

Dealing with assessment procedures and transparency of learning outcomes

The example of MOVET

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Background

The roots of mobilities from/to Munich BSFT:

- Students exchange with FIN for ~ 8 years (private initiative, bilateral)
- Students exchange and development project with DK for ~ 4 years (pr. ini., bilat.)
- Idea of „making more out of it“
- Setting up a big partnership for Tol
- Mobilities for testing developed modules

Objectives I

Overarching priorities

(according to the Copenhagen process):

- Encouragement of mobilities
- Enhancement of transparency of LO
- Recognition of learning outcomes
- Quality assurance for Modules

Objectives II

- Providing modules/units in IVET
- Modules concerning compulsory curriculum (mechatronics, ind. mechanics, ...)
- Implementation of school and company based education
- Duration of 3 weeks abroad
- Module language English
- Connection of ToI and Mobilities

Partnerships

- Core partners:
5 VET providers / schools in IVET
(DE, FI, DK, SK)
- Supporting partners:
> 4 companies (dual partners in DE)
competent bodies
- Project Coordinator

Obstacles I

- Mutual trust
→ transparency of LO using TaxTab, partner meetings, mediation
- Recognition of LO
→ different levels of recognition possible (school, company, competent body)
- English speaking VET teachers

Obstacles II

- Financial resources
 - Cofinancing of Mobilities from Tol
 - demand for „Mobility overhead“
- Continuity
 - depending on personal resources
 - replacing coordinator?

Tools

- *Comparision of Curricula*
- Competence Matrix from VQTS
- Taxonomy Table (see flyer)
- Description of Learning Outcomes
- Assessment (paper and pencil test, skills demonstration, technical discussion)
- Memorandum of Understanding / Learning Agreement
- Instruments for evaluation

Competence Matrix (VQTS)

Competence
areas
(5-25 areas)

Competence Matrix "Mechatronics"				
Competence area	Steps of competence development			
Maintaining and assuring the reliability of mechatronic systems	He/She can perform the basic scheduled maintenance on systems and adhere to the equipment maintenance plans.	He/She can master the maintenance procedures for mechatronic systems such as the use of service documents and maintenance plans and, if faced with new challenges, can make the necessary adaptations.	He/She can use preventive maintenance to assure the trouble-free operation of mechatronic systems. In addition, he/she can set up the correction technology, to implement quality-assurance measures	He/She can develop the necessary procedures for maintenance of mechatronic devices and systems, and can schedule the maintenance and quality-assurance procedures.
Installing and dismantling mechatronic systems and facilities	He/She can use written instructions to install and dismantle individual components (sensors, actuators, drives, motors, transport systems, racks) that form a functional group of mechatronic systems.	He/She can master the installation and dismantling of mechatronic systems that use several technologies (mechanics, hydraulics, pneumatics, electrical-mechanics, electronics), set up the correction technology, and check the efficiency of the overall system.	He/She can provide independent mechatronic solutions for the construction of production lines, assure their overall ability to function, and, in addition, can use both existing and modified standard components.	
Installing and adjusting mechatronic components in systems and production lines	He/She is able to install and adjust standardized mechatronic components, e.g. individual electro-pneumatic valves, sensor and actuator units.	He/She can install and adjust components of mechatronic subsystems (e.g., linear drives, measuring systems, transport systems).	He/She can install and adjust complex mechatronic facilities that include diverse technologies and instrumentation and control (I&C) equipment, adjust the associated parameters, test the facilities overall functions, and assure their reliability.	
Designing, adapting, and building mechatronic systems and facilities on the basis of client needs and site plans	He/She can use machine tools controlled either manually or via computer-program to fabricate (according to production designs and customer requirements) the individual components for mechatronic systems. He/She can provide simple designs and descriptions of mechatronic subsystems and can use basic CAD applications.	He/She can build simple mechatronic subsystems by using engineering drawing and can install the devices according to specific production needs. He/She can act on extensive knowledge of standards and regulations (e.g. on surface treatments) and is able to use CAD's more advanced functions (e.g. interference check).	He/She can build mechatronic systems by using both original construction techniques and suitable measuring and testing facilities. He/She fully understands CAD functions and can document system developments (parts lists, descriptions of function, operating instructions).	He/She can design and build autonomous mechatronic subsystems and, with suitable measuring and testing facilities, can assess the necessary production accuracy. He/She can document the results with quality-control systems.
Putting mechatronic systems into operation and providing clients with technical and economic support	He/She can, according to specifications and blueprints, put mechatronic devices into operation and provide support to the client in the hand-over phase.	He/She, after considering the enterprise's needs and basic conditions, can master the start-up of interconnected mechatronic systems and machines, and can provide the necessary documentation including a manual. He/She can review client needs and configure machines that provide solutions. He/She can train the customer where necessary and provide support for safe operating procedures.	He/She can evaluate customer requirements for mechatronic facilities, develop solutions, and can plan the system's implementation and operation.	He/She can direct, including scheduling and time management, the start-up of the project from the creation of a proposal to the client's acceptance.
Supervising and evaluating both the process sequences of mechatronic systems and facilities and the operational sequence (including quality assurance)	He/She can supervise process sequences according to specifications as well as implement any requested quality-control measures.	He/She can independently supervise the process sequences, evaluate the results, operate an accompanying SPC, seek the optimal results of the quality control plan, and prepare simple work schedules, including production schedule and time management.	He/She can operate and supervise mechatronic facilities, choose testing and monitoring plans, set up the accompanying SPC, seek the optimal results of the production line according to material-flow, and provide work schedules including standard production times.	He/She can master the monitoring of complex mechatronic systems using virtual instruments and PPS systems as well as open loop control for the optimisation of machinery arrangement, material flow analysis, and scheduling.
Installing, configuring, programming and testing hardware and software components for control and regulation of mechatronic systems and facilities	He/She is able to install and configure programs for hardware and software components as well as set up simple software control programs (SPS).	He/She can master the selection of hardware and software for mechatronic systems (sensors, actuators, interfaces, communication procedures) and can provide and test simple software control programs (SPS) according to production process requirements.	He/She can integrate and configure program-, control-, and regulation-mechanisms in mechatronic systems, program simple devices and co-operate with developers) and simulate the program sequence before start-up.	He/She can develop, test, and configure hardware and software solutions for networked mechatronic systems, and can monitor system conditions with suitable measuring and visualisation tools.
Preparing and distributing the technical information for adjustment of each enterprise's mechatronic systems	He/She can provide descriptions and designs of mechatronic subsystems and is familiar with the basic CAD applications.	He/She can fully understand the management of technical information documents for mechatronic systems and can prepare and adapt these documents according to an enterprise's specific operating requirements.	He/She is able to analyse complex operational sequences separately in order to understand the connections and draw up maintenance and production procedures. He/She can understand that the system parameters are important for the equipments' functions and can independently assess and document the wear and general conditions of the mechatronic equipment.	
Diagnosing and repairing malfunctions with mechatronic systems and facilities, advising clients on avoiding malfunctions, and modifying and expanding mechatronic systems	He/She can diagnose and repair errors and malfunctions on the simple components and devices in the mechatronic systems. He/She can use the necessary checking, measuring, and diagnostic tools.	He/She can independently correct problems in mechatronic production equipment with the help of (computer-aided) diagnostic systems and the use of expert systems, databases, and error documentations.	He/She can diagnose and repair errors and disturbances in complex mechatronic equipment and is able to advise clients on how to avoid sources of malfunctions through changes or upgrades in the equipment and system.	He/She can develop, through analyses of malfunctions in the mechatronic equipment, a monitoring and diagnostic system

Steps of
competence
development
(2-6 steps)

facilities and the operational sequence (including quality assurance)	responsible quality control measures.	process control (SPC) for the quality control plan, and prepare simple work schedules, including production schedule and time management.	the optimal results of the production line according to material-flow, and provide work schedules including standard production times.	as open loop control for the optimisation of machinery arrangement, material flow analysis, and scheduling.
Installing, configuring, programming and testing hardware and software components for control and regulation of mechatronic systems and facilities	He/She is able to install and configure programs for hardware and software components as well as set up simple software control programs (SPS).	He/She can master the selection of hardware and software for mechatronic systems (sensors, actuators, interfaces, communication procedures) and can provide and test simple software control programs (SPS) according to production process requirements.	He/She can integrate and configure program-, control-, and regulation-mechanisms in mechatronic systems, program simple devices (in co-operation with developers), and simulate the program sequence before start-up.	He/She can configure solutions for system conditions and visualise
Preparing and distributing the technical information for adjustment of each enterprise's mechatronic	He/She can provide descriptions and designs of mechatronic subsystems and is familiar with the basic CAD applications.	He/She can fully understand the management of technical information documents for mechatronic systems and can prepare and adapt these documents according to an enterprise's specific operating requirements.	He/She is able to analyse sequences separately, the connections and production procedures that the system para	

Need for operationalisation

Description of LOs

6. Sequence Chain				
6.1	Structured Program	- Sisableto recall the structure of a program - Sisableto exemplify why a program should have a structure and how it can be structured	34-36	1F, 1Ca, 1P 2Ca
6.2	Sequence chain	- Sisableto exemplify the principles of o a sequence chain - Sisableto implement a sequence chain into FC 2 - Sisableto organize a program in different FCs - Sisableto check and evaluate his own program	37-39	2P, 2Co 3Ca, 3P, 3Co 4P, 4Co 5F, 5Ca, 5P, 5Co
6.3	Pushbuttons and switches	- Sisableto implement a standard set of pushbuttons and switches - Sisableto organize the different functions of the mechatronic system by means of the switches and pushbuttons	40-41	3Ca, 3P, 3Co 4P, 4Co
6.4	FC1 Modes of operation	- Sisableto compare the different modes of operation - Sisableto carry out and organize the programming of the necessary networks for the modes of operation	42	2P, 2Co 3 Co 4P, 4Co

Taxonomy Table

		COGNITIVE PROCESS					
		Remember [1]	Understand [2]	Apply [3]	Analyze [4]	Evaluate [5]	Create [6]
KNOWLEDGE	Factual knowledge [F]						
	Causal knowledge [Ca]						
	Procedural knowledge [P]				6.4		

Assessment

BMW MTU SWM BSFT	Skills demonstration	Module PLC
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The skills demonstration consists of three parts:

1. Work order **team work** (Monday to Wednesday morning)
2. Work order **single work** (Wednesday afternoon)
3. **Presentation** (Thursday morning)

Good luck!

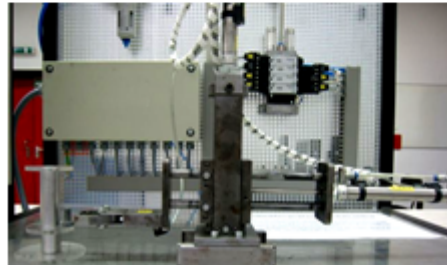
Work order team work

Please read the order carefully and program the station.

Basic programming in team work

The system consists of a horizontal cylinder (X-axis) a vertical cylinder (Z-axis) and a gripper.

The initial position you see in the photo with gripper closed. The initial position is indicated with a lamp.



Initial position

The mechatronic system has 2 operation modes:

- **Single step**
- **Automatic**

Both modes are switched on by two separate push buttons and shown by two separate lamps.

Operation mode single step:

Every movement of the mechatronic system can be carried out separately:

up and down; fore- and backward.

The movements are started with **4 pushbuttons**, one for every movement.

The front gripper is **opened and closed** also by **2 pushbuttons**.

Operation mode automatic

For starting the automatic mode, the mechatronic system must be in its initial position which can also be carried out by means of a pushbutton.

Function:

After the start button is pushed the gripper extends to its front position (X-axis) and picks a workpiece (bolt). Reaching the front position the gripper closes and retracts with the closed gripper holding the work piece.

Then it moves to the upper end position (Z-axis) extends to its front position and opens the gripper. After the work piece is placed the mechatronic system moves back in its initial position.

Paper and pencil test

Workorder

- Teamwork
- Singlework
- Presentation (Technical discussion)

Content and LO
related to level in
TaxTab

Presentation





Certificate



Certificate

Module PLC

Ms/Mr Tarja Halonen

has successfully taken part in

the 90 hours PLC (Programmable Logic Control) training

at **Städtische Berufsschule für Fertigungstechnik München**

and **SWM GmbH**

from 5th of October 2009 to 23rd of October 2009.

She/he has programmed a mechatronic system with PLC Siemens S7-300 in teamwork. Additionally she/he has successfully programmed various functions in single work.

She/He passed the final test (paper and pencil test; skills demonstration and technical discussion) successfully.

All communication during the training and the team work was in English language.

Herewith we certify that

he/she can integrate and configure program-, control-, and regulation mechanisms in mechatronic systems, program simple devices (in co-operation with developers) and simulate the program sequence before start-up.

(Competence level description 7.3 according to VQTS model),

Munich, 23rd of October 2009

Peter Brandstätter
SWM GmbH
head of vocational training (Ausbildungsleiter)

Friedrich Dreßl
Städtische Berufsschule für Fertigungstechnik
Headmaster



Project flow

Steps

1. Identification of relevant contents for modules on basis of national curricula
2. Allocation of modules in Competence Matrix
3. Development of modules in English language by vocational schools
4. Analysis of modules with Taxonomy Table
5. Validation of contents and intended LOs

Project flow II

Steps *(continued)*

6. Sheduling of mobilities in LdV
7. Design of Memorandum of Understanding
8. Performance of modules
9. Competence assessment at end of modules /
Validation of LO in hosting institution
10. Recognition of LO in sending institution
11. Evaluation of modules and process



Thanks for your attention
and please don't hesitate to give remarks!

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