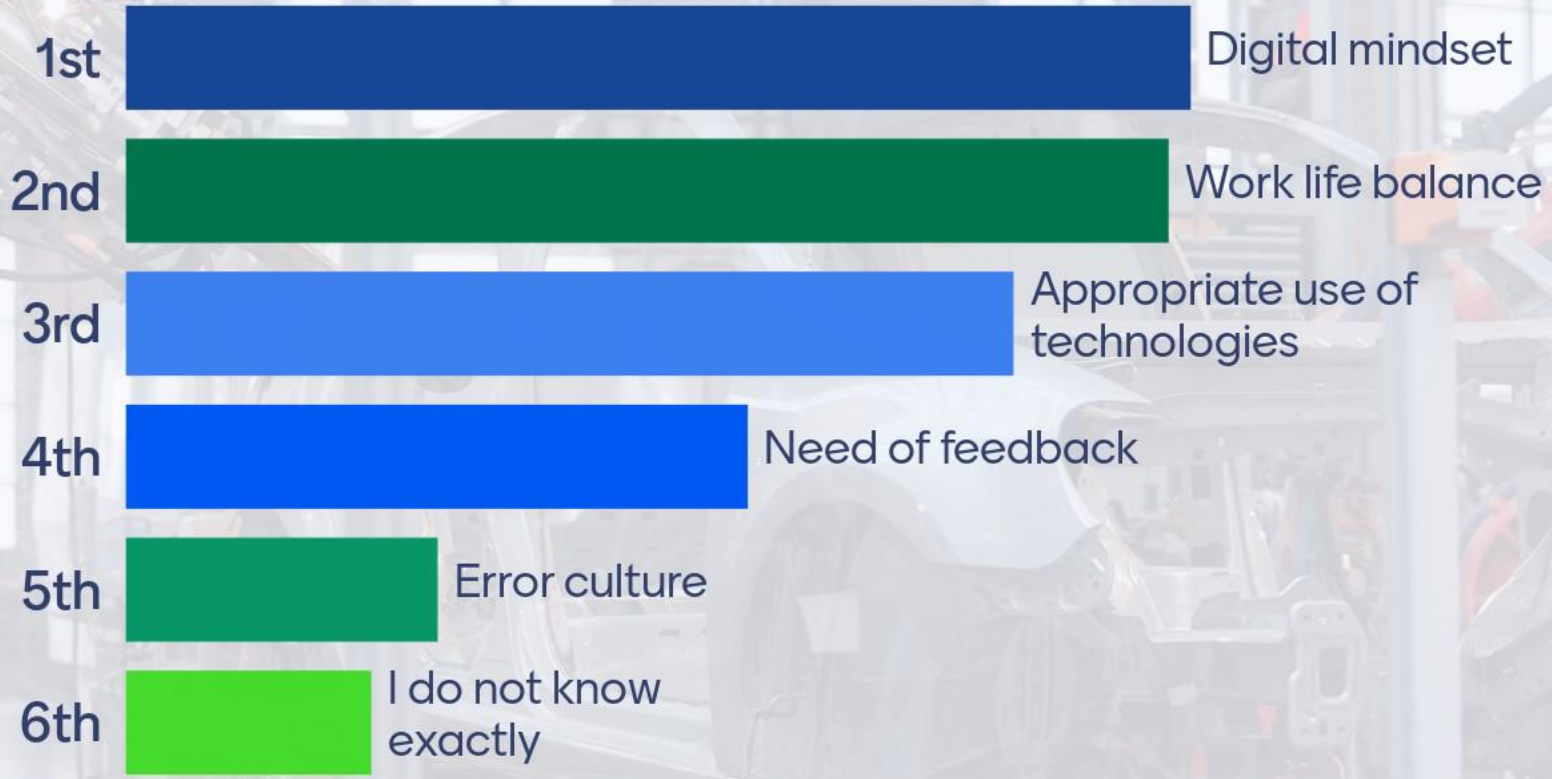
Mentimeter

Mentimeter

How precisely do you know the requieremements on VET 4.0?

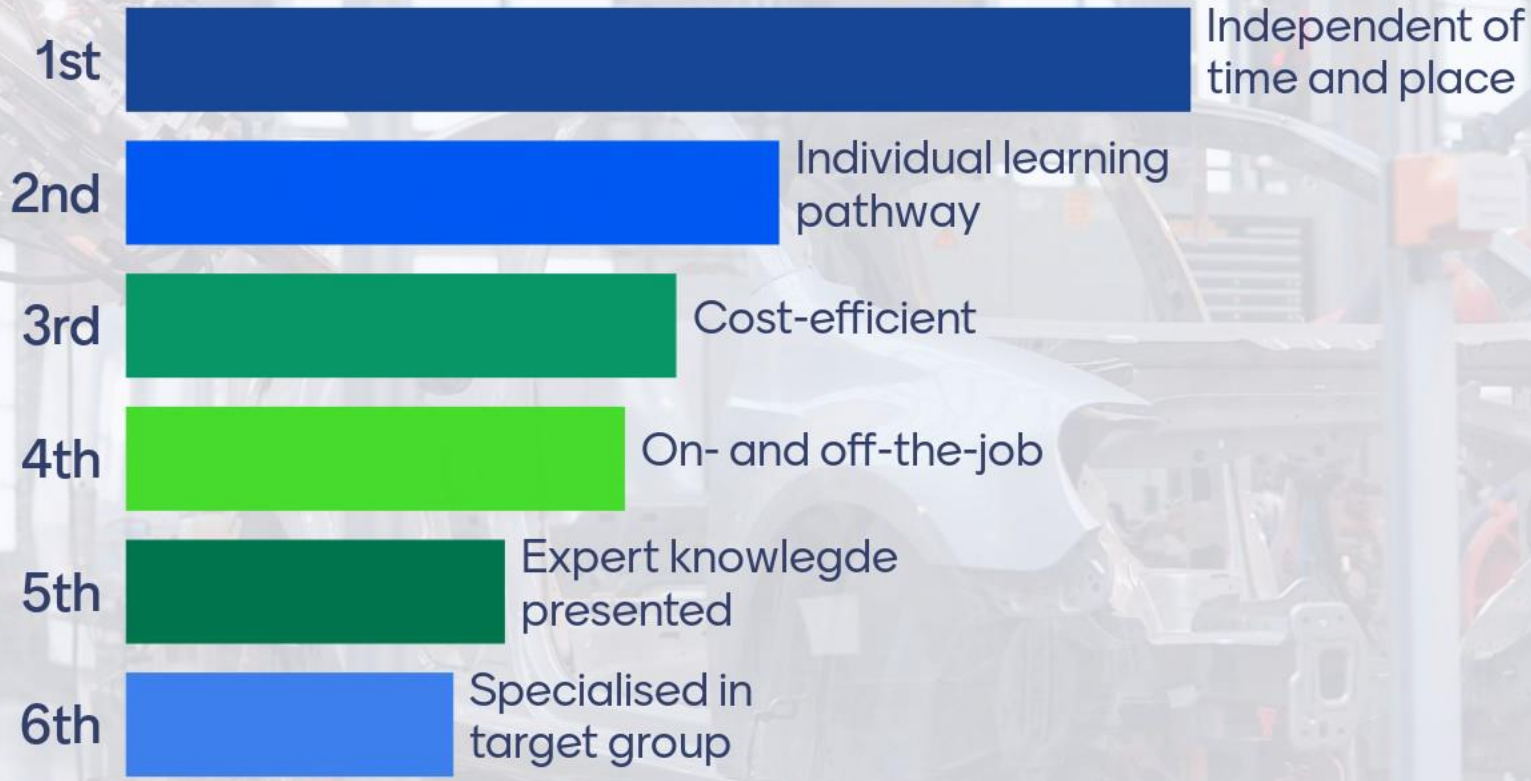
Mentimeter

What are the most significant issues of Generation Z?



Mentimeter

What are the most relevant issues of digital learning?



Agenda – Day 2

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10:00 – 10:20

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12:00 – 13:30

- Topics, brief content, goals
- Electro and Metal in particular

04 Discussion

13:30 – 14:00

- Conclusion
- Implementation methods: EU and national issues

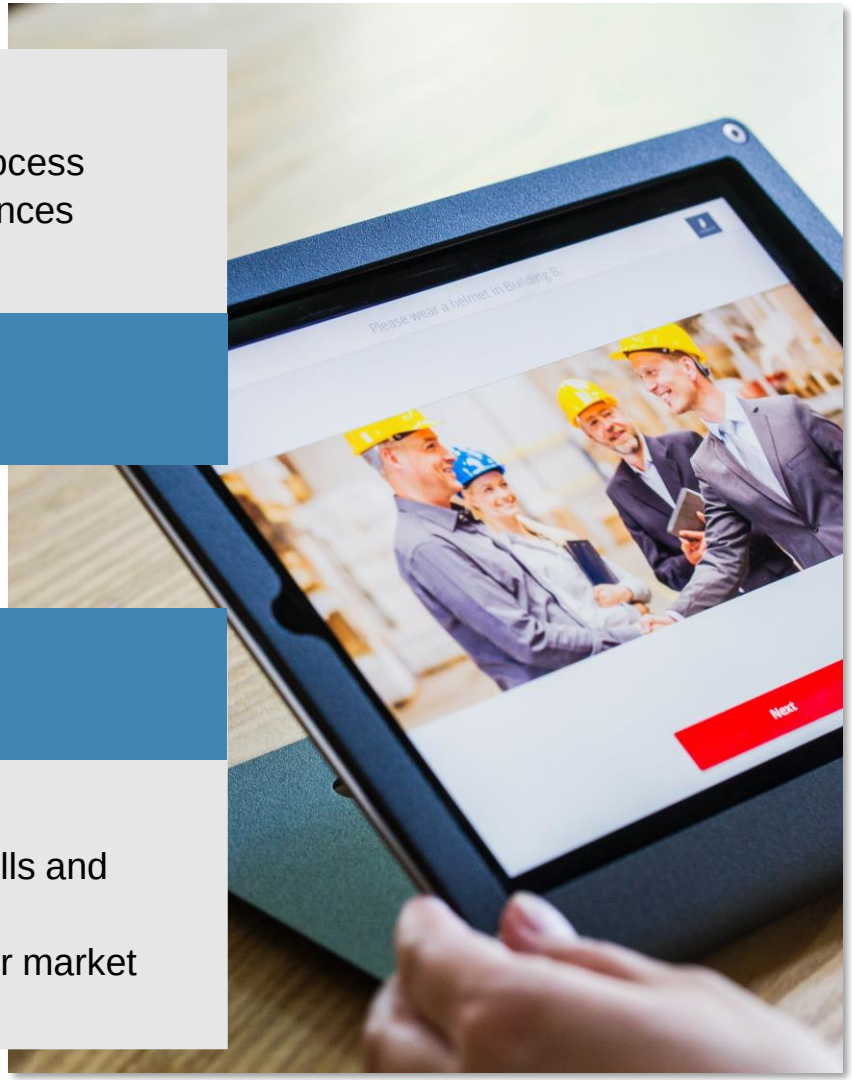
2. Vocational education

Innovations in production:
- Automation
- Technologies
- Networking

Industry 4.0

Adequately qualified staff:
- Ensuring the production process
- Transformation of competences

Working world 4.0



Vocational education

Practical vocational training:
- Professional knowledge, skills and abilities
- Directly usable on the labour market

HR development

Qualified and trained staff:
- Further training in line with requirements
- Resource management

Factcheck

2. Vocational education

Efficient work in complex data-based systems

Interdisciplinary

Virtual collaboration

With different responsibilities

From different disciplines

Learning platform

Preparatory or directly in the work process

Independent or guided

Ongoing and sustainable

Technical communication

Possibilities and dangers of media technologies

Erasmus+

Factcheck

2. Vocational education

Well-trained skilled workers help determine the success of the company!

Erasmus+

2. Vocational education

Vocational orientation

Attractiveness of vocational education and training

Advantages of digital methods:

- Independent of time and place
- Individual in the course
- Can be repeated as often as desired
- Specialised in target group and subject area

Vocational education

Professional skills

Advantages of digital methods:

- Expert knowledge
- Reduction of the probability of errors
- Applicable in and outside production
- Cost-efficient
- Sustainable
- Updatable

Further qualification

Skilled workforce

Advantages of digital methods:

- Further training of the workforce
- Adapted to the needs of the company
- Applicable on- and off-the-job
- Part-time
- Integrated into personnel development strategy
- Safeguarding productivity

2. Vocational education

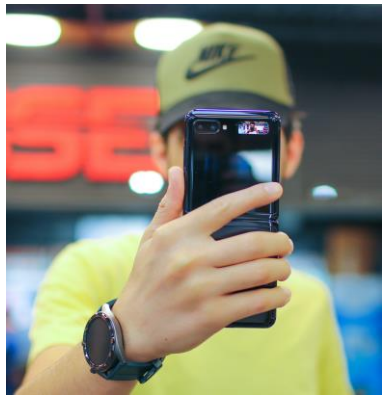
Generation Z

Digital natives

“Fast and furious”

Technologies

Connected

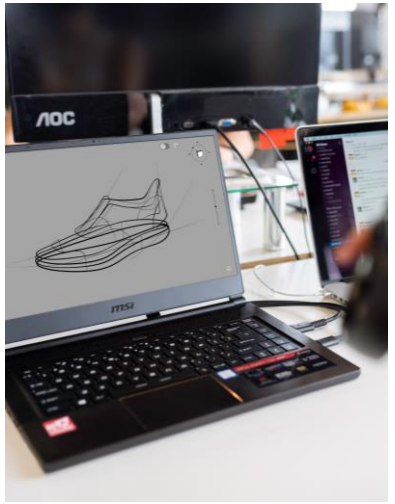


Reactions

Feedback

Work life balance

Digitalisation



Factcheck

2. Vocational education

Volatility

Rate of change

Complexity

Multiple key decision factors

Uncertainty

Unclear about the present

Ambiguity

Lack of clarity about meaning of an event

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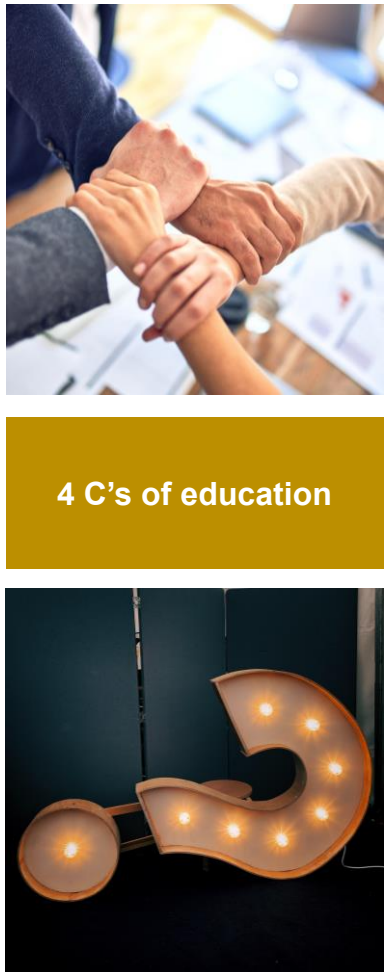
2. Vocational education

4 C‘s of education

From knowledge transfer to skills transfer

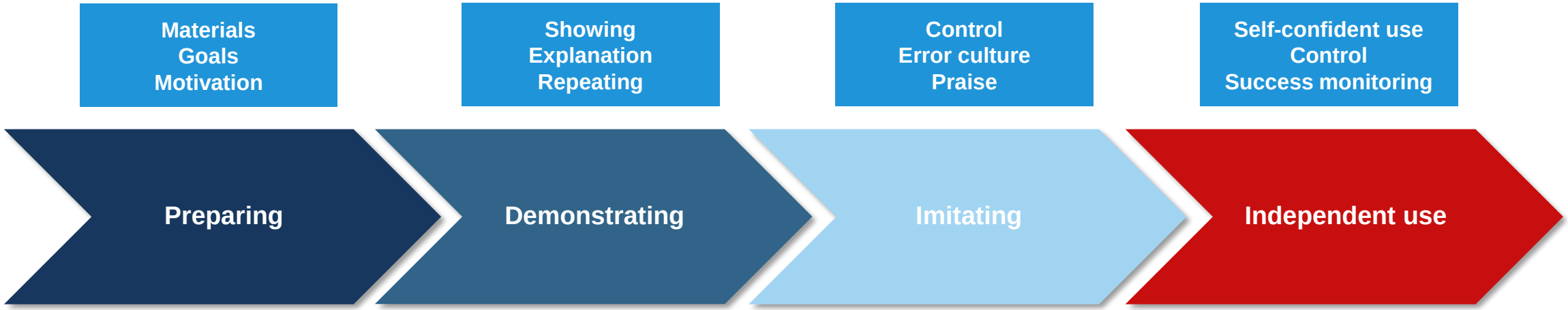
Skills that cannot be digitised:

- Creativity
- Critical thinking
- Communication
- Collaboration



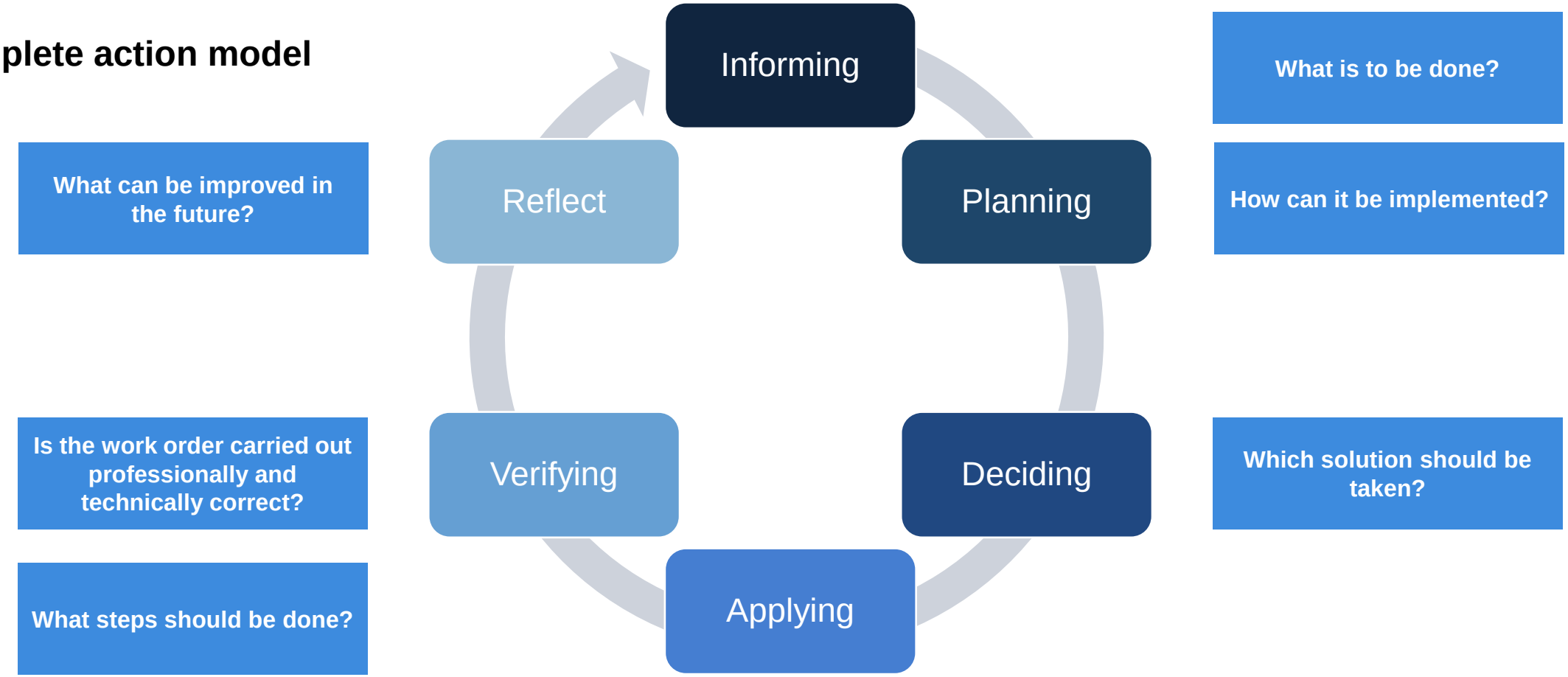
2. Vocational education

Conventional model of VET



2. Vocational education

Complete action model



2. Vocational education

Complete action model

Trainees

- Self-determined learning
- Get feedback

Trainers

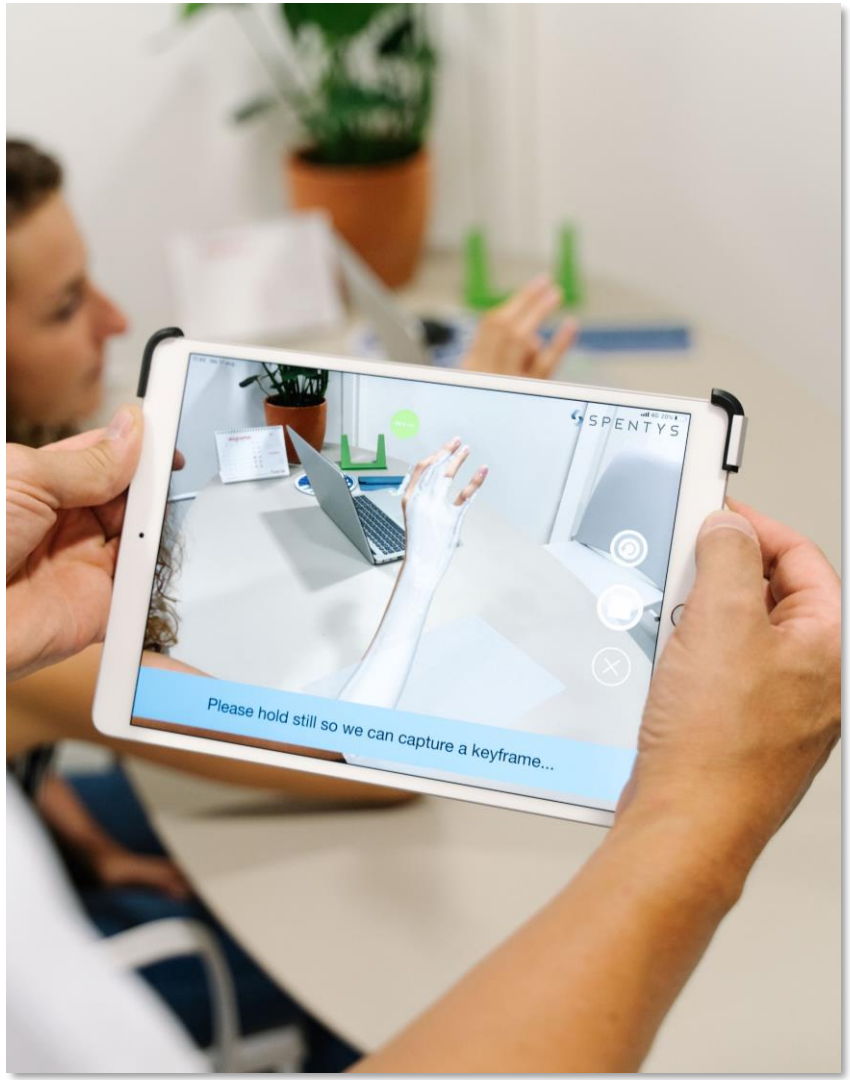
- Accompany the learning process
- Give tasks and support

Learning platform

- Media affinity
- Variety of methods

Digital mindset

- Digital learning



2. Vocational education

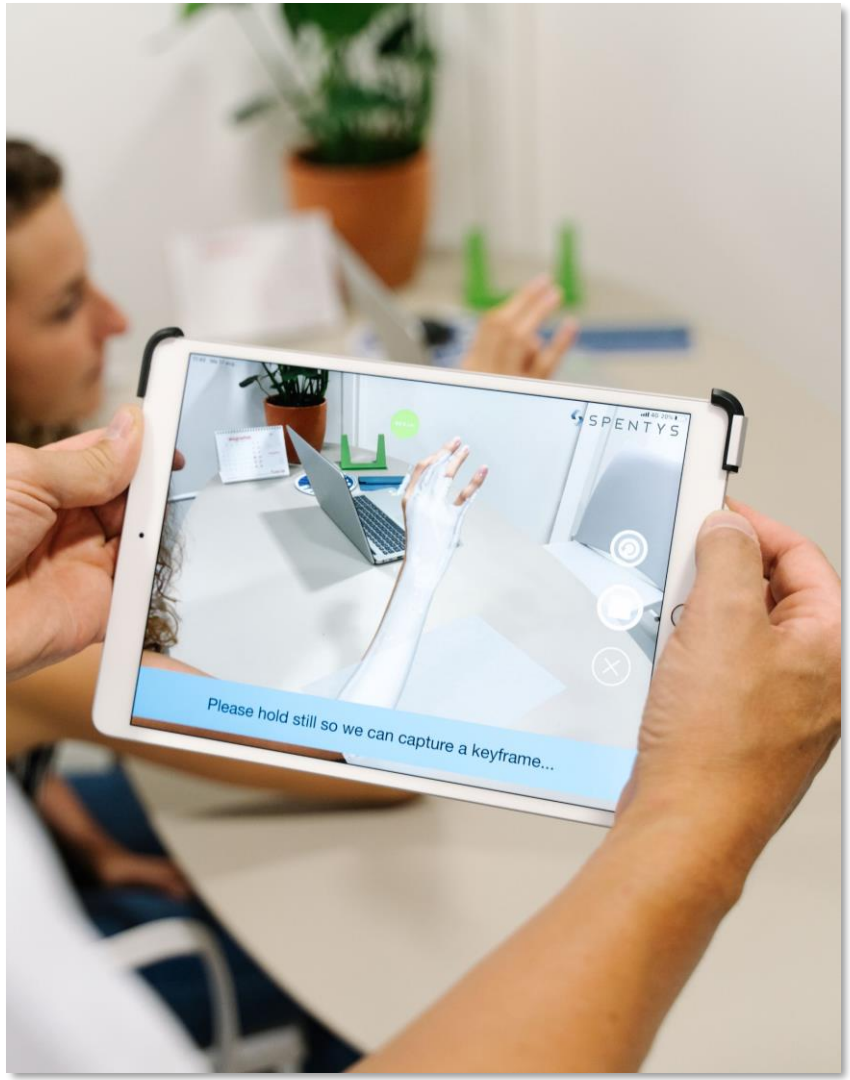
Complete action model

Advantages

- Connecting theory and practice
- Encouraging independent work
- Strengthening of key competences
- Can be used in individual and group work
- Learning and applying presentation and creativity techniques

Disadvantages

- Changing the training method can be time-consuming
- Can be too much for trainees at first
- Work equipment must be available



YEAH!
11:00 -
11:30 AM

Agenda – Day 2

01 Introduction — 10:00 – 10:20

- Key findings from Day 1
- Skills required by companies

02 Vocational education — 10:20 – 11:00 / 11:00 – 11:30

- Role of the trainer, prerequisites of the trainees
- Initial design of European Training Modules

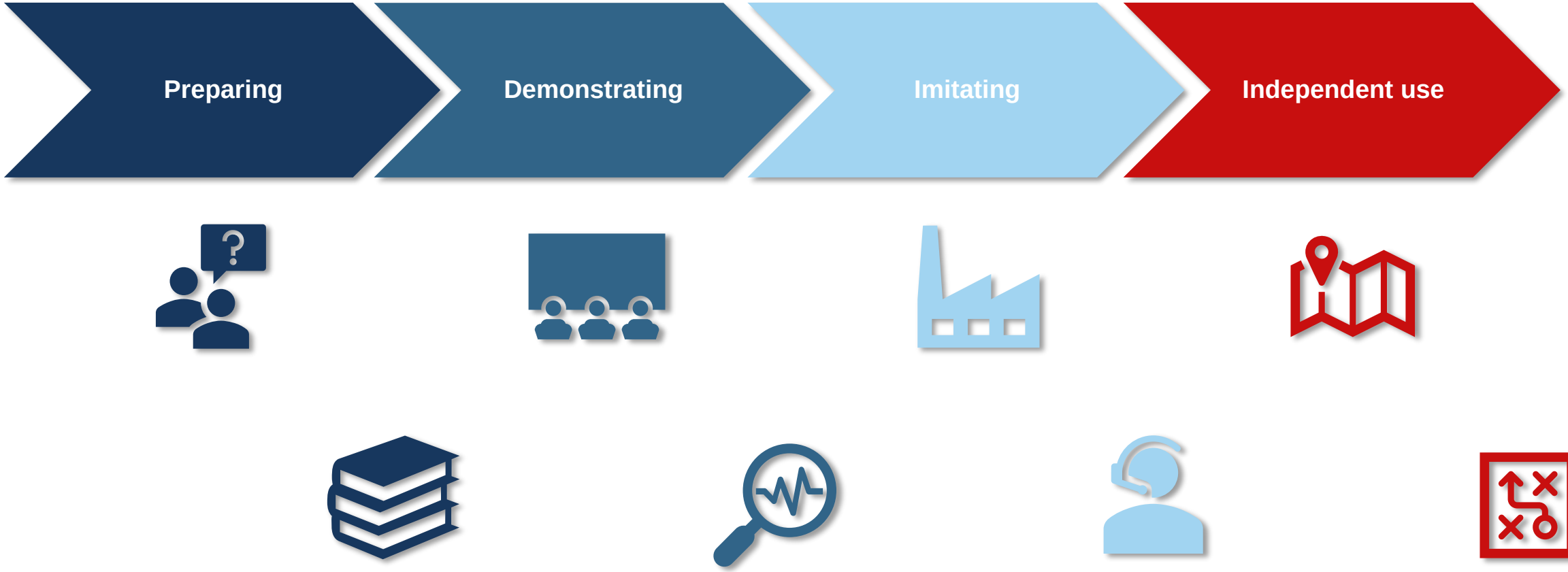
03 Occupational training — 11:30 – 12:00 / 12:00 – 13:00

- Topics, brief content, goals
- Electro and Metal in particular

04 Discussion — 13:00 – 14:00

- Conclusion
- Implementation methods: EU and national issues

3. Occupational training



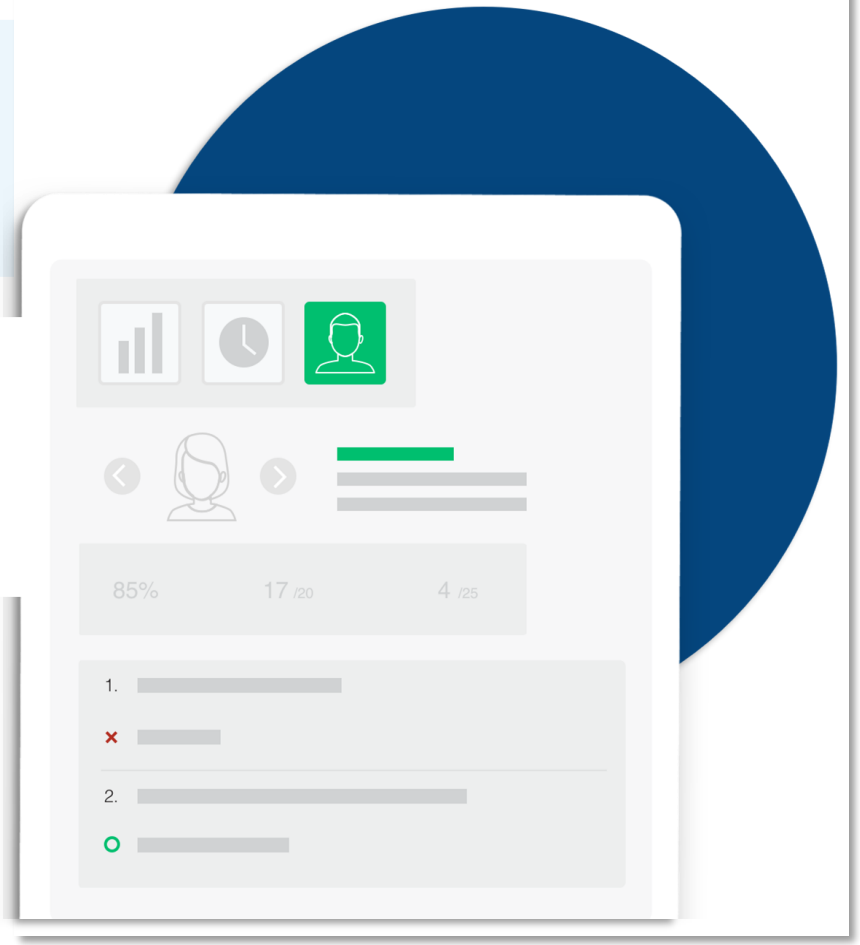
3. Occupational training

Preparing | Demonstrating | Imitating

- ✓ Independent of time and place
- ✓ Individual in the course
- ✓ Can be repeated as often as desired
- ✓ Specialised in target group and subject area

Assessment of the state of knowledge

- Real-time evaluation
- Can be used during lessons
- Anonymous or personalized
- Monitoring of the learning process



3. Occupational training

Preparing | Demonstrating | Imitating

- ✓ Independent of time and place
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- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

Creation of teaching materials

- Task sheets
- Presentations
- Interactive learning paths
- Integration of audio and video media

3. Occupational training

Preparing → **Demonstrating** → Imitating

- ✓ Independent of time and place
- ✓ Individual in the course
- ✓ Can be repeated as often as desired
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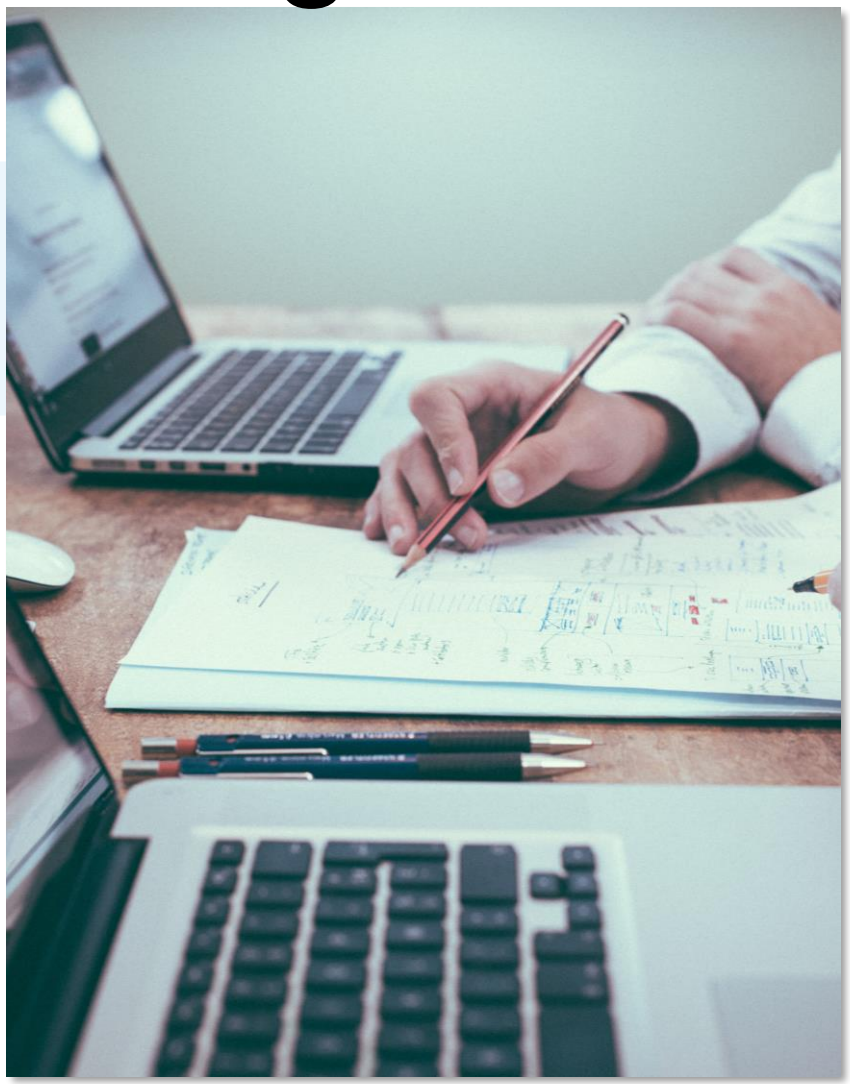
- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

Media learning

- Recordings of the work and production processes
- Notes and explanations
- Audiovisual tasks



3. Occupational training

Preparing | **Demonstrating** | Imitating

Simulation environments

- Virtual working environment
- Based on operational work processes
- Far away from production
- Targeted training of malfunctions

- ✓ Independent of time and place
- ✓ Individual in the course
- ✓ Can be repeated as often as desired
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- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
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3. Occupational training

emonstrating → **Imitating** → **Independent use**

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- ✓ Individual in the course
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- ✓ Specialised in target group and subject area

- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

- ✓ Out of the production

Training area

- Operational production processes in a controlled environment
- Away from production
- Within the company structure
- Interdisciplinary
- Fully comprehensive work processes

3. Occupational training

emonstrating → **Imitating** → **Independent use**

- ✓ Independent of time and place
- ✓ Individual in the course
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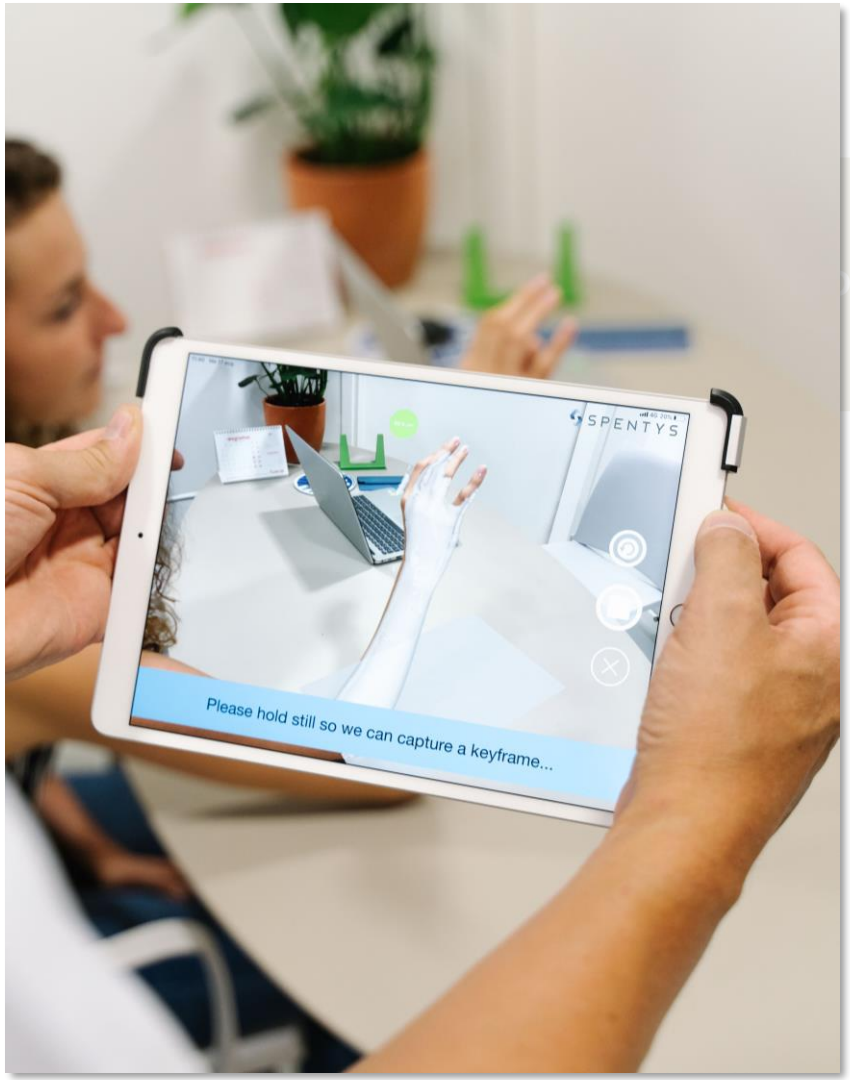
- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

- ✓ Out of the production

Virtual reality

- Realistic simulation in a controlled environment
- Far away from production
- Operational production processes
- Interdisciplinary
- Fully comprehensive work processes
- Training of incidents

3. Occupational training



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- ✓ Specialised in target group and subject area

- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

- ✓ Reduction of the probability of errors
- ✓ Applicable in and outside production

Augmented reality

- Part-time
- On-/Off-the-job
- Additional information
- Warnings
- Technical communication

3. Occupational training

emonstrating → Imitating → **Independent use**

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- ✓ Expert knowledge
- ✓ Cost-efficient and resource-saving
- ✓ Sustainable and updatable

- ✓ Reduction of the probability of errors
- ✓ Applicable in and outside production

Assistance systems

- Integration into production processes
- Guidance of work steps
- Quality assurance
- For every level of qualification
- Increasing productivity

3. Occupational training

Overview

Needs assessment

Concept

Evaluation

Implementation

TaskCards

Prezi

mindmeister

PhET Interactive Simulations

Kahoot!

Poll Everywhere

Mentimeter

Actionbound

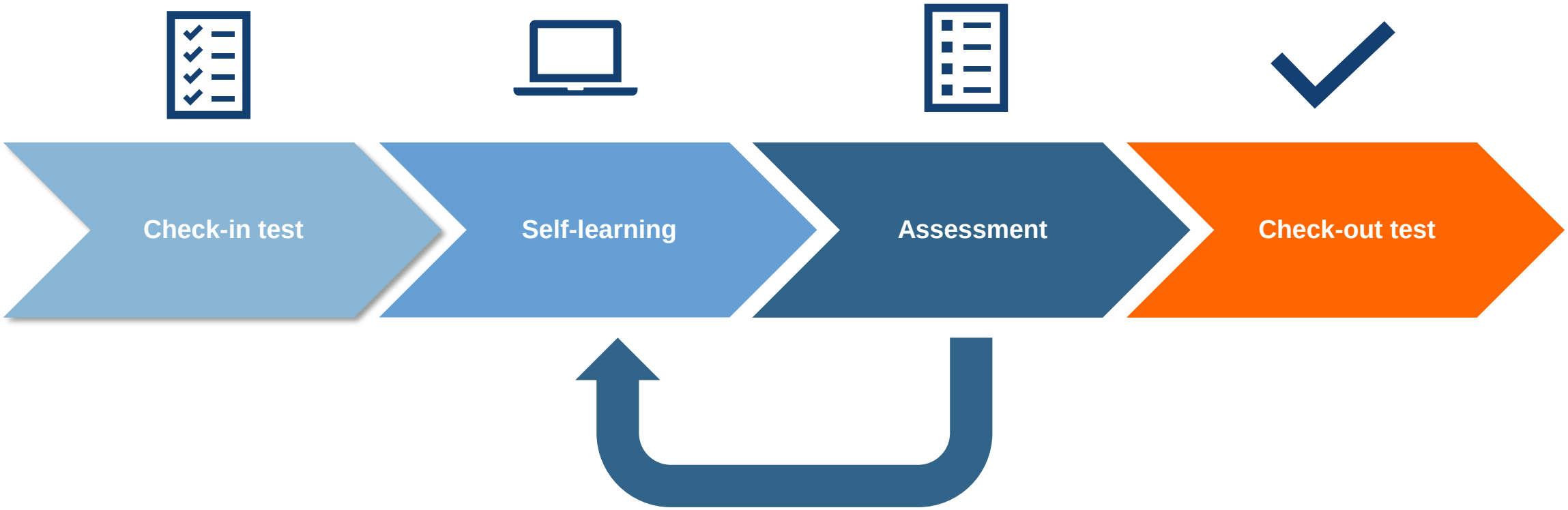
tutory

H5P

Erasmus+

3. Occupational training

Online training module: Learning pathway



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➢ Key findings from Day 1		**10:20**
➢ Skills required by companies		
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➢ Initial design of European Training Modules		**11:00**
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➢ Electro and Metal in particular		**13:00**
04 Discussion		**13:00**
➢ Conclusion		**14:00**
➢ Implementation methods: EU and national issues		

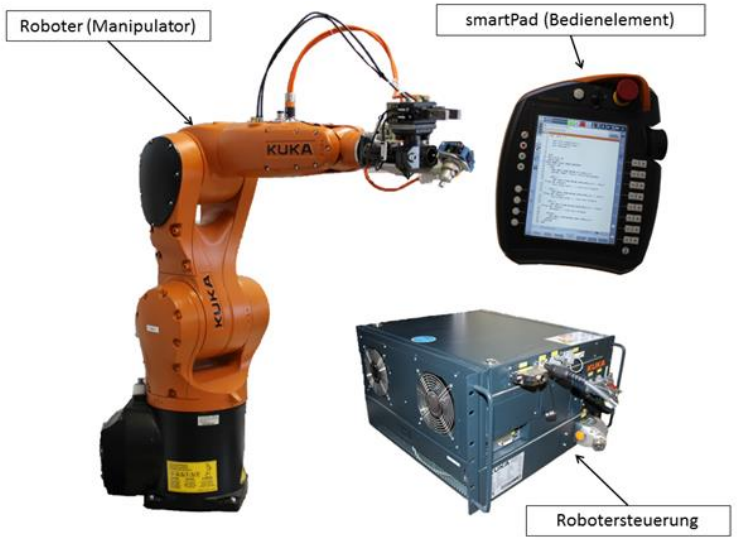
4. Discussion: Training

METAL

Machine and systems operator

ELECTRO

Electronics technician for devices and systems

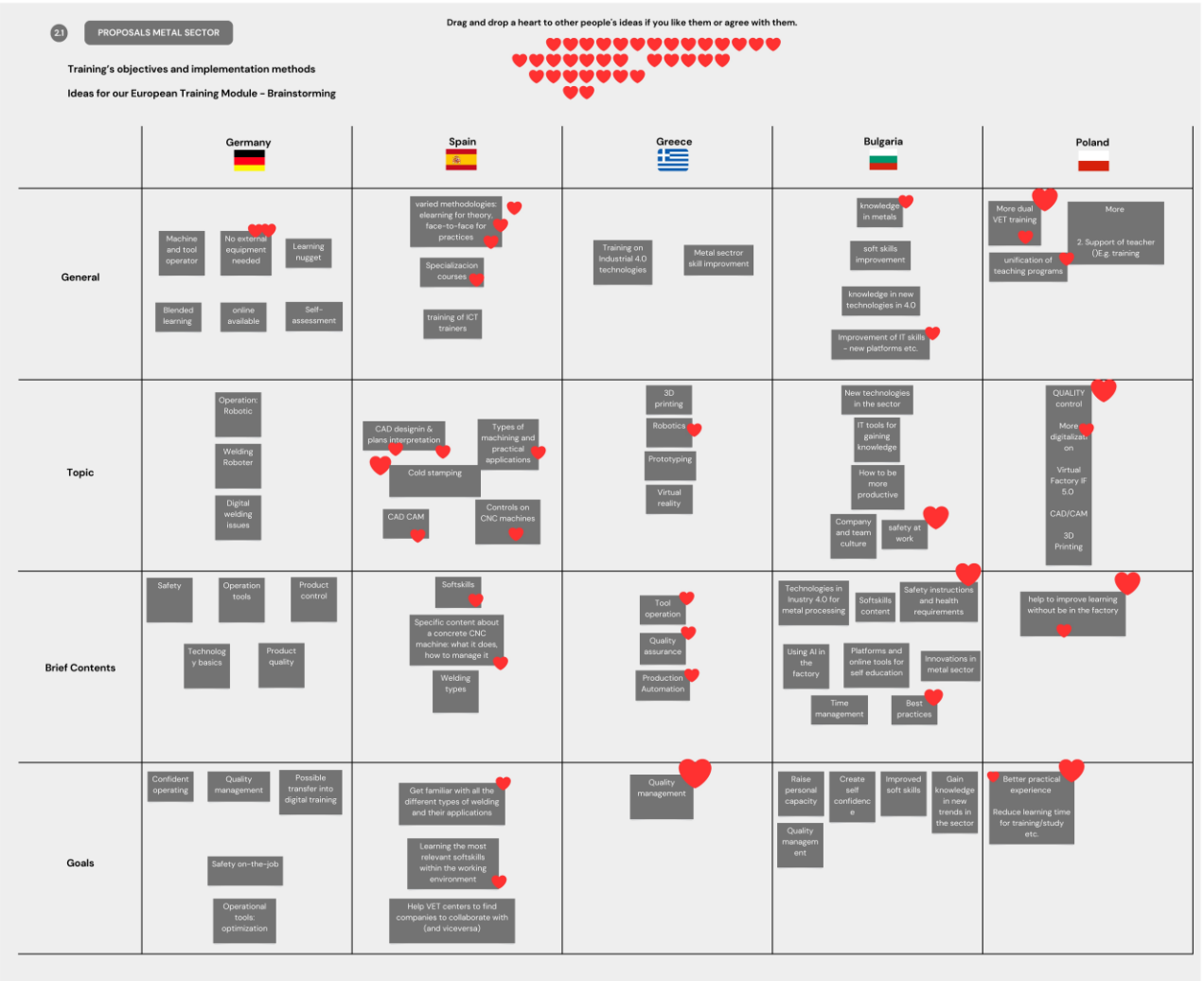


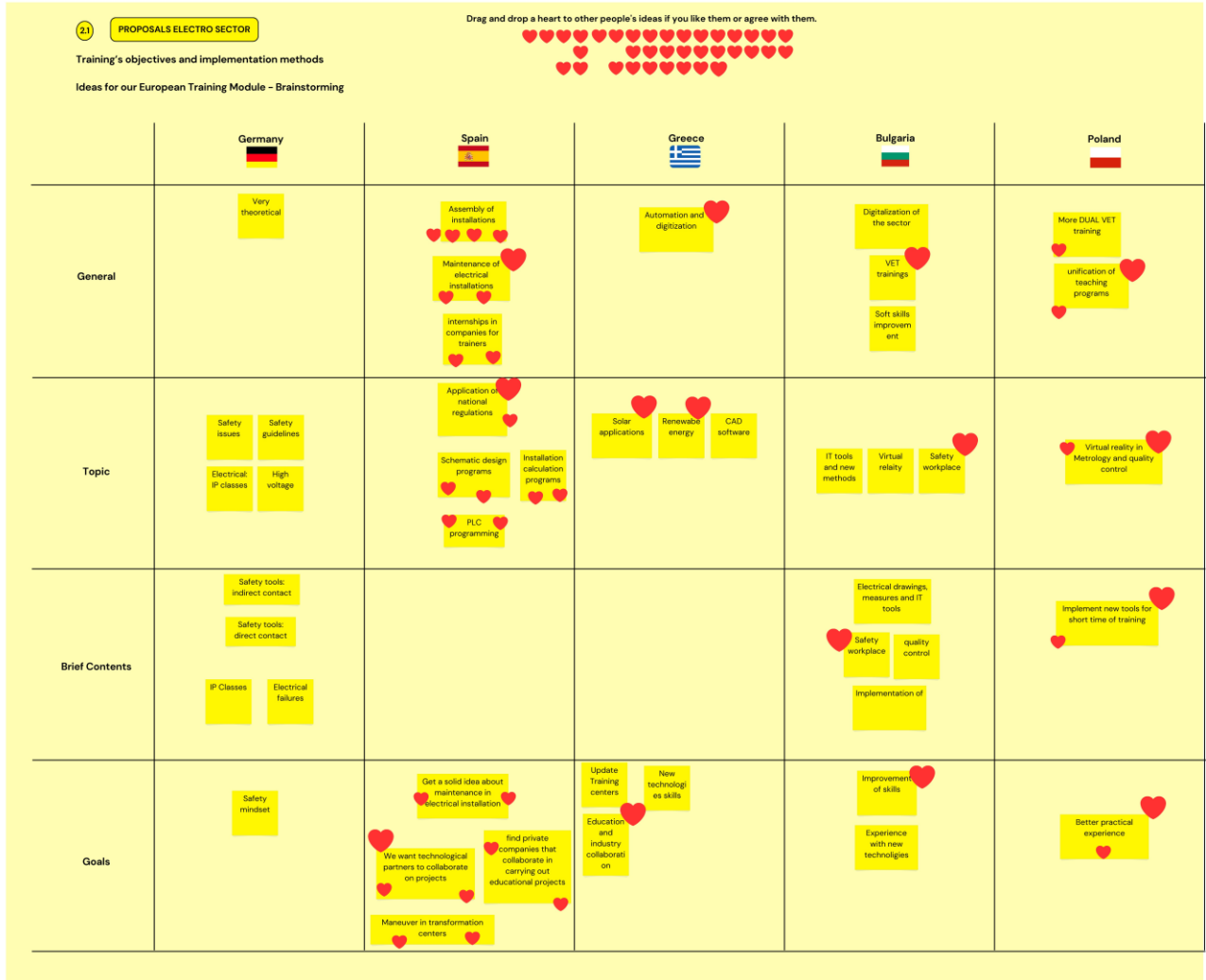
4. Discussion: Training

Please join: rb.gy/rdpp1

DAY 2 – Thursday 5 oct

Considerations for occupational training





Day 3

PREVIEW

Considerations for occupational training

01 Introduction

- Key findings from Day 2
- Methods for training

02 Occupational training

- Objectives to be achieved and results
- Theoretical input and implementation

03 Localisation in curriculum

- National considerations
- Discussion

04 Conclusions

- Summary of complete workshop

Feedback

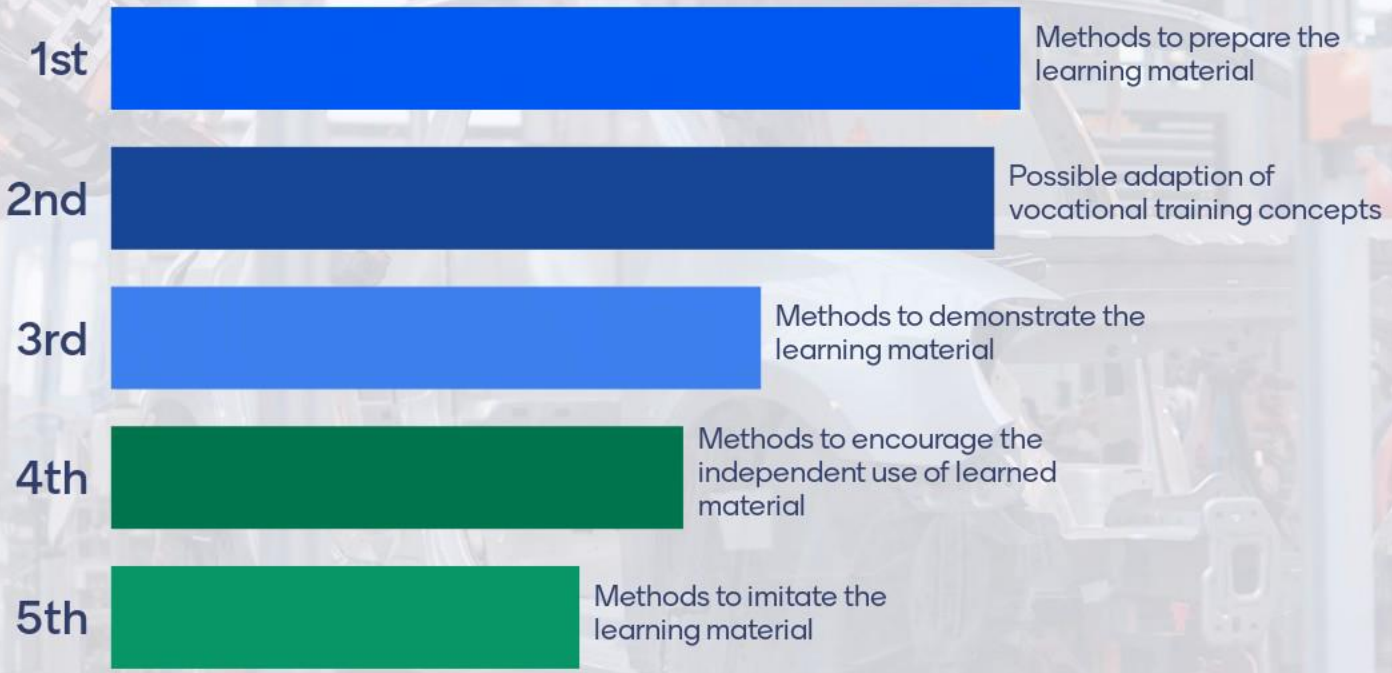
Mentimeter

Mentimeter

What VET-related topics you were today well informed in?

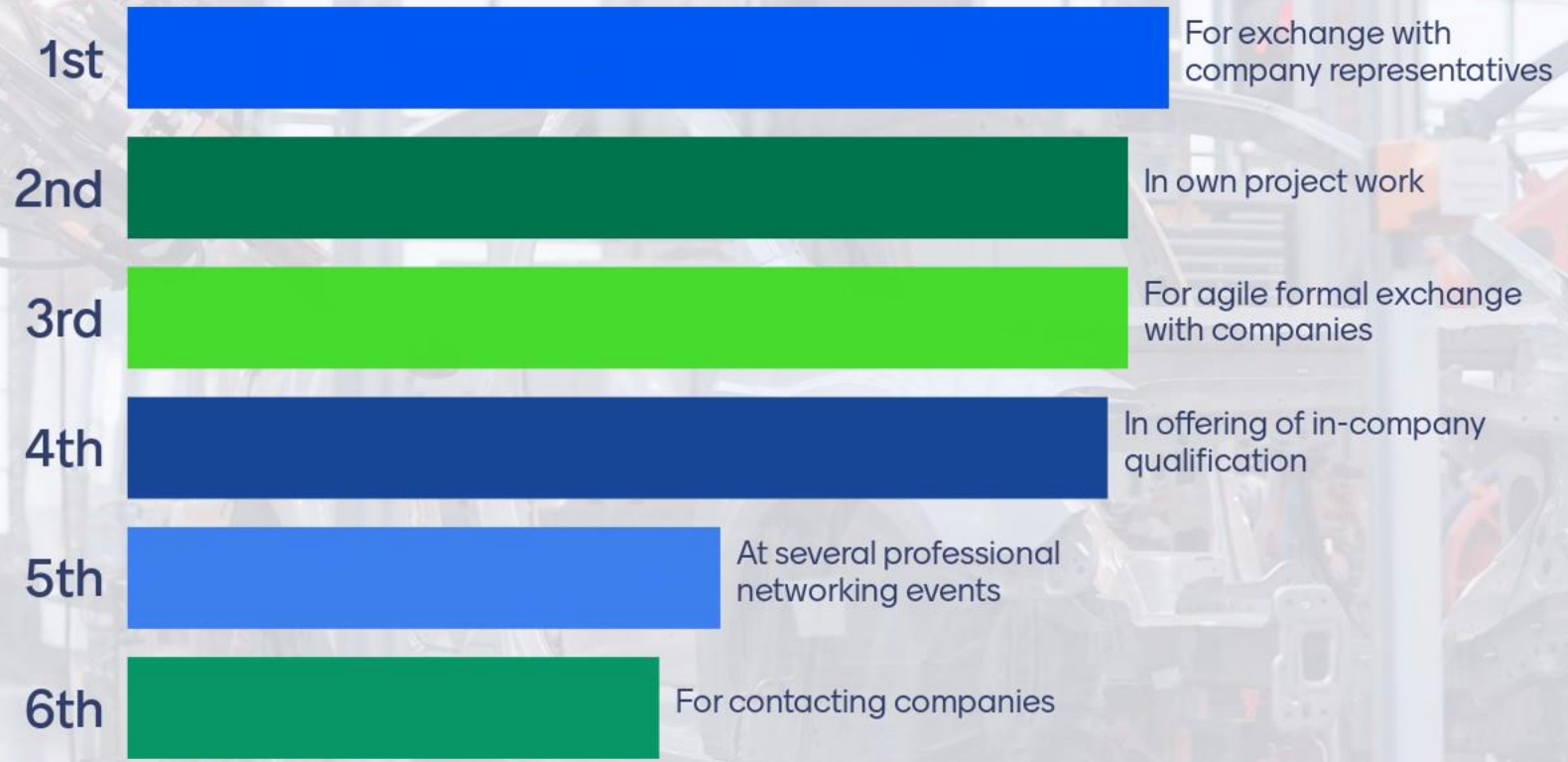
Mentimeter

What did you experience today about occupational training methods?



Mentimeter

How can you use the findings of today's event?



Thank you!

Erasmus+

Factcheck

Adapting quality of VET offer to the need of industry – manufacturing sector

Metal & Electro Qualifications

Elaboration of training module

Erasmus+

Agenda - Day 3

01 Introduction		**10:00**
➢ Key findings from Day 2		**10:20**
02 Occupational training		**10:20**
➢ Topic, brief contents and goals – in discussion (Canva)		**11:30**
➢ Objectives to be achieved and results – in discussion (Canva)		
03 Localisation in curriculum		**12:00**
➢ Suggestion of training content		**12:45**
➢ National considerations		**13:30**
04 Conclusions		**13:30**
➢ Summary of complete workshop		**14:00**

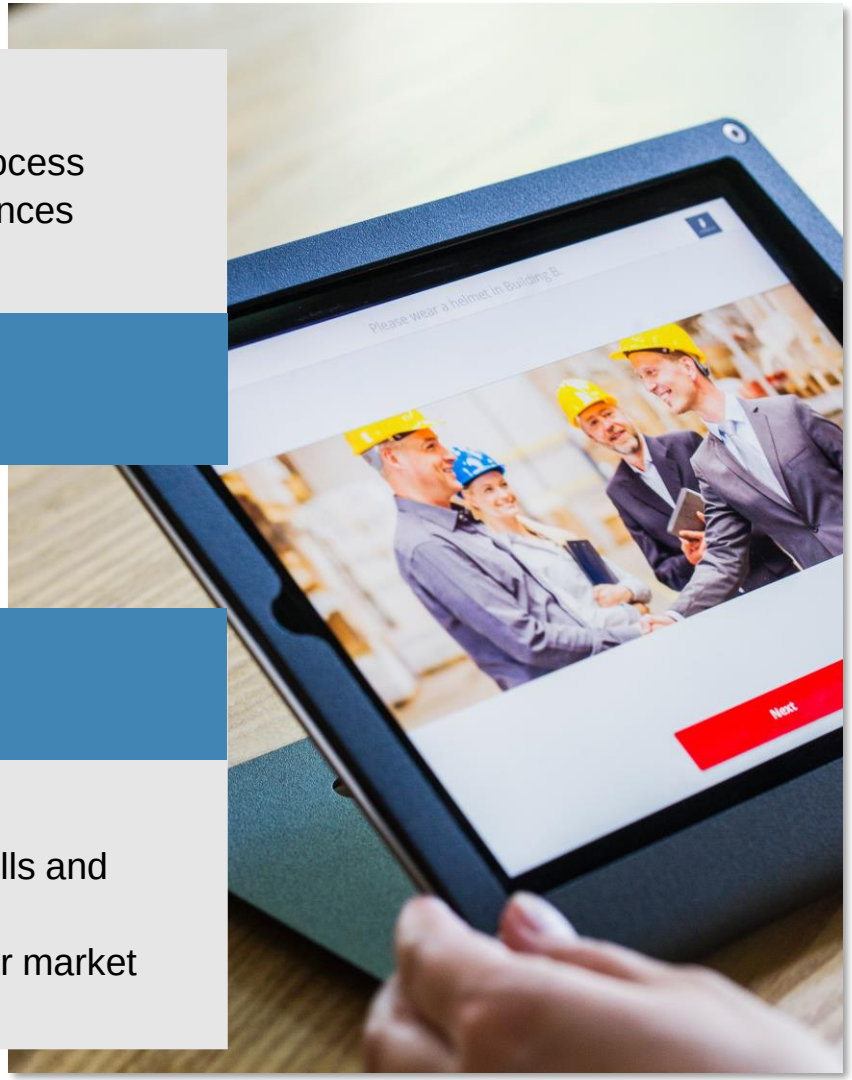
1. Introduction: VET

Innovations in production:
- Automation
- Technologies
- Networking

Industry 4.0

Adequately qualified staff:
- Ensuring the production process
- Transformation of competences

Working world 4.0



Vocational education

Practical vocational training:
- Professional knowledge, skills and abilities
- Directly usable on the labour market

HR development

Qualified and trained staff:
- Further training in line with requirements
- Resource management

Factcheck

1. Introduction: VET

REVIEW: Day 2

Vocational orientation

Attractiveness of vocational education and training

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- Independent of time and place
- Individual in the course
- Can be repeated as often as desired
- Specialised in target group and subject area

Vocational education

Professional skills

Advantages of digital methods:

- Expert knowledge
- Reduction of the probability of errors
- Applicable in and outside production
- Cost-efficient
- Sustainable
- Updatable

Further qualification

Skilled workforce

Advantages of digital methods:

- Further training of the workforce
- Adapted to the needs of the company
- Applicable on- and off-the-job
- Part-time
- Integrated into personnel development strategy
- Safeguarding productivity

Erasmus+

Factcheck

REVIEW: Day 2

1. Introduction: VET

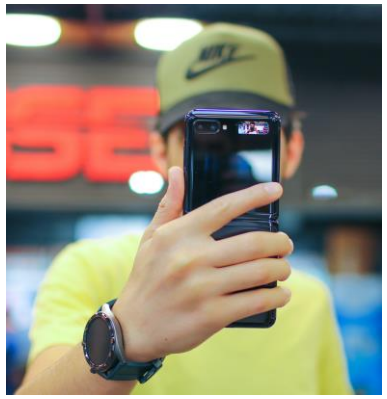
Generation Z

Digital natives

“Fast and furious”

Technologies

Connected

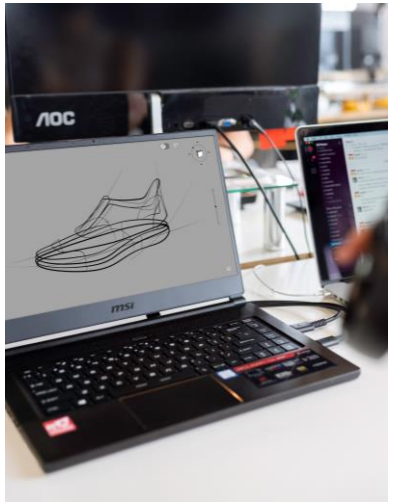


Reactions

Feedback

Work life balance

Digitalisation

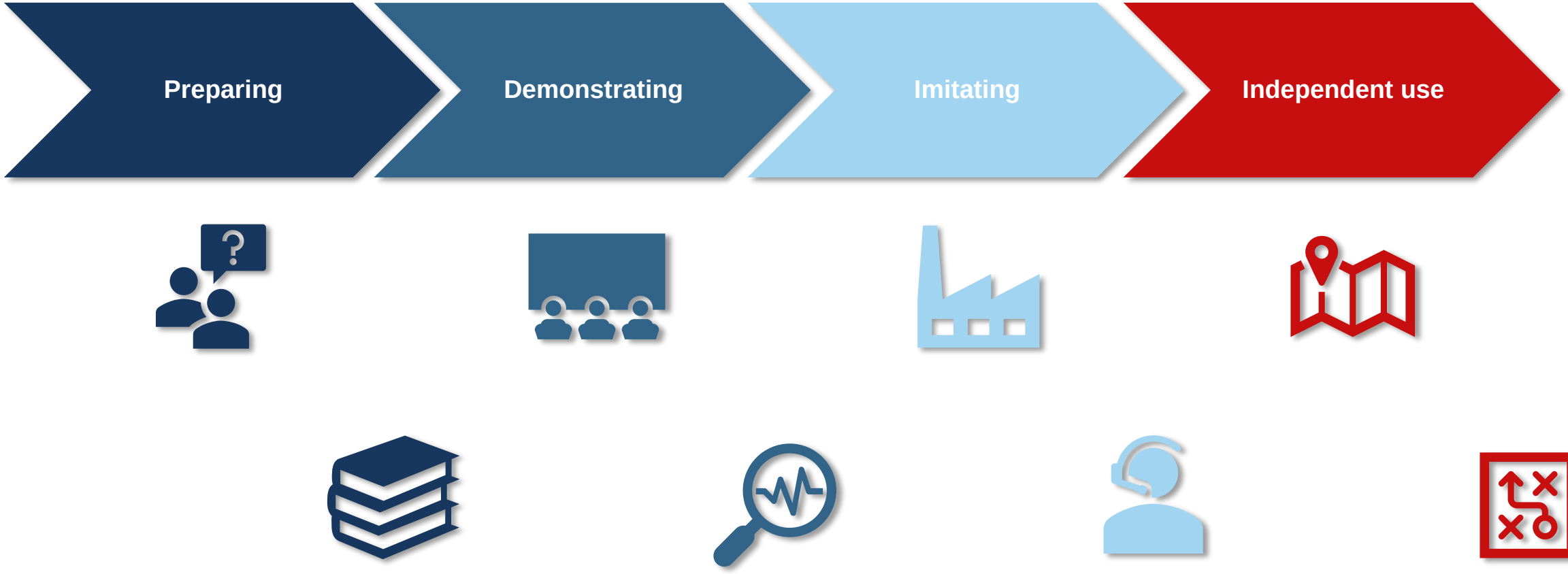


Erasmus+

Factcheck

REVIEW: Day 2

1. Introduction: VET



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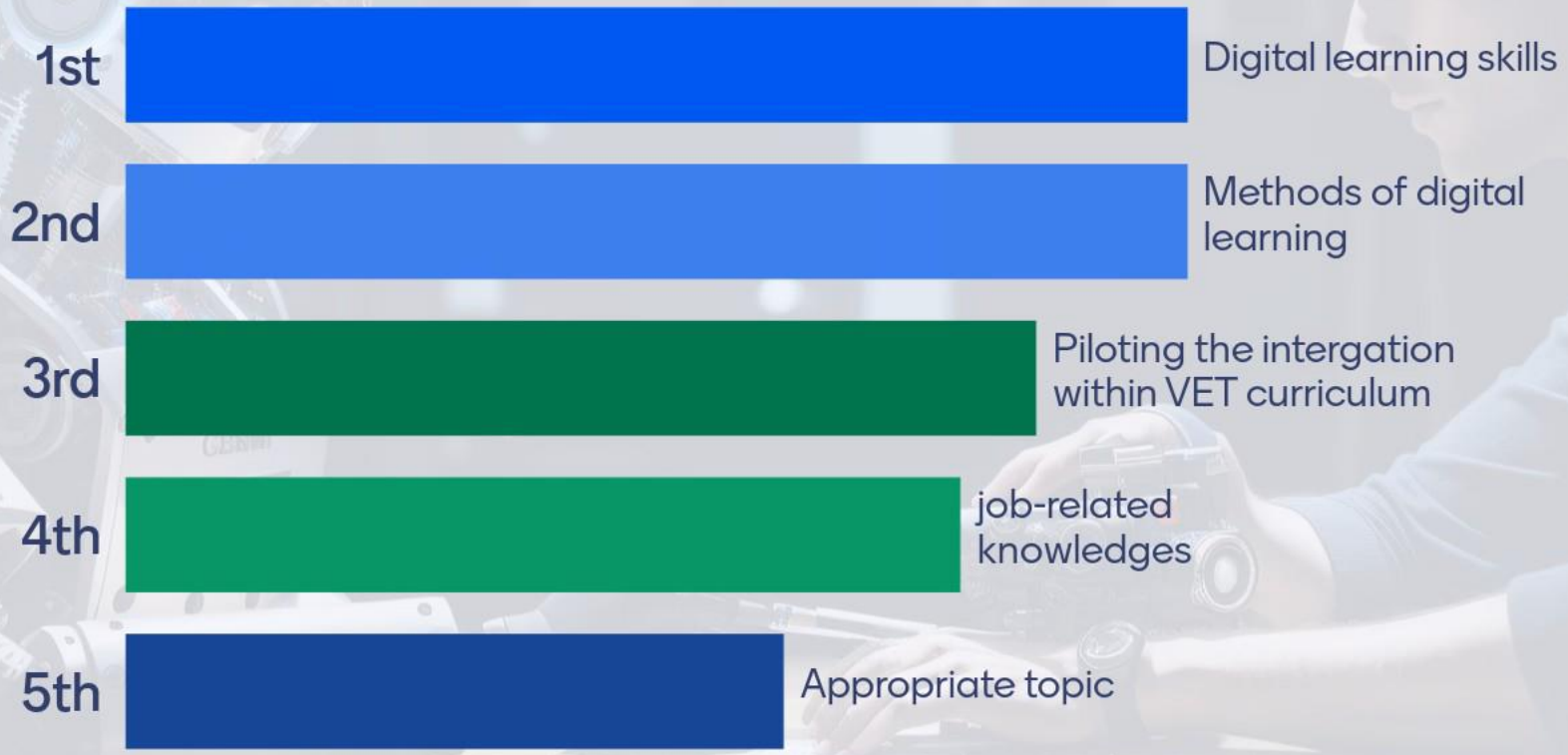
Expectations

Mentimeter

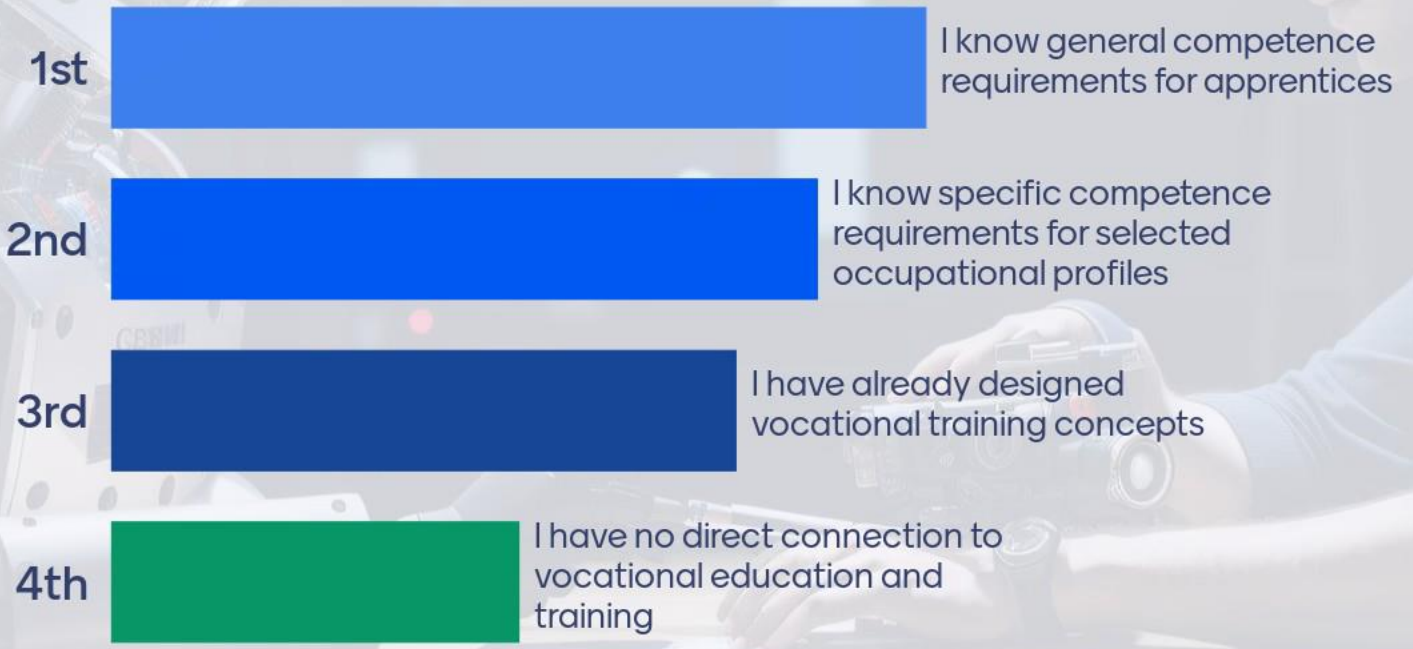
Mentimeter

What issues of the Training module you are interested in?



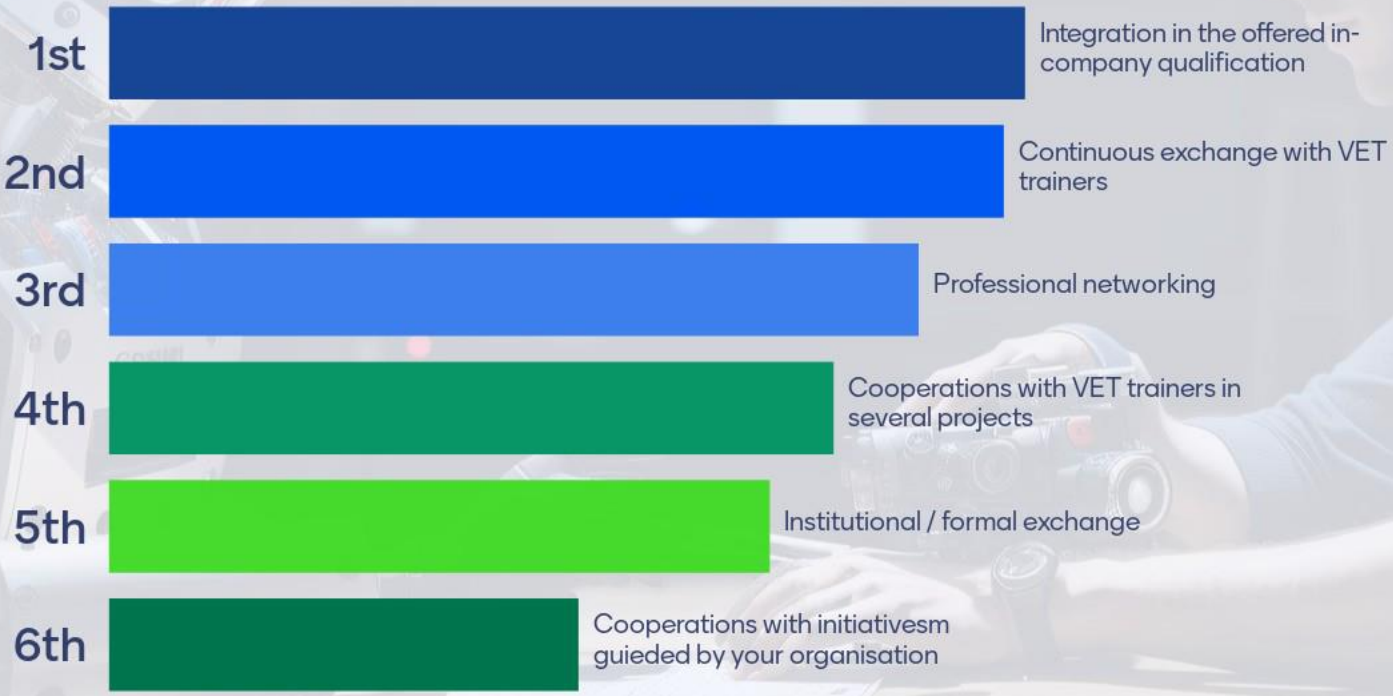
Mentimeter

How precisely do you know methodological and professional frameworks?



Mentimeter

How can you establish the integration of EU training module in vocational education cources?



Agenda - Day 3

01	**Introduction**	**10:00**
➢	Key findings from Day 2	**10:20**
02	**Occupational training**	**10:20**
➢	Topic, brief contents and goals – in discussion (Canva)	**11:30**
➢	Objectives to be achieved and results – in discussion (Canva)	
03	**Localisation in curriculum**	**12:00**
➢	Suggestion of training content	**12:45**
➢	National considerations	**13:30**
04	**Conclusions**	**13:30**
➢	Summary of complete workshop	**14:00**

2. Occupational training

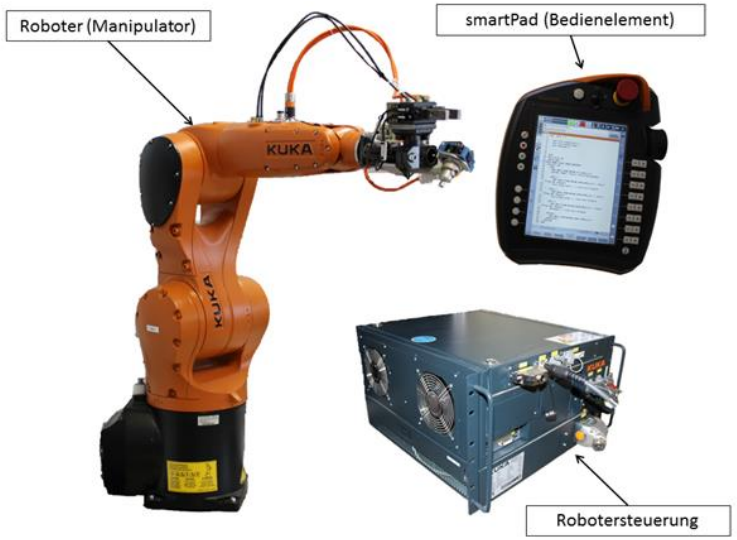
REVIEW: Day 2

METAL

Machine and systems operator

ELECTRO

Electronics technician for devices and systems



Factcheck

2. Occupational training

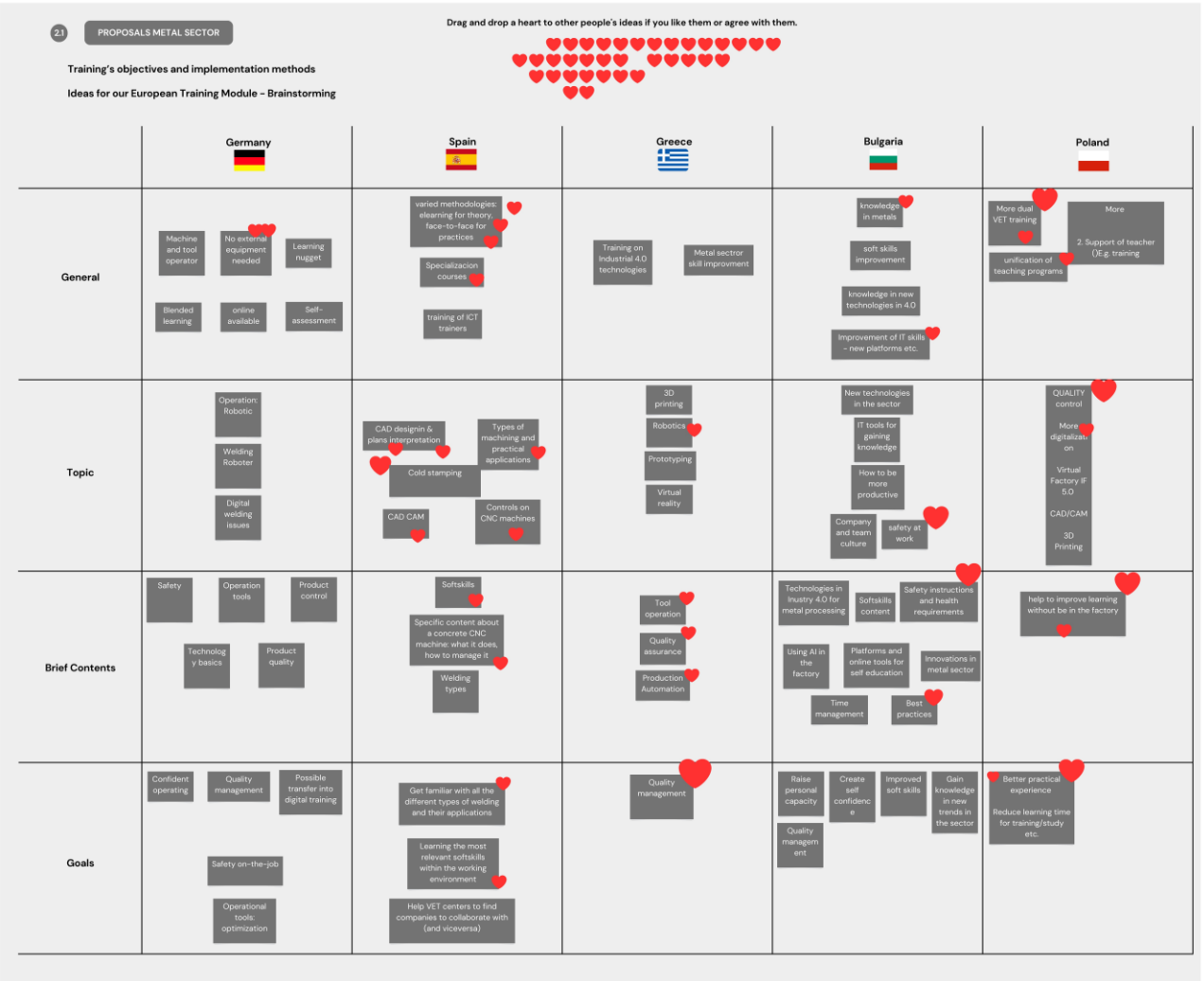
REVIEW: Day 2

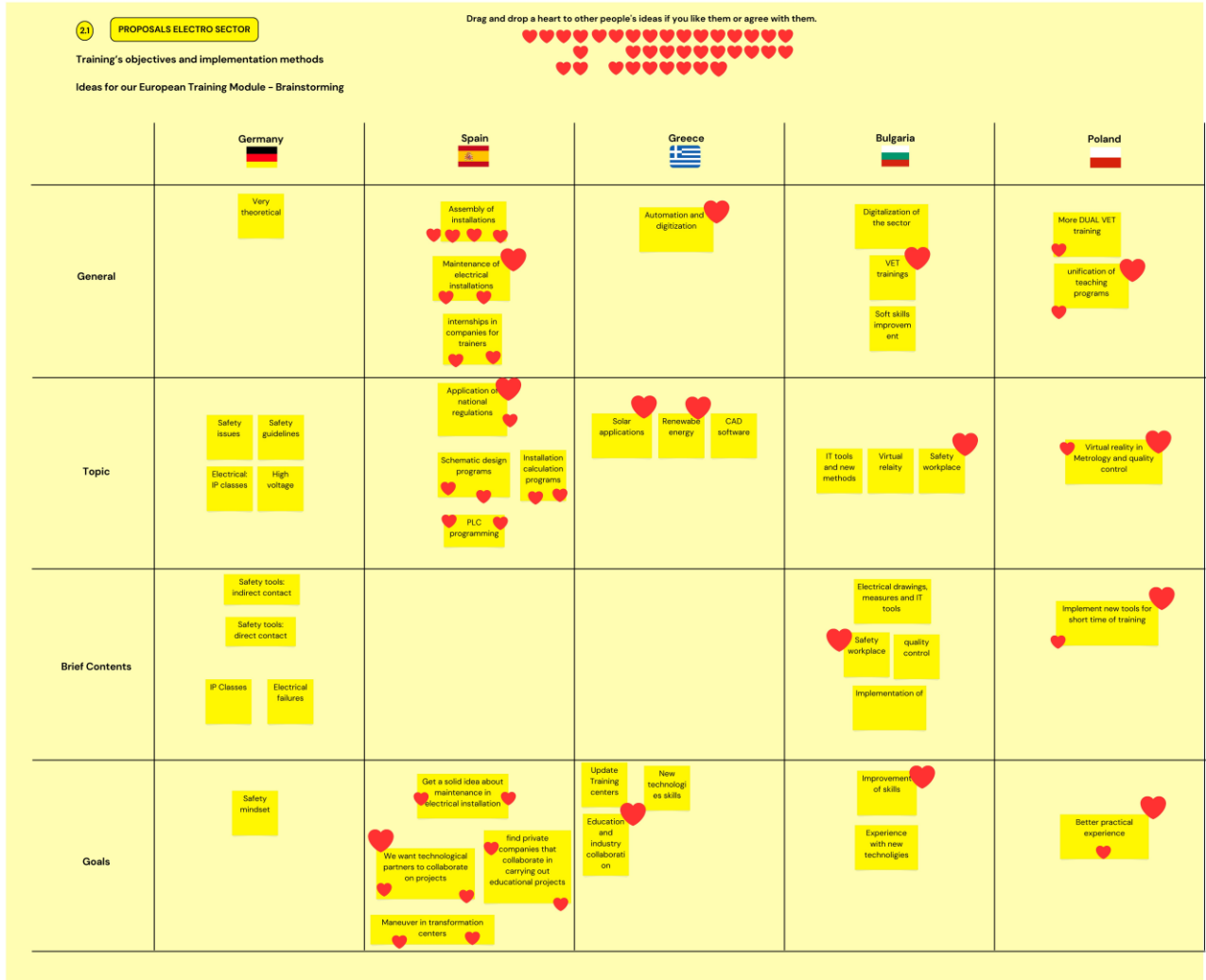
Please join: rb.gy/rdpp1

Erasmus+

DAY 2 – Thursday 5 oct

Considerations for occupational training





YEAH!
11:30-
12:00 AM

Agenda - Day 3

01 Introduction

10:00 – 10:20

- Key findings from Day 2

02 Occupational training

10:20 – 11:30

- Topic, brief contents and goals – in discussion (Canva)
- Objectives to be achieved and results – in discussion (Canva)

03 Localisation in curriculum

12:00 – 13:30

- Suggestion of training content
- National considerations

04 Conclusions

13:30 – 14:00

- Summary of complete workshop

Factcheck

3. Localisation

Overview

Needs assessment

Concept

Evaluation

Implementation

TaskCards, Prezi, mindmeister, PhET Interactive Simulations, Kahoot!, Poll Everywhere, Mentimeter, Actionbound, tutory, H5P

Erasmus+

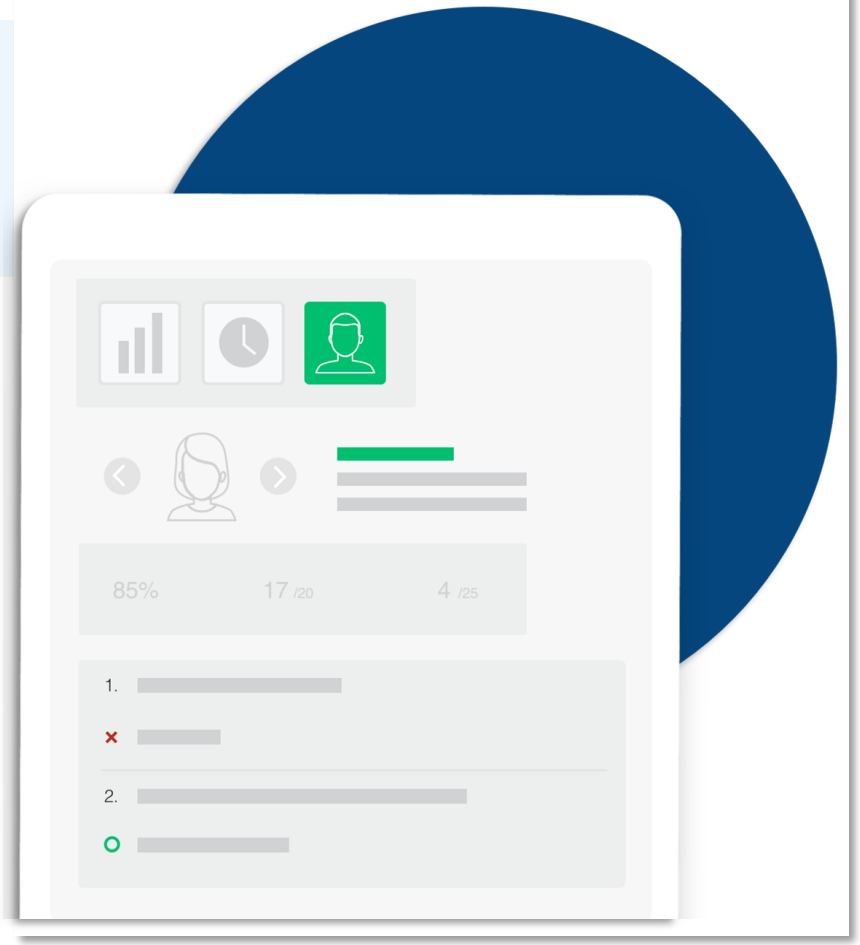
3. Localisation

Preparing | Demonstrating | Imitating

- ✓ Independent of time and place
- ✓ Individual in the course
- ✓ Can be repeated as often as desired
- ✓ Specialised in target group and subject area

Assessment of the state of knowledge

- Real-time evaluation
- Can be used during lessons
- Anonymous or personalized
- Monitoring of the learning process



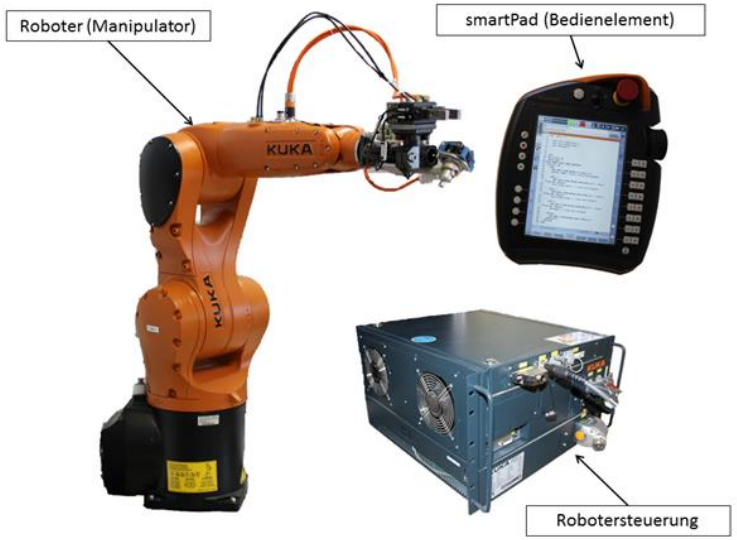
3. Localisation: Metal

METAL

Machine and systems operator

ELECTRO

Electronics technician for devices and systems



Factcheck

3. Localisation: Metal

Check-in knowledge test

Self-learning phases, each with a subsequent test

2a. Welding robots: components and mode of operation
2b. Welding: Basics and Safety
2c. Quality management: Detecting and evaluating welding defects

Application examples

Check-out knowledge test

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3. Localisation: Metal

Topic: Welding Roboter

- Welding robots are industrial robots that work flexibly, quickly and reliably.
- They are classified as automation technology.
- The task of these robots is to weld products automatically in a wide variety of production environments.

Goals: Functionality, structure and safety knowledges

- The goal is to provide the participants with a basic overview of the functionality, structure and occupational safety when handling a welding robot.

Objectives: Quality management skills

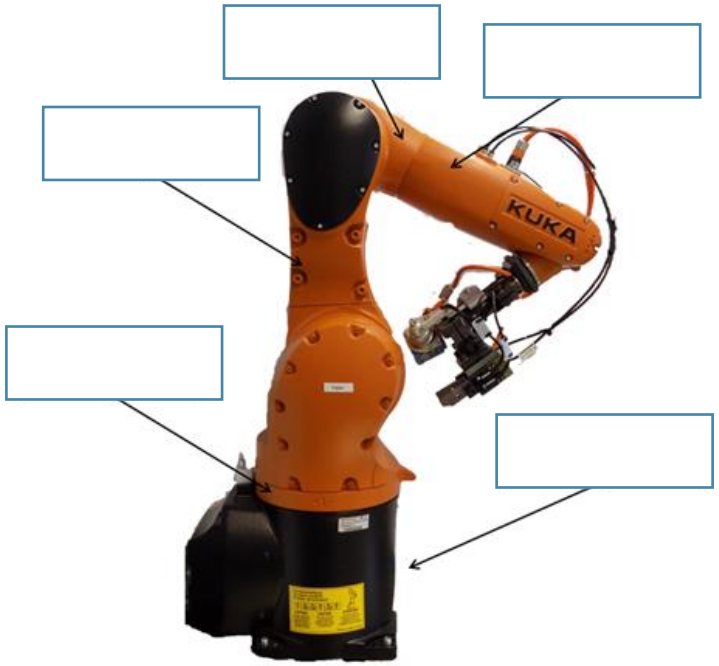
- The training serves to impart basic welding knowledge, in particular the recognition of external welding seam irregularities.
- The use of measuring equipment and pictures for target/actual comparison should make it easier to recognise and evaluate weld seam faults.
- Causes for occurring weld defects should also be localised, forwarded to the appropriate welding supervisor and repaired.

3. Localisation: Metal

Check-in knowledge test

Assign the following components to the robot shown:

- carousel,
- swing arm,
- base frame,
- arm,
- central hand



3. Localisation: Metal

Check-in knowledge test

Name the main hazards of a robot:

- Explosion hazard
- Danger from electric current
- Risk of injury due to unpredictable and complex movements

What is the function of the shielding gas in welding?

- Protection of the weld pool against air ingress
- Cooling of the weld pool
- The shielding gas has no special task

3. Localisation: Metal

Check-in knowledge test

Which rays can cause burns while welding on uncovered parts of the body?

- X-rays
- Light rays
- Ultraviolet rays (UV rays)

How do pores form in a weld?

- Current intensity set too high
- Workpiece not cleaned, dirty surface
- Wrong amount of shielding gas

3. Localisation: Metal

Self-learning phases, each with a subsequent test

2a. Welding robots: components and mode of operation

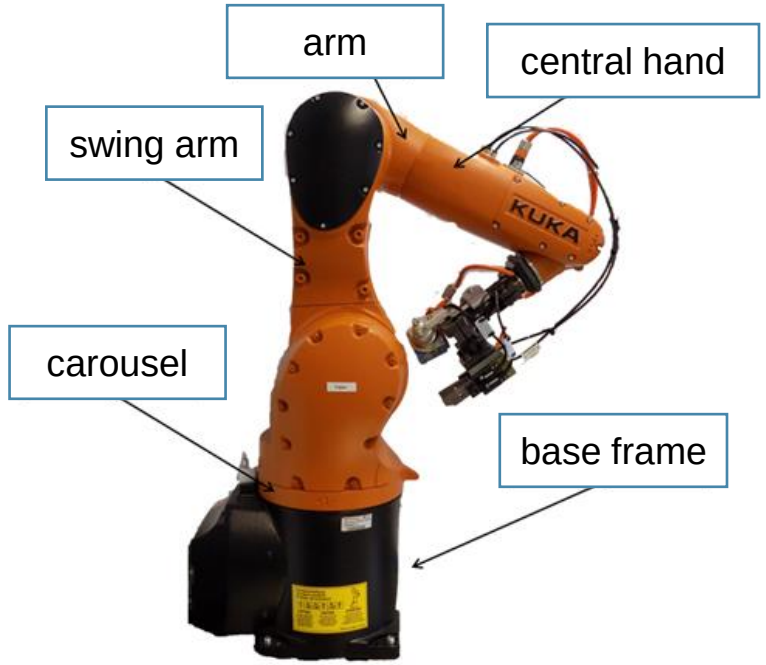
Learning objectives:

- Overview of how a robot works
- Correct naming of the individual components

Contents: Structure of the robot system

The structure of the robot system and the individual components are to be explained.

The robot system consists of three main components. These are shown in the following picture:



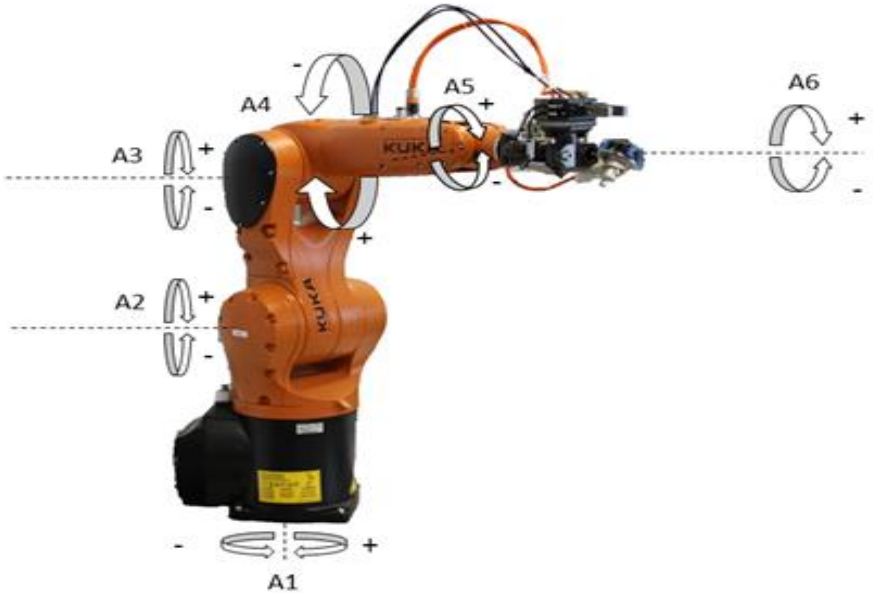
3. Localisation: Metal

Self-learning phases, each with a subsequent test

2a. Welding robots: components and mode of operation

Contents: Structure of the robot system

- The **central hand** of the robot comprises three axes (A4, A5, A6) and forms the end of the robot arm. On the central hand there are three 5/2-way solenoid valves and a CAT5 data line, which can be used to control tools.
- In front of this is the **arm**, which is moved by axis A3. In the robot, the arm represents the connection between the central hand and the swing arm.
- The **swing arm** contains the power supply lines for axes 2 to 6.
- The **carousel** is responsible for the rotary motion of the robot (axis A1) and is connected to the base frame via a gearbox.
- The **base frame** forms the basis of the robot. The interfaces between the robot mechanics and the control system are located on the base frame.



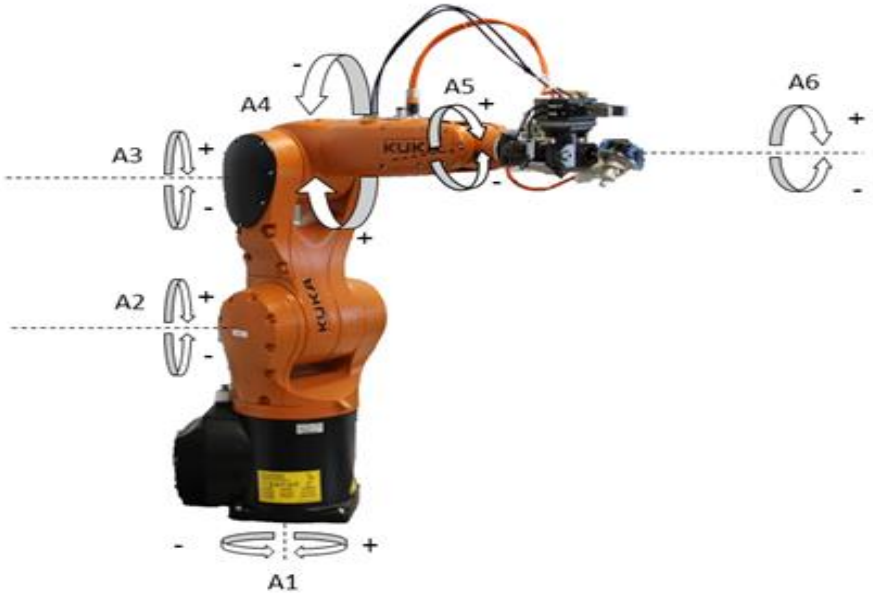
3. Localisation: Metal

Self-learning phases, each with a subsequent test

2a. Welding robots: components and mode of operation

Contents: Structure of the robot system

- Each robot has both mechanical limit stops and electronic limit switches (software limit switches). Among other things, this mechanically prevents the robot from turning more than 190°. In addition, the range of movement can be limited via the robot programme. If one of these end positions is reached, a fau (workspace error) is signalled so that no damage can occur to the robot.
- The individual axes of robots are driven by servo motors. Compared to hydraul motors, these are much quieter and more flexible. Furthermore, the work is more precise and well suited for high repetition accuracy. In addition, there are different ways to equip the hand (effector) of the robot.
- In the case of the BBS2 robot, a pneumatic gripper is installed. This is controlle via one of the 5/2 directional control valves in the central hand. In addition, inductive sensors have been installed to detect the current state of the gripper (open; closed). Furthermore, an optical component check has been integrated determine whether the robot has picked up the workpiece correctly.



3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Basics and Safety

Learning objectives

- To know the dangers of working with robots and
- Work safely with robots

Contents:

- Operating the robot without external safety measures is not permitted and is also prohibited by the manufacturer!
- Operating a robot without safety measures can have fatal consequences. Overestimation of one's own capabilities or gross negligence can injure not only the operator himself but also other persons.
- If protective devices are bypassed or deactivated, the operator can move freely in the danger zone.
- In the case of ill-considered travel movements in manual mode or an automatic start-up of the drives, the human is completely at the mercy of the robot.
- In most cases, there is no collision detection, so everyone has to rely on the additional protective devices (safety grid, light curtain, safety door, etc.).

3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Basics and Safety

Contents: Safety measures

- Special safety instructions or training are just as necessary as a very good understanding of the safety regulations of the respective industrial robot.
- Likewise, an assessment of the possible dangers must be made before starting work.
- The operator of the plant in which the robot is installed can provide support.
- Both the obligation to monitor and the obligation to instruct must be fulfilled.
- Among other things, attention is paid to safety-related integration, in which, for example, the following points are addressed:
  - Preparation of operating instructions for the system
  - Carrying out a risk assessment
  - Use of the necessary safety functions and protective devices
  - Selection of persons who are suitable and competent for the work

3. Localisation: Metal

Self-learning phases, each with a subsequent test

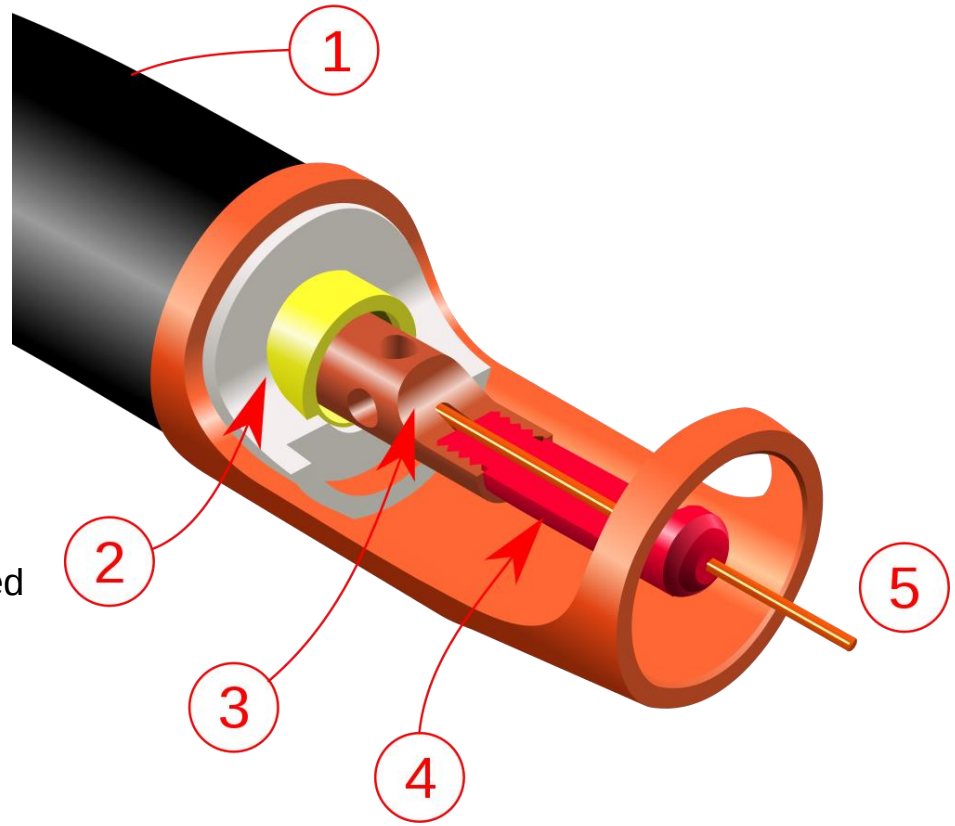
2b. Welding: Basics and Safety

Learning objectives:

- Getting to know the function and structure of a MAG welding machine
- Evaluating welds on the basis of external irregularities

Contents:

- MAG welding belongs to the group of gas-shielded metal arc welding processes in which a wire electrode is melted under inert gas and is particularly common in industrial manufacturing for joining metallic materials.
- In MAG welding, the permanent joining of metals is achieved using intense heat and welding consumables. The heat input for the fusion welding process is provided by an electric arc. The wire electrode used flows together with the molten base material as a welding filler and contributes to the formation of the weld seam.
- The process is characterised by a high processing speed and the possibility of automation. It is therefore particularly suitable for industrial applications.



3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Safety

Learning objectives:

- Recognise the dangers of welding and observe and apply appropriate safety precautions.

Contents: General

- Welding processes are classified according to the energies used, such as gas, electricity, laser or friction.
- The electrical processes are of great importance. This includes, for example, metal active gas welding (MAG).
- If you want to implement measures to promote safe welding, it is important to bear in mind: Each process involves different risks, such as optical radiation, electric current, fire and explosion hazards, the release of hazardous gases and fumes or the displacement of oxygen in the air we breathe.

3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Safety

Contents: Electrical hazards

- An electrical hazard begins when a voltage higher than 25 V AC (rms) or 60 V DC can be touched and a sufficiently high current could flow. Therefore, a first protective measure must be implemented as basic protection (e.g. insulation).

Contents: Pollutants

- When welding smoke forms, there is a chain of physical and chemical processes behind it. The pollutants in welding fumes are also formed from very different elements during the welding process.
- Welding fumes are produced when an arc or flame hits a material at high temperatures.
- Physical and chemical processes take place, such as evaporation, condensation, oxidation, decomposition, pyrolysis (thermal-chemical splitting) or combustion.
- Pollutants are produced which can be formed from: Filler materials - Base materials - Protective gases - Coatings - Contaminants - Ambient air.
- The concentration of all these hazardous substances in the air at the workplace must be determined by measurements.
- According to the Occupational Health and Safety Act, the employer is obliged to take the necessary measures against these hazards. Accordingly, the correct extraction equipment must be installed depending on the process, material and the resulting welding fumes.

3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Safety

Contents: Optical radiation (UV radiation)

- The human body has no sensory organ for ultraviolet radiation.
- The human body needs small amounts of UV radiation for the formation of vitamin D. However, too high doses are harmful to humans.
- UV radiation causes, among other things, blinding of the eyes by causing inflammation of the outer eye (conjunctivitis).
- Other effects of UV radiation are also not felt by humans until it is too late.
- Short-term high doses of UV radiation lead to sunburn, in welding for example to the so-called "welder's tie" (the burn of the uncovered area between the shirt and the face shield).
- In the long term, too high doses can lead to skin cancer and cataracts (clouding of the lens of the eye).

3. Localisation: Metal

Self-learning phases, each with a subsequent test

2b. Welding: Safety

Contents: Safety measures

- To avoid skin and eye damage, the whole body must be protected from radiation exposure.
- Face protection is required. A welding helmet is preferable to a protective shield so that the temples are also adequately covered. Covers for the top of the skull, neck and throat should also be attached to this hard hat.
- All parts of the skin that are not covered by the protective clothing must be protected, e.g. if necessary, by the protective bonnet and by using a UV skin protection cream specially made for welding.
- In this way, persons at welding workplaces are not only protected against radiation from neighbouring workplaces, but also against radiation reflected from the walls or the workpieces

3. Localisation: Metal

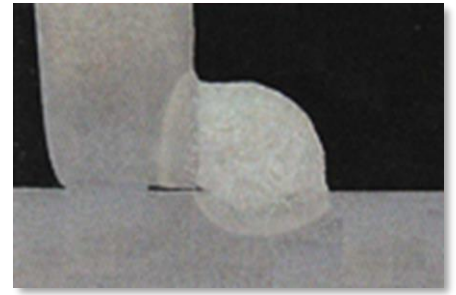
Self-learning phases, each with a subsequent test

2c. Quality management: Detecting and evaluating welding defects

Learning objectives: Detection of weld defects

Contents: Weld defects

- Welding seam defects of a welded joint are an expression of a reduced manufacturing quality.
- No statements can be made about the serviceability of the manufactured product if they are detected.
- Geometric irregularities in metallic welded joints are described in DIN EN ISO 6520 Parts 1 and 2.
- A distinction is made between internal and external irregularities. These include:
  - Cracks
  - Cavities (pores)
  - Solid inclusions
  - Binding defects and insufficient welding penetration
  - Shape and dimensional deviations
  - Other irregularities.



3. Localisation: Metal

Self-learning phases, each with a subsequent test

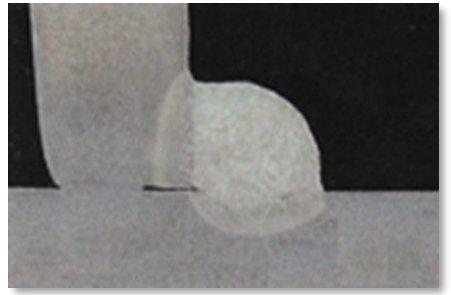
2c. Quality management: Detecting and evaluating welding defects

Contents: Cracks

- Cracks often occur due to an unsuitable base material or the selection of the wrong filler metal.
- High stresses in the weld assembly can also lead to cracking.
- A crack in a weld is an impermissible irregularity, as component failure is often the result.

Contents: Seam cant

- A seam cant is a geometric irregularity and is tolerated up to a certain deviation.
- The cross-section of a fillet weld (picture) should ideally correspond to an isosceles triangle. Excessive superelevation has disadvantages in terms of strength.
- The height or fillet weld dimension is calculated in advance and shown in technical documents.



3. Localisation: Metal

Application examples

Exercise: Weld failures detection

- A welding assembly is inserted into the robot system. The assembly is fixed with the provided clamping device and the safety doors are closed.
- After the production process has run automatically, you open the safety door and remove the assembly. This is followed by a routine visual inspection of all existing weld seams.
- You notice the following irregularities:

3. Localisation: Metal

Check-out knowledge test

What irregularity do you see ?

- Pores
- burn-in notch
- large weld protrusion

What could be the cause of the irregularity shown?

- Fault in the shielding gas supply
- Unclean workpiece surfaces
- Too high current intensity.

What is the cause of the following imperfection?

- Unclean workpiece surfaces
- Poor fitting accuracy of the parts to each other

Agenda - Day 3

01 Introduction

10:00 – 10:20

- Key findings from Day 2

02 Occupational training

10:20 – 11:30

- Topic, brief contents and goals – in discussion (Canva)
- Objectives to be achieved and results – in discussion (Canva)

03 Localisation in curriculum

12:00 – 13:30

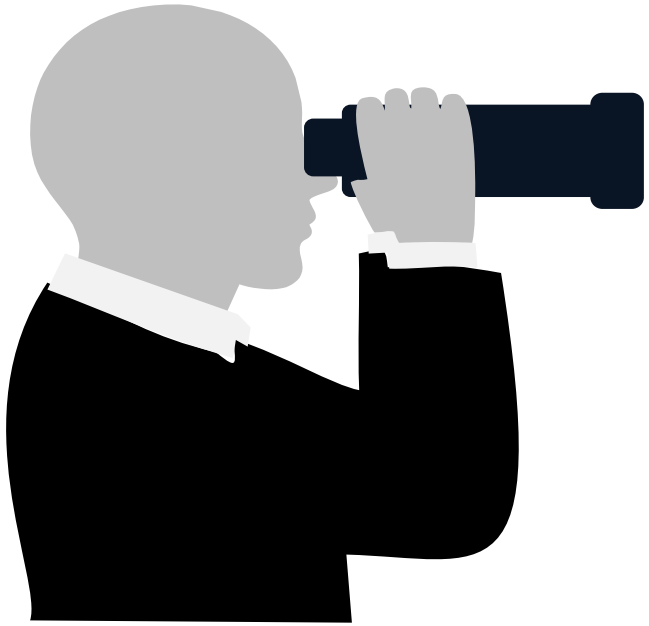
- Suggestion of training content
- National considerations

04 Conclusions

13:30 – 14:00

- Summary of complete workshop

4. Conclusions: Survey



Company information
Name, country, profile

Extended view
Ownership, Company structure, economic and labour characteristics

Current demands
Advanced qualification, most wanted profiles and skills

Adaptation in VET
Requirements to human resources: trainer and students

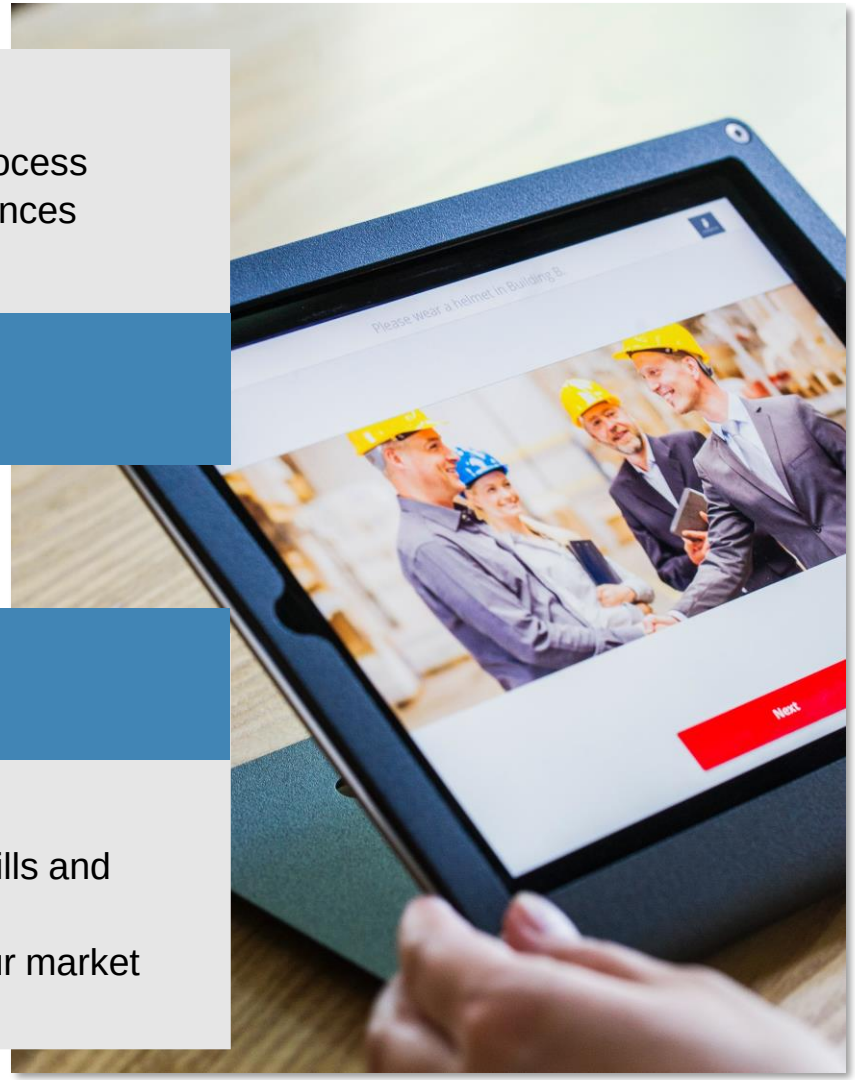
4. Conclusions: VET 4.0

Innovations in production:
- Automation
- Technologies
- Networking

Industry 4.0

Adequately qualified staff:
- Ensuring the production process
- Transformation of competences

Working world 4.0



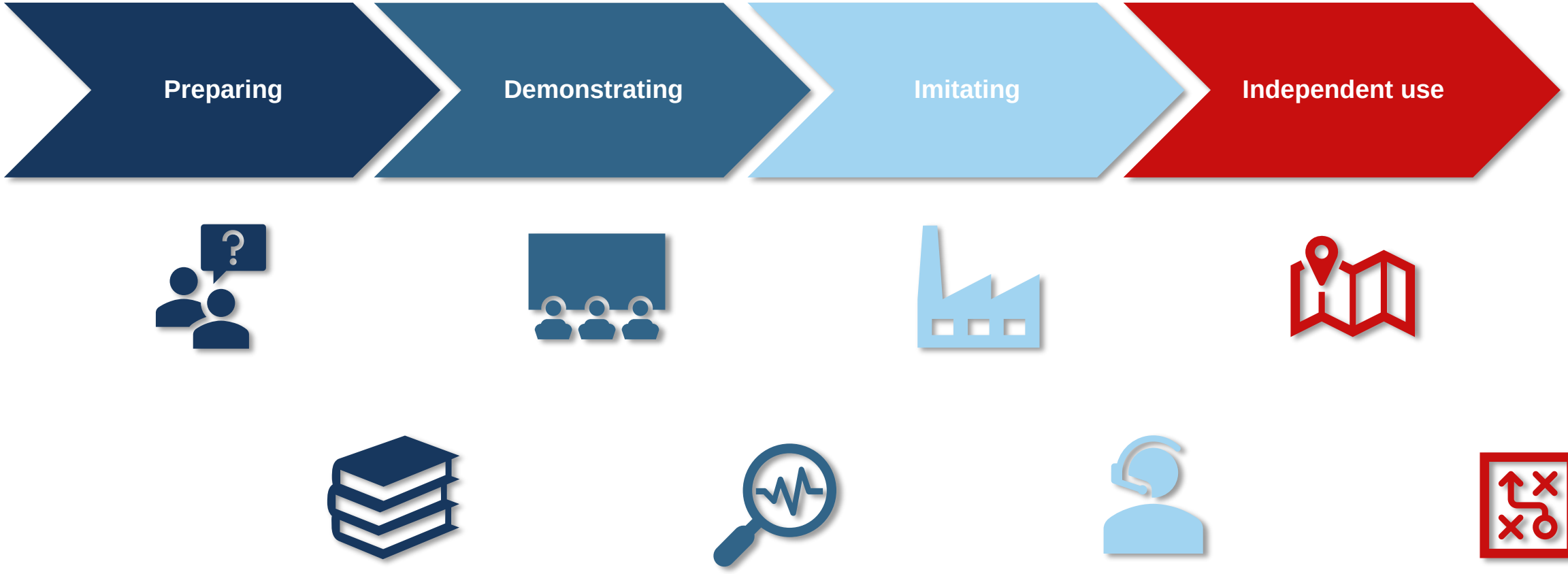
Vocational education

Practical vocational training:
- Professional knowledge, skills and abilities
- Directly usable on the labour market

HR development

Qualified and trained staff:
- Further training in line with requirements
- Resource management

4. Conclusions: Digital VET



4. Conclusions: Exchange

Please join: rb.gy/rdpp1

DAY 3 – Friday 6 oct

Proposals for implementation of our European Training Module within the national curriculum

2.1 PROPOSALS METAL SECTOR

Drag and drop a heart to other people's ideas if you like them or agree with them.

Localization of the Training Module in VET or in-company training (depending on the specific topic)

Germany	Spain	Greece	Bulgaria	Poland
Contents specific vs. common	Training in-company (end users: company workers)	Trainers Training	in-company training	DUAM VET training
Time for worlking on theaining module	Decide the degree of training according to the VET Law of March 2022 (A, B, C, D, E)	Educational content that ensures the adequacy of basic skills	online parts	More discussion about profession before decided to start raining and change profession Share your idea here
Ressources and practical issues	Decide whether the training is level 1, level 2 or level 3.	Online training modules	self education with provided materials	
Technical equioment	Modular design for generation of specific itineraries adapted to the needs of each company	Flexible VET	self assessment	Include more metrology and digitall tools in it
Financial support shall be managed		Continuing Professional Training	networking with peers	unification of course content throughout Europe
		In job training		PLATFORM for CET teacher for all topic to share experience INTERATIONAL

2.1 PROPOSALS ELECTRO SECTOR

Drag and drop a heart to other people's ideas if you like them or agree with them.

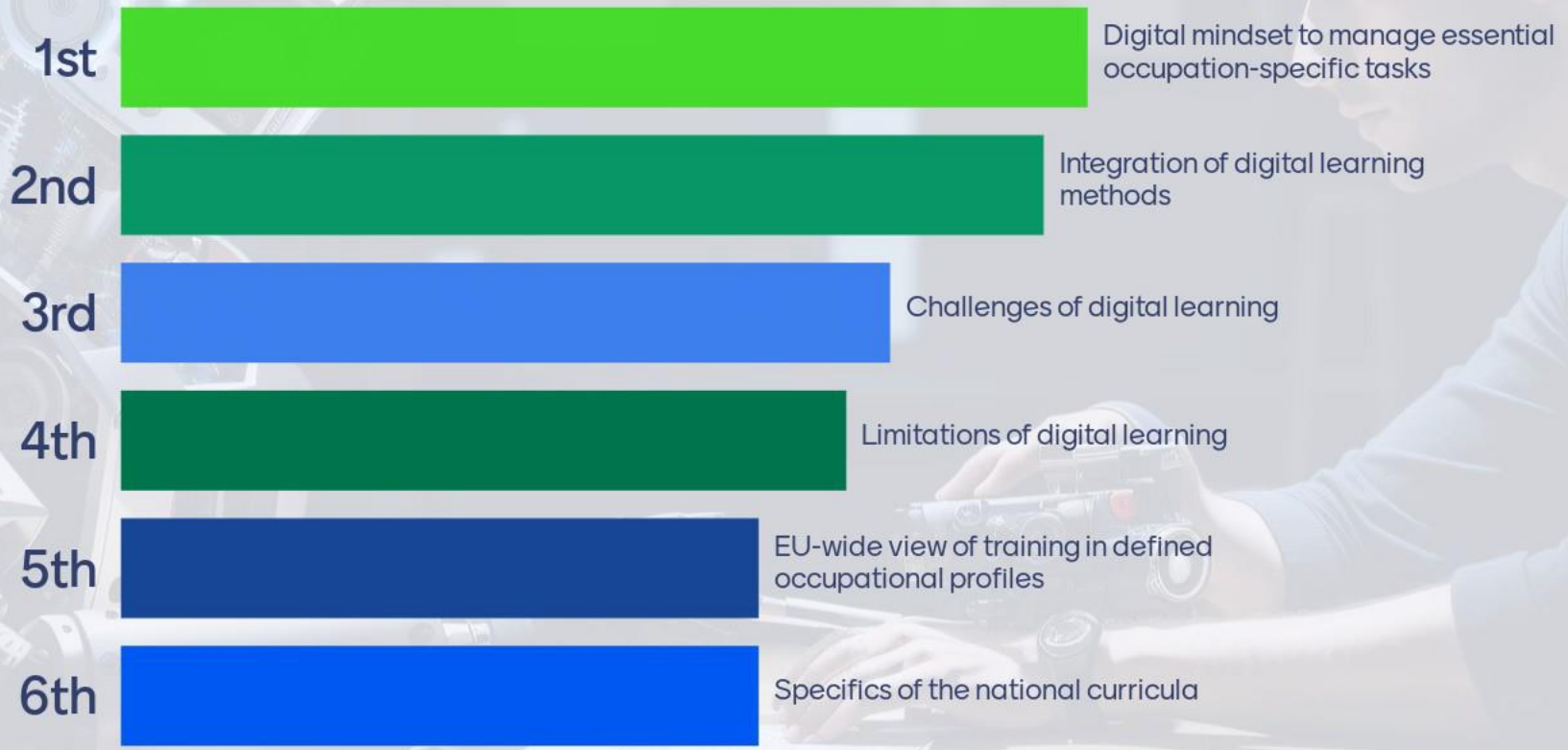
Localization of the Training Module in VET or in-company training (depending on the specific topic)

Germany	Spain	Greece	Bulgaria	Poland
Safety issues	Decide the degree of training according to the FP Law of March 2022 (A, B, C, D, E)	Training in new sectors (PV, Renewable energy)	In- company training	More discussion about profession before decided to start raining and change profession
Audio and visual appropriate design	Decide on the vocational family to which the training is addressed: Mechanical manufacturing, Electricity-electronics, Energy and water or other.	Lifelong Training and Continuing Professional Development	On-line sessions	unification of course content throughout Europe
Theoretical content	Decide whether the training is level 1, level 2 or level 3.	Continuous training of VET teachers	Cooperation with training centres	Implementation of more Internet f things
Useful in the praxis on-the-job	Modular design for generation of specific itineraries adapted to the needs of each company. Specialist	Online Training		PLATFORM for CET teacher for all topic to share experience INTERNATIONAL
Detailed contents for the training		Skills relevant and closely linked to the labor market		
Digital tools on online plattform needed		Update educational content		
Financial support for technical equioment is needed				

Mentimeter
Feedback
8

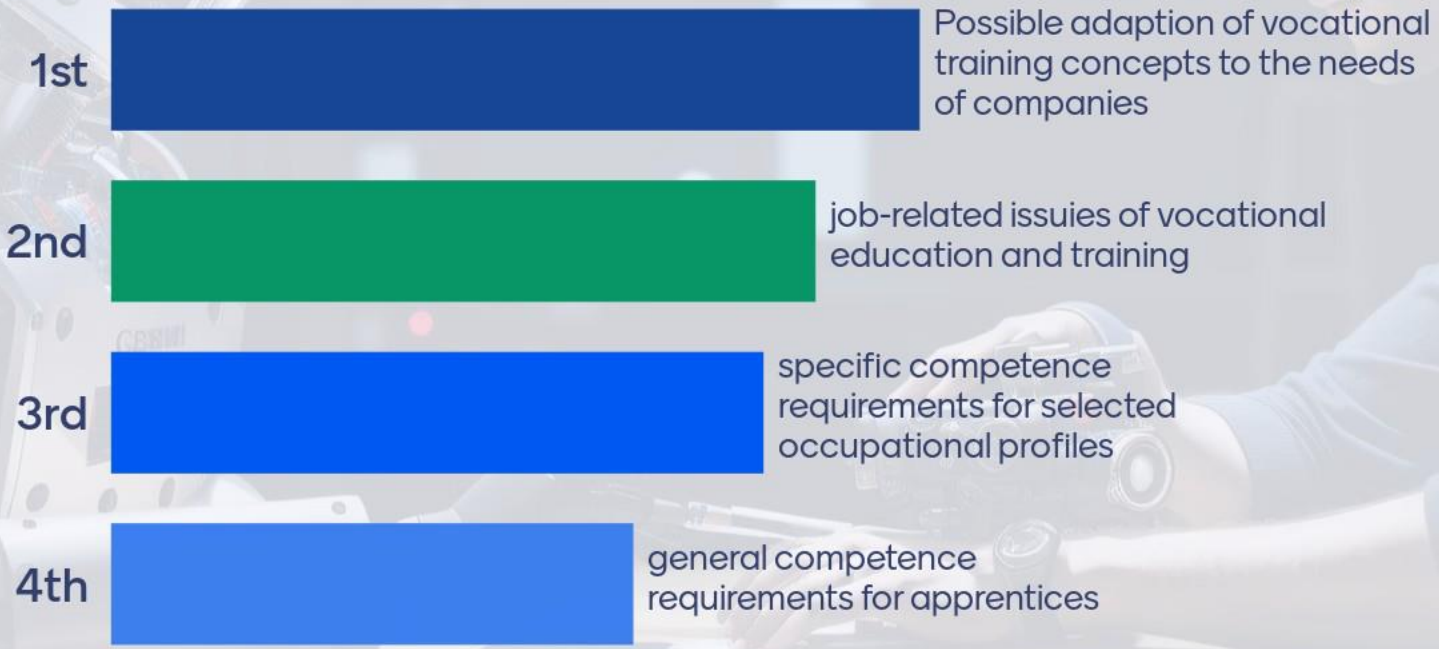
Mentimeter

What VET-related topics you were today well informed in?

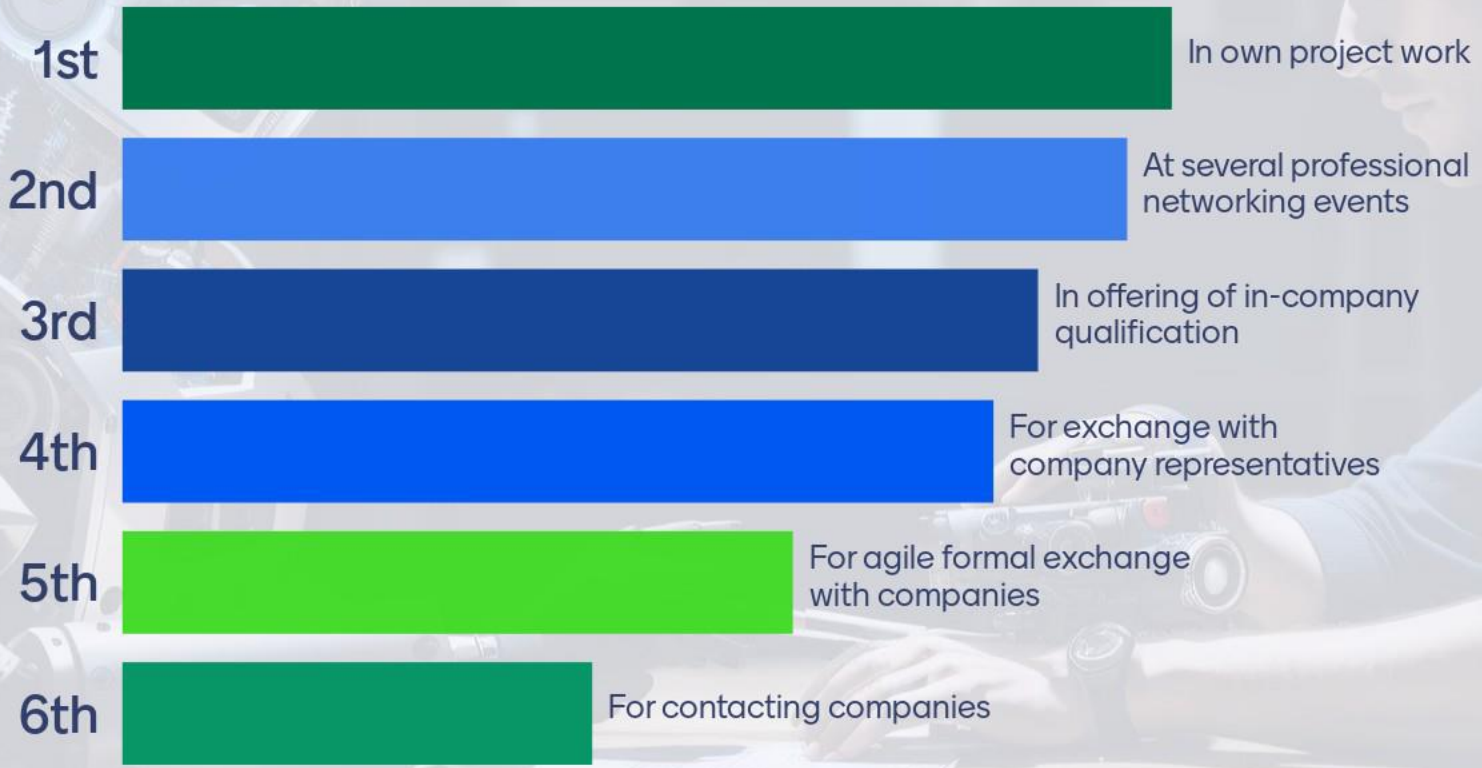


Mentimeter

What did you experience today about occupational profiles in metal and electro sector?



How can you use the findings of today's event?



Thank you!
Erasmus+