



Annexes

ANNEX 4: EXAMPLES OF TECHNICAL WORKSHOPS



DB Rail Academy
by DB Engineering & Consulting GmbH

DB Benchmark

The DB Vocational Education Center in Darmstadt delivers four programs to qualify students to become:

- Operation Services Electricians,
- Industrial Mechanics Technicians,
- Mechatronic Specialists who can be qualified in mechatronics or electronics and
- Construction Mechanics

The vocational education program lasts 3.5 years; however, it can be shortened to 3 years if the student achieves high results and stands out.

The centre does not only provide the programs but also other training courses for other professions on specific topics, while the remaining part of their education is either provided by other training suppliers or during the on-the-job training.

Moreover, it trains external clients on more than one module in essential vocational topics (such as grinding and welding), lasting 2-6 weeks. In addition to the technical skills taught, the training covers the planning and organisation parts.

Based on the curricula set by the Industrie- und Handelskammer (IHK) Region Stuttgart/ Chamber of Commerce And Industry (CCI) in Germany, vocational education should take place in vocational education schools for theoretical knowledge and workshops for practical learning. The students should have on-the-job training to get familiarised with the working environment and get hands-on experience using machinery, equipment, tools, materials, ...etc. used at the workplace and faced challenges during job performance. In addition to the curricula set and approved by the IHK, the employer shares its learning objectives and the learning material.

Based on the German curricula, the students take theoretical classes (school-based) for 60 days/year. Of the 3.5-year program, 42- 46 weeks are practical studies, of which 32 weeks are delivered during the first 18 months of the program.

Classes are mainly conducted in workshops at DB Vocational Education Center. If the trainer needs to give an introduction or instructions, they do this either in the same workshop or in the only classroom available in the centre, and then they move again to the workshop.

The classroom has a capacity of 20 Students and is equipped with chairs, tables, a flipchart, a whiteboard, a projector and projector screen, a computer for the trainer, a cabinet, and an internet router, as shown in the figure below.



Classroom at DB Vocational Educational Center-Darmstadt

In the classroom, each student should have 1.5 m², 60 cm of space for the chair to move back from the table, and an aisle for exiting the classroom.

There are nine workshops in DB Vocational Education Center, which are:

Electric workshop 1, 2, and 3: For operational technology	
Overview of exemplary Machines:	
<ul style="list-style-type: none"> ■ Laboratory tables ■ Tall cabinets ■ Drawer cabinets ■ Row workbenches ■ Bench drill with vice ■ 3D mechatronics simulation ■ Modular mechatronics system 	<ul style="list-style-type: none"> ■ Electrical machines - connection programmed control ■ Machine safety learning set ■ mMS Station Robotics (modular Mechatronic System) ■ DC (Direct Current)/ AC (Alternating Current)-Cases for direct current and alternating current technology ■ Teaching System Electrical Machines ■ Electric perforated plates

Learning Objectives:

- Sensors
- Industrial processes, Industry 4.0/IoT (Internet of Things)
- Plant, machine and operator safety
- HMI (Human-Machine-Interaction) project planning
- Network communication
- Data acquisition, storage, analysis and data protection
- Maintenance and troubleshooting
- Technical documentation and communication
- Work planning, execution and interdisciplinary collaboration
- Drive technology
- Power Electronics
- Control technology
- Manufacturing of components with hand-guided tools
- Assembling, wiring, installing

Room Specifications:

- ca. 120 - 200 m²
- ca. 16 students

Electric workshop 1



Instructor Room for the electric workshops 1 and 2

Electric workshop 1

Electric workshop 2



Electric workshop 2

Electric workshop 3



Electric Workshop 3

Overview of exemplary Machines:

Programmable logic controller (PLC): an industrial computer that is rugged and adapted to control manufacturing processes.

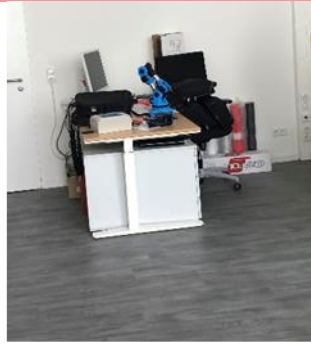
Learning Objectives:

PLCs control manufacturing processes, such as assembly lines, machines, robotic devices, or any activity that requires high reliability, ease of programming, and process fault diagnosis.

- PLC programming
- Maintenance and troubleshooting
- Data acquisition, storage, analysis and data protection
- Network communication

Room Specifications:

- ca. 80 - 100 m², ca. ten students



Computer Room

Overview of exemplary Machines:

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Computerized Numerical Control Trolley ■ Milling machine, tool milling machine ■ Lathe, Center lathe and feed spindle lathe ■ Workbenches ■ Surface grinding machine | <ul style="list-style-type: none"> ■ Double grinding machine ■ Column drilling machine, table drilling machine ■ Measuring and testing plate ■ Metal technology training case |
|--|---|

Learning Objectives:

Drilling, countersinking, reaming, milling, turning and grinding

- Functional units of machines and their mode of operation
- Tool life
- Production data and their calculation
- Manufacturing of components with machines
- Manufacturing of single parts with machine tools
- Manufacturing of components with hand-guided tools
- Manufacture of simple assemblies

Room Specifications:

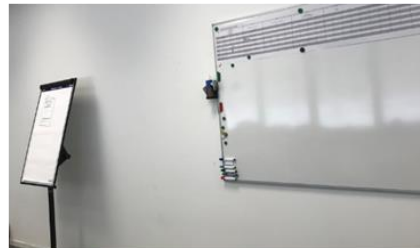
- ca. 165 - 325 m²
- ca. 16 students

Metal workshop 1



Metal Workshop 1

Metal Workshop 2: Electrotechnics and Metalworking



Metal Workshop 2

Fluid Technology: (Pneumatic, Hydraulic, Bearing Technology)/ Metalworkshop	
Overview of exemplary Machines:	
<ul style="list-style-type: none"> ■ E-Screen with mounting solution ■ Equipment set case - pneumatic starter ■ Simulation software ■ Equipment set for electro-pneumatic/ pneumatics/ hydraulics 	<ul style="list-style-type: none"> ■ Functional assembly kit automatic assembly machine ■ Learning Board ■ Tall cabinets
Learning Objectives: <u>Pneumatics</u> <ul style="list-style-type: none"> ■ Integration of components of the control and regulation technology ■ Planning of control systems ■ Installation and commissioning of control systems ■ Ensuring the operability of automated systems ■ Setting up and testing pneumatic and electro-pneumatic control systems ■ PLC programming ■ GRAFCET (Graphe Fonctionnel de Commande Etapes/ Transitions): European DIN standard for creating function plans, especially for sequence controls. 	<u>Hydraulics</u> <ul style="list-style-type: none"> ■ Industry 4.0 in hydraulics ■ Manual/electrical switching hydraulics ■ Troubleshooting ■ Continuous valve technology - Proportional hydraulics/control hydraulics ■ Mobile hydraulics - throttle control / load-sensing control / LUDV (load sensing system) control/hydrostat. Steering systems / programmable remote control (joystick) ■ PLC (programmable logic controller) technology
Room Specifications: <ul style="list-style-type: none"> ■ ca. 120 - 180 m² ■ ca. 16 students 	



Fluid Technology



Innovation Workshop

Overview of exemplary Machines:

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Bench drill with V-belt drive ■ Workbench system with clamping crank ■ 3D printer | <ul style="list-style-type: none"> ■ Laser box ■ Transport cases ■ Storage cabinets ■ Various educational devices |
|---|---|

Learning Objectives:

An innovation workshop offers the optimal solutions to promote co-creative learning and the development of ideas. It creates the right learning environment, whether it's discovering technical principles, construction, coding and robotics, technical drawings, or craft skills such as drilling, sawing, or soldering.

- Promoting self-organised learning
- Personal responsibility for projects and learning progress
- Independent organisation of information
- Learning while working and creating
- Imparting future-oriented competencies

Room Specifications:

- ca. 160 m²
- ca. 16 students



Innovation Workshop

Welding Workshop

Overview of exemplary Machines:

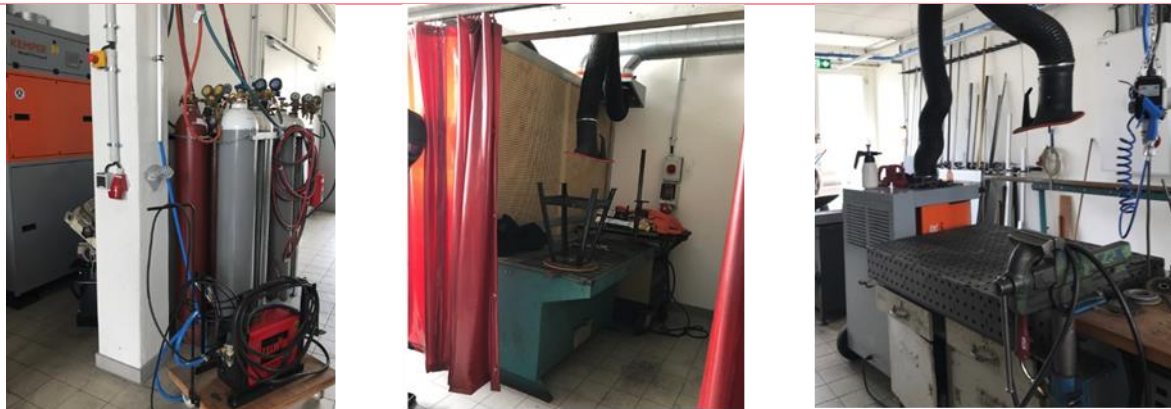
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| <ul style="list-style-type: none"> Motorized guillotine shear Grinding table with suction Gear drilling machine | <ul style="list-style-type: none"> Welding machine with accessories Training welding table Extraction unit with activated carbon filter |
|--|--|

Learning Objectives:

- | | |
|---|--|
| <ul style="list-style-type: none"> Gas fusion welding Hard soldering Manual arc welding MIG (Metal Inert Gas) welding: suitable for thicker workpieces and longer welds | <ul style="list-style-type: none"> Thermal cutting Heat treatment Hot forming TIG (Tungsten Inert Gas) welding |
|---|--|

Room Specifications:

- ca. 200 - 290 m², ca. 16 students



Welding workshop