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Competence assessment in Vocational Education and Training (VET) in Germany and its suitability for assessing the capabilities of AI

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German Vocational Education and Training (VET) uses performance-based tasks to assess competence

The dimensions and levels of competence in German vocational education and training are largely based on the German Qualifications Framework (BMBF, 2013; DQR, 2011) and the European Qualifications Framework (Cedefop, 2020).

Professional
Competence

Personal
Competence

Knowledge

Social Competence

Skills

Autonomy

Specification and application to different vocational areas and vocations

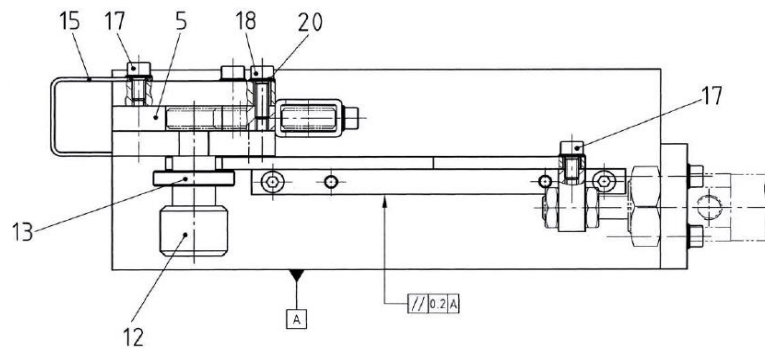
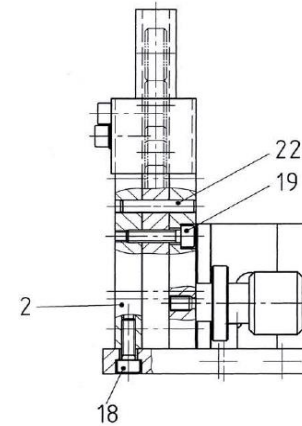
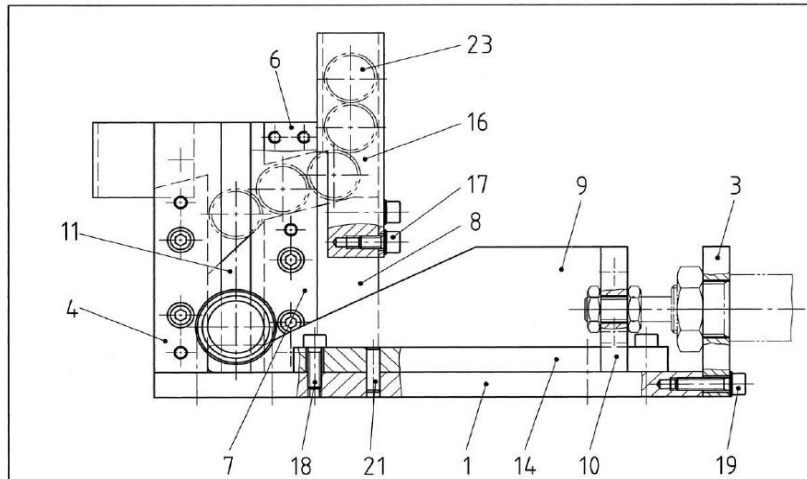
Operationalization through different (types of) examinations tasks

Can these (examination) tasks be used to train AI and/or assess their (future) professional capabilities in vocational contexts?

Most examinations are case-related with all tasks referring to a certain professional case

Type of task	Description of the instrument	Evaluated dimension
Practical	Apprentices craft a product sample typical for their profession (e.g., a wooden product)	<ul style="list-style-type: none"> • The final product
Practical	Apprentices carry out a single professional activity (work sample) typical for their profession (e.g., provision of a service).	<ul style="list-style-type: none"> • Work procedure
Practical	Apprentices carry out a professional assignment typical for their profession	<ul style="list-style-type: none"> • Work procedure and/or • Final result of the assignment
Oral	Situational expert discussions are held during the completion of a product or work samples or a professional assignment and discuss apprentices' procedures, encountered problems and solutions.	<ul style="list-style-type: none"> • Understanding backgrounds and contexts • Methodical approach • Quality of solutions
Written	Written tasks might cover drafting a business letter in commercial professions or a circuit diagram in technical professions.	<ul style="list-style-type: none"> • Demonstration of professional knowledge • Understanding backgrounds and contexts • Methodical approach • Quality of solutions

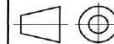
Case-related materials are provided to apprentices beforehand (Example: Materials for Advanced Manufacturing Technicians)



Note: Drawing is not to scale.

5	Disk		11SMn30+C	23	Rd 20x10 EN 10278 (Workpiece)
4	Dowel pin 5 x 28-A	ISO 8734	St	22	
2	Dowel pin 5 x 18-A	ISO 8734	St	21	
	Washer 5	ISO 7090	200HV	20	
9	Washer 5	ISO 7090	200HV	20	
6	Cap screw M5 x 20	ISO 4762	129	19	
6	Cap screw M5 x 16	ISO 4762	129	18	
5	Cap screw M5 x 10	ISO 4762	129	17	
1	Cartridge	S235JR		16	□25 x 15 x 2 x 90 EN 10305
1	Workpiece guide plate	DC01-A		15	Bl 1.5 x 30 x 87 EN 10131
1	Tapered slide guide	S235JRC+C		14	4kt 10 x 14.0 EN 10278
1	Pulley	11SMn30+C		13	Rd 30 x 12 EN 10278
1	Handle	11SMn30+C		12	Rd 25 x 52 EN 10278
1	Ejector	S235JRC+C		11	Fl 70 x 20 x 21 EN 10278
1	Follower	S235JRC+C		10	Fl 25 x 10 x 50 EN 10278
1	Tapered slide	S235JRC+C		9	Fl 50 x 5 x 157 EN 10278
1	Guide	S235JRC+C		8	Fl 70 x 10 x 4.3 EN 10278
1	Guide pad right	S235JRC+C		7	Fl 25 x 10 x 100 EN 10278
1	Guide piece	S235JRC+C		6	Fl 20 x 10 x 17 EN 10278
1	Guide	S235JRC+C		5	Fl 20 x 10 x 79 EN 10278
1	Guide pad left	S235JRC+C		4	Fl 25 x 10 x 100 EN 10278
1	Cylinder mount	S235JRC+C		3	Fl 50 x 10 x 60 EN 10278
1	Support plate	S235JRC+C		2	Fl 100 x 10 x 61 EN 10278
1	Base plate	S235JRC+C		1	Fl 80 x 10 x 205 EN 10278
Qty.	Designation	Standard	Material	Item no.	semifinished products based on material staging list

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AHK USA Chicago Final examinations part 1

Industrial Maintenance Technician

Time:

Sheet: 1 (7)

No.: 000000704

Test taker no.:

Examination tasks refer to the professional cases provided (Here: A work assignment for Advanced Manufacturing Technicians)

7 Performance phase

Your assignment is to produce a functional module with control technology on your assembly panel according to the examination drawings and examination documents. Always be sure to follow safety procedures. Your assignment includes the following:

- produce individual parts through forming and cutting processes
- mark all components
- assemble of the individual parts according to drawing
- ensure quality standards are followed
- set-up, check and adjust all assembly components
- inspect for proper function

Set up requirements (functional description) of the operation cycle:

- The extension of the piston rod of cylinder 1A is throttled and the extension time is approx. 3 seconds.
- The retraction of the piston rod of cylinder 1A is throttled and the retraction time is approx. 2 seconds.
- The piston rod of cylinder 1A fully extends and retracts with damping.
- Controlled by the timing relay device, two workpieces are separated; after which the piston rod of cylinder A1 retracts and stops. To separate the next workpiece the operating cycle must repeat.
- All set up requirements must be met.
- The operating pressure is to be set to min. 4 bar.

8 Inspection

All inspections must be performed according to customer specifications. Customer specifications are designated as follows on the drawing:



Using the "Inspection" work sheet, check your work. Decide for yourself, when to perform the inspection. Evaluate whether the specifications are met. Document your decision in the table by choosing "yes" or "no".

9 Submitting the documents

Make sure that all documents, including your own documentation, diagrams and notes, are complete with your first and last names, as well as your test taker number. After that, submit the documents together with the assembly to the examination board.

Case-related tasks can be practical tasks or other formats (Here: Multiple-choice tasks for Advanced Manufacturing Technicians)

4

General drawing, page 1(7)

How many dowel pins (Item No. 22) are required for the module?

- 1 5 pieces
- 2 4 pieces
- 3 3 pieces
- 4 2 pieces
- 5 1 piece

5

How are the ISO tolerances to be selected when designing the workpieces?

- 1 They should be selected as small as possible.
- 2 They should be selected large enough that no scraps are created during manufacturing.
- 3 They should be selected large enough that no test equipment is required for the quality inspection.
- 4 They should be selected large enough that no checks have to be carried out.
- 5 They should be selected as large as possible, without impairing the intended use of the workpieces.

Using performance-based assessments provides advantages for capturing the (future) vocational capabilities of AI

Advantages



Performance-based measures capture competence at the hand of actual professional performance based on requirement analyses. We can be sure that the target behavior has **immediate relevance to the profession**.



Assessing performance on concrete vocational tasks is **far less contingent on theoretical assumptions regarding underlying general mental abilities** that are assumed to be predictive of performance, which might hold for a generalized/strong AI but **hardly hold for a specialized/weak AI**.



Performance-based measures provide **concrete professional behaviors** which can be used to train and assess an AI.

Disadvantages



Performance-based measures are linked to concrete professional requirements and behaviors. Training a specialized AI based on these measures predicts the AI's performance on these target behaviors but **likely fails to predict its performance on different behaviors** or applications of these behaviors in **unknown situational contexts**.

Although performance-based assessments aim to capture underlying competences, the results of the assessments can also be **meaningfully interpreted without making inferences on underlying constructs** (i.e., a successfully completed professional task is a successfully completed professional task).



**Thank you for
your attention!**

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