

I02: The EDU-VET Curriculum

Paper Brochure

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VET schools – Creating online Learning
Environments in Technical Education for European metal industry

Acronym: EDU-VET

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Introduction

Digitisation - With more than 31,700,000 entries on Google, the megatrend of digitisation, caused by global change, illustrates the importance of digitisation in every organisational context. Especially in the field of education, the relevance of digital change is increasing. Nevertheless, digitisation also requires challenges in the education sector. Consequently, it is necessary to improve the education system with innovative knowledge and ways of learning and teaching to meet the challenges of digitisation. For vocational schools digitization becomes a challenge. The learners are a new medium because they use technical devices such as smartphones and tablets in their daily lives. However, digitization is not yet so much in focus in school.

So, the Erasmus+-project EDU-VET (“E-Learning, Digitisation and Units for Learning at VET schools - Creating online Learning Environments in Technical Education for European metal industry”) addresses the challenges of the rapidly changing environment in economy and transfer this into pedagogical settings.

The main objective of the EDU-VET project is to create new teaching and learning environments for VET. The project focuses on the development of e-learning courses. For this reason, the partners will design a curriculum, an online teaching approach for learning technical education at vocational schools. This supports both teachers with appropriate innovative learning resources as well as learners with innovative modern ways to deal with topics and learning activities.

The 31-month project (funding period 01.09.2019 to 31.03.2022) is coordinated by University of Paderborn in Germany, presented by Prof. Dr. Marc Beutner. The other five European project partners are the Ingenious Knowledge GmbH and Berufskolleg Bocholt-West from Germany, Lancaster and Morecambe College from the United Kingdom, Centro Integrado de Formación Profesional Somes from Spain and Stichting BE Oost-Gelderland from the Netherlands.



The EDU-VET Curriculum

A bespoke, modular VET curriculum for the metal industry will be developed as a basis for the online courses and learning modules on the learning platform to be developed. The idea is to support the acquisition of key high-value competences necessary for the establishing modern and innovative learning in the field with as comparable European focus. The development of this new curriculum will require an 'ab initio' approach as there is little in terms of available coherent educational resources addressing the target groups or the green entrepreneurship area in any partner country.



It is accepted that considerable differences in business cultures, market opportunities and external supports for the development of the will exist in partner countries, therefore, the range of modules required to address the topic area will necessarily be comprehensive to ensure the curriculum has a practical value in all partner countries.

The agreed learning outcomes outlined in the Summary Pedagogic Research Report will be the constant benchmark for partner work and this will allow partners to tailor content to suit local cultural and societal values. Demonstrating the flexibility of the proposed curriculum will also aid further transferability beyond the project consortium. The curriculum developed will specifically address the needs of the target group.

Basic approaches of the EDU-VET Curriculum

Basic competence approaches

Technical competence (professional competence)

This competence refers to the willingness and the ability to solve tasks and problems in a goal-oriented, appropriate, method-guided and independent manner on the basis of professional knowledge, as well as the ability to assess the results. In this context, the trainees are required to have basic knowledge in mathematics and technical aspects (cf. KMK 2002).

Action competence

Here, the focus is on decision-making and assuming responsibility with regard to the tasks. Action competence is developed within the dimensions of professional competence, personal competence and social competence (cf. *ibid.*).

Personal competence

This refers to the willingness and the ability of an individual to clarify, think through and assess the development opportunities, requirements and limitations in family, work and public life, to develop his or her own talents and to make and develop life plans. It includes personal qualities such as independence, critical faculties, self-confidence, reliability, a sense of responsibility and duty. In particular, it also includes the development of well-thought-out values and a self-determined attachment to values (cf. *ibid.*).

Social competence

Social competence refers to the willingness and the ability to conduct social relationships and to shape, grasp and understand possibilities and tensions and to discuss and communicate with others in a rational and responsible manner. In particular, this includes the development of social responsibility and solidarity (cf. *ibid.*).

Methodological and learning competence

Knowing, analysing and applying suitable methods for the learning process is an important set of competences. These competences

grow from a combination of the above-mentioned competence areas (cf. IBID.).

As well as fostering the aforementioned competences, the integration of syllabus objectives for VET learners in the metal sector is also relevant. The objectives of the syllabus for VET learners in the metal sector should be realised according to the development of the curriculum as well as through online and face-to-face learning courses. Furthermore, the partners should follow the didactic principles by creating the curricular framework.

In concrete terms, the objectives of VET require that instruction should be related to action (cf. KMK 2020). That means that young people should learn to plan, carry out and evaluate tasks independently within the framework of their occupation. Learning at vocational school occurs in relation to professional action as well as various cognitive operations (cf. IBID.).

On the basis of learning theory and didactic findings, the pragmatic approach to the design of action-oriented teaching is as follows:

- Didactic reference points are situations that are important for carrying out the profession (learning for action).

- The starting point of learning is formed by actions, if possible carried out by the learner or mentally understood (learning by doing).
- Actions must be planned and carried out by the learners as independently as possible, and have to be checked, corrected if necessary and finally evaluated.
- Actions should promote a holistic understanding of the professional reality; for example, technical, safety, economic, legal, ecological and social aspects must be included.
- Actions must be integrated into the learners' experiences and be relevant to their social context.

Actions should also include social processes, such as the declaration of interests or conflict resolution. Action-oriented teaching is a didactic concept which is based on intertwining subject-specific and action-systematic structures. It can be realized through different teaching methods (cf. IBID.).

The EDU-VET Blended Learning Approach

EDU-VET combines pedagogical needs and approaches with the technical environment based on the blended learning approach.

Blended learning is a mix of e-Learning and classroom instruction. Norm FRIESEN states that “Blended learning’ designates the range of possibilities presented by combining internet and digital media with established classroom forms that require the physical co-presence of teacher and students” (FRIESEN 2012, p. 1).

The EDU-VET Blended-Learning approach offers new possibilities to rethink VET in the metal industry and enhances the access of the learners to training and qualifications. This is the reason why in the context of EDU-VET VET schools and enterprises cooperate to meet the economic needs of practice and the world of work. It is crucial to have a strong and relevant curriculum as a basis for EDU-VET which ensures quality and provides both structure and learning tips for VET teachers, VET educators and learners.

The EDU-VET Blended-Learning approach is separated into two parts: the online scenario and the classroom scenario.

The online scenario refers to the development of online courses and materials which will be provided via the online learning platform. It also includes interactive tasks and videos as well as audios, photos, images and illustrations. The use of the survey module provides a variety of tested questionnaire instruments in order to discover relevant information about the EDU-VET target group. The task creation is completed through the H5P platform.

Concerning the classroom scenario, the partners have to create courses and content for face-to-face classrooms lessons. Additionally, existing methods can be used, such as group work, discussions, creating a poster, working in the workshop and on the machine, building a model, simulations etc. The partners could also create additional didactical materials which can be used in the classroom in combination with the online platform.

The objectives for authentic learning in the EDU-VET blended learning scenario are the following:

- a) EDU-VET take the learner's/person's qualifications and interests into account and offers learning modules and courses that fit to the needs and fit to the curricular structures of EDU-VET and the partner countries.
- b) EDU-VET provides scientifically sound concepts and teaching and learning resources.
- c) EDU-VET offers high quality OER.
- d) EDU-VET addresses the metal industry where blended learning on the basis of learning platforms is currently not state of the art and here the project offers
- e) EDU-VET offers modern learning and takes digitisation in education into account
- f) EDU-VET will be sustainable. The EDU-VET approach will be completely transparent. It can be developed to further stages. EDU-VET will provide a sound basis for future work, too. The implementation of EDU-VET and the activities of the partners will ensure that the curriculum, the courses and the handbook which

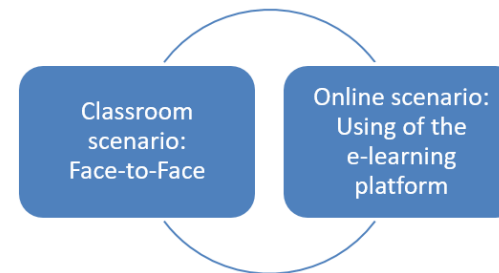
will be there also after the end of the project will be used in the daily work of VET teachers.

g) EDU-VET brings young, potentially young disadvantaged people in contact with interesting knowledge which fit to the needs of economy in the metal sector.

h) EDU-VET can grow and diversify. In contrast to currently available eLearning approaches, EDUVET offers the advantage that traditional modules and foci can be integrated easily also after the end of the project duration.

i) EDU-VET integrates the idea of authentic learning.

The EDU-VET blended learning approach is shown below:



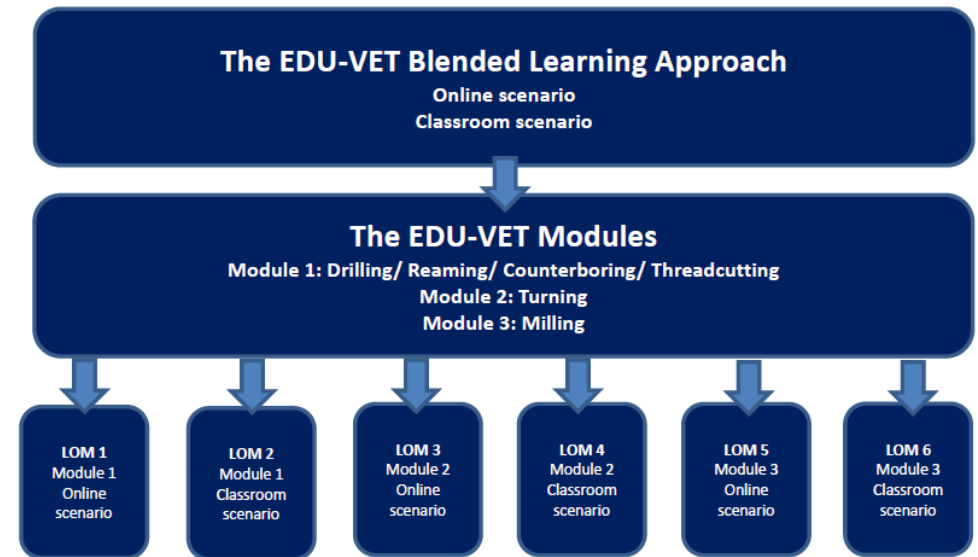
Modular structure of the EDU-VET Learning Modules

Basic modular structure

A modular VET curriculum for the metal industry will be developed as a basis for the online courses and learning modules on the learning platform to be developed. The idea is to support the acquisition of key high-value competences necessary for the establishing modern and innovative learning in the field with as comparable European focus. The development of this new curriculum will require an 'ab initio' approach as there is little in terms of available coherent educational resources addressing the target groups in any partner country.

The six learning outcome matrices of EDU-VET (LOM1 to LOM6) provides insights in the addressed outcomes, suggested methodological approaches and possible assessments.

The Learning Outcome Matrices are designed to inform about the development of the curriculum structure to integrate the results of



the Summary Research Report. Focusing on a learning outcomes approach facilitates the tailoring of the pedagogic induction resources. This provides the possibility to suit specific cultural and societal values and ensures that local issues and necessary topics are addressed within the EDU-VET approach.

The EDU-VET modules for VET learners will be addressed in the EDU-VET curriculum. These modules based on the researches which are being conducted in each partner country:

EDU-VET focusses on three modules and their subareas for learners:

• *Module 1: Drilling/ Reaming/ Counterboring/ Threadcutting*

- Fundamental definition of terms and processes
- DRCT-Part_1: small diameters/low bore depth (flat) bores of different types: blind/through bores, fitting bores, tapered bores (steps a-f)
- DRCT-Part_2: medium diameters/medium depts bores of different types: blind/through bores, threaded bores, counterbores (steps a-f)

• *Module 2: Turning*

- Fundamental definition of terms and processes
- TURN-Part_1: Simple external contour (steps a-f)
- TURN-Part_2: Medium complex external contour with groove and thread (steps a-f)
- TURN-Part_3: Simple internal contour (steps a-f)
- TURN-Part_4: Medium complex internal contour with groove and thread (steps a-f)

- TURN-Part_5: Medium complex external- and internal contour with grooves and/or threads (steps af)

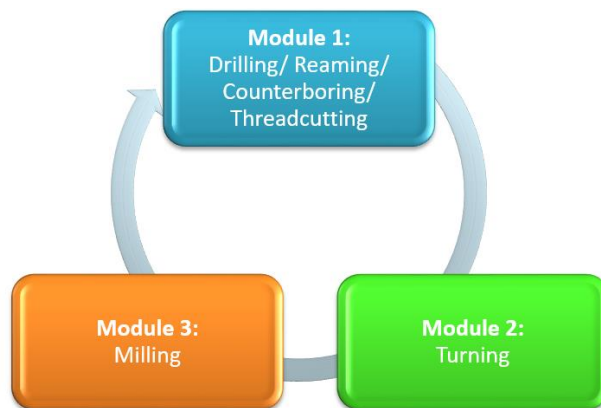
• *Module 3: Milling*

- Fundamental definition of terms and processes
- MILL-Part_1: simple external contour (2 1/2D) (steps a-f)
- MILL-Part_2: medium complex external contour (2 1/2D) (steps a-f)
- MILL-Part_3: simple external contour and one or more pockets (rectangular and/or circular pockets with and/or without pin) (2 1/2D) (steps a-f)
- MILL-Part_4: medium complex external contour and one or more slots (linear and/or arced slots) (2 1/2D) (steps a-f)
- MILL-Part_5: medium complex part (3D) (steps a-f)

For all the different work piece types and all three different manufacturing methods (DRCT, Turning, Milling) the manufacturing process comprises the following six steps (a-f):

- Step a: Manufacturing planning (defining the machine(s), device(s), tool(s) and cutting technology)
- Step b: NC programming (including simulation)
- Step c: Preparing the machine (including testing of NC-programme on the machine „air cutting“)
- Step d: Manufacturing the work piece (doing the real thing)
- Step e: Measuring and testing the manufactured work piece (dimensions, forms, surfaces)
- Step f: Documenting and presenting the manufacturing process (steps a-f)

Following, the modules are shown graphically once again:



Didactical und curricular conception of the modules and the LOMs

According to the didactical and curricular conception of courses for technical education in the metal sector, the partners should create these courses for two scenarios:

Online scenario:

Firstly, they should develop online courses and materials which will be provided via the online learning platform MOODLE. EDU-VET courses come with introductions, address concrete objectives, offer descriptions and explanations as well as rationales.

They include interactive tasks and can include videos as well as audios, photos, images and illustrations. The use of the survey module provides a variety of proven questionnaire instruments for discovering interesting information about the state of mind of the EDU-VET target group.

In EDU-VET course pages themselves are a main tool for VET teachers, allowing them to add or remove and structure activities as necessary. The use of Quizzes and Assignments help to structure the courses. At the end of a course or module as general overview is provided to the learners to let them fit to their experiences and

knowledge in the wider context of the whole curricular approach behind the courses and modules. Therefore, the courses and modules will be interlinked but designed in a way to fit to the needs of the learners and their own learning path as well as their own speed.

Moreover, the partners will create these online tasks via H5P. In total at least 80 H5P tasks should be created by the partners. Firstly, all tasks should be created in English, then follows the translation into the respective national language of the partners.

There are over 60 different types of tasks via H5P, e.g.: Multiple Choice, Advanced fill the blanks, Arithmetic Quiz, Find the words, Image Slider etc.

Furthermore, also facilitating discussions in forums, as well as asking questions, and guiding learners within the modules and courses creates a specific EDU-VET learning experience with regard to topics of the metal sector.

Classroom scenario:

The partners should also create courses and contents for face-to-face classrooms scenarios. The partners could also create additional didactical materials which can be used in the classroom in combination with the online platform.

Here, the partners can use known and existing methods of face-to-face teaching. These could be group work, discussions, creation of a poster, work in the workshop and on the machine, creation of a work piece, simulations, etc.

Integration of syllabus objectives for VET learners in the metal sector

The objectives of the syllabus for VET learners in the metal sector should also be noticed according to the development of the online and face-to-face learning courses. Furthermore, the partners should follow the didactical principles by creating the courses.

Concretely, the didactical objectives and principles¹ are as follows:

¹ Cf. KMK (2002): Rahmenlehrplan für den Ausbildungsberuf Metallbauer/Metallbauerin. On the internet: <https://www.kmk.org/fileadmin/Dateien/pdf/Bildung/BeruflicheBildung/rlp/metallbauer.pdf>, date: 01.04.2020.

The objectives of VET require that instruction should be action oriented. That means that young people should learn to plan, carry out and evaluate independently within the framework of their occupation. Learning at vocational school is basically carried out in relation to concrete professional acting as well as in various mental operations.

On the basis of learning theory and didactic findings, the pragmatic approach to the design of action-oriented teaching is following:

- Didactic reference points are situations that are important for the exercise of the profession (learning for action).
- The starting point of learning is formed by actions, if possible self-executed or mentally understood (learning by doing).
- Actions must be planned and carried out by the learners as independently as possible, are checked, corrected if necessary and finally evaluated.
- Actions should promote a holistic understanding of the professional reality, e.g. technical, safety, economic, legal, ecological, social aspects include.
- Actions must be integrated into the learners' experiences and be relevant to their social impacts are reflected.

Actions should also include social processes, e.g. the declaration of interests or conflict resolution. Action-oriented teaching is a didactic concept that is based on subject-specific and action-systematic structures are intertwined. It can be realized by different teaching methods.

Specific modular structure of EDU-VET Learning Modules

As the curricular framework mentioned, the curriculum will be based on the blended learning approach, which focus on the one hand online scenarios, and on the other hand classroom scenarios.

Under this roof, the EDU-VET learning modules will be developed:



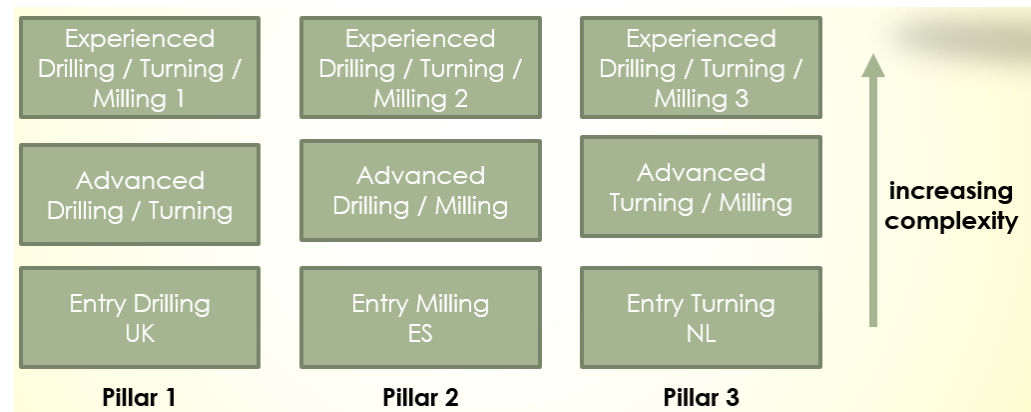
As you can see in the graphic above, the nine modules focus the three manufacturing topics milling, drilling and turning. Moreover, they also consider the difficulty level. In total, we define three difficulty levels: 1) Entry level 2) Advanced level 3) Experienced level.

For all the different work piece types and all three different manufacturing methods (DRCT, Turning, Milling) the manufacturing process comprises the following six steps (a-f):

- Step a: Manufacturing planning (defining the machine(s), device(s), tool(s) and cutting technology)
- Step b: NC programming (including simulation)
- Step c: Preparing the machine (including testing of NC-programme on the machine „air cutting“)
- Step d: Manufacturing the work piece (doing the real thing)
- Step e: Measuring and testing the manufactured work piece (dimensions, forms, surfaces)

- Step f: Documenting and presenting the manufacturing process (steps a-f)

In this context, the above-mentioned content focuses as well as the difficulty levels are combined, resulting in the following modular structure:



The fundamental pillars of the EDU-VET Curriculum

The EDU-VET curriculum aims to support many different users in different European countries – this shall be made possible by integrating the specifically different viewpoints of the four EDU-VET partner schools.

The following design principles should help to meet this objective:

- The curriculum is primarily structured by the process steps of the „EDU-VET manufacturing process model“ in the format of an event process chain. Thus, there is a first trans-national and trans-school-system applicable integration means.
- Secondly the curriculum is structured by the skill levels of the „EDU-VET curriculum skill level model“. This allows the assignment of the learning units to different student groups according their state of development.
- Thirdly the EDU-VET curriculum and learning units shall be easily integrated with the user's local curriculum and

learning units, therefore the „EDU-VET curriculum learning unit model“ distinguishes different *learning unit types* and *learning unit variants*.

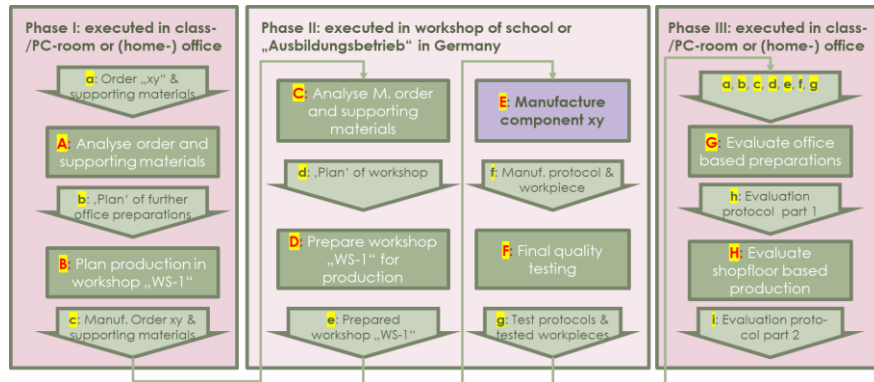
- *Finally*, the learning units of the EDU-VET curriculum are classified regarding delivery media and learning activity type in order to support the users in the process of delivery preparation and student orientation.

Summarized the curriculum will be structured with three fundamental pillars:

- Pillar 1) The EDU-VET Process Model
- Pillar 2) The EDU-VET Curriculum Skill Level Model
- Pillar 3) The EDU-VET Curriculum Learning Unit Model.

The EDU-VET Process Model

The EDU-VET Process model describes a manufacturing process. An event initiates the execution of a process step. The execution of the process steps leads to the events of step is completed and step outcomes are ready.



The EDU-VET Skill Level Model

The EDU-VET Curriculum Skill Level Model comprises three different skill levels distinguished by the complexity level to be handled on each skill level. Four sources drive the complexity. The EDU-VET Curriculum Skill Level Model is also linked to the difficulty levels of the EDU-VET learning modules.

The EDU-VET Curriculum Learning Model

The EDU-VET Curriculum Learning Unit Model comprises learning units of different types and variants and shall support several different learning unit application types and variants, too. This will be shown in the figure below:

Learning unit types and variants

- [Type: **e-L**] **e**lectronic-Learning unit
 - [Var: **EVb**] EDU-VET built
 - [Var: **H-m**] Home-made
 - [Var: **Sbs**] Supplied by supplier A, B, C ...
- [Type: **e-E**] **e**lectronic-Exercise unit
- [Type: **c-L**] **c**onventional-Learning unit
- [Type: **c-E**] **c**onventional-Exercise unit

This structure should enable users to combine EDU-VET learning units with different "local" learning units according to their specific circumstances

Learning unit application types and variants

- [Type: **ILA**] Instructor-lead Learning unit Application
 - [Var: **pcr**] physical classroom
 - [Var: **vcr**] virtual classroom
 - [Var: **PCr**] physical PC-room
 - [Var: **pWs**] (physical) Workshop
- [Type: **SLA**] Self-directed Learning unit Application
 - [Var: **soi**] self-organising individuals
 - [Var: **sog**] self-organising groups
 - [Var: **smg**] (self-)moderating groups

This structure should enable users to apply the EDU-VET learning units in different ways according to their specific circumstances

With regard to delivery media the units are classified either „e“ or „c“

- The attribution „**e**“ or „**electronic**“ marks a learning unit as being delivered digitally. Digital terminals like PCs, notebooks, tablets, smartphones are therefore required to access and use this learning unit.
- The attribution „**c**“ or „**conventional**“ marks a learning unit as being delivered conventionally. No digital terminals are required to access the learning unit. The learning materials are available in the form of digital print templates and/or paper-based copy templates.

With regard to delivery media the units are classified either „L“ or „E“

- The attribution „**L**“ or „**Learning**“ marks a unit as being dedicated to help the user create a consistent mental model of all the relevant entities and relationships in the subject area called terms and concepts.
- The attribution „**E**“ or „**Exercise**“ marks a unit as being dedicated to help the user build comprehensive capabilities in the execution of particular tasks or activities, the build-up of a mental model of the relevant methods and tools and experiences in the application of these methods and tools are supported.

The EDU-VET curriculum learning units are classified regarding delivery media and regarding learning activity type, this creates four basic types: [e-L], [e-E], [c-L], and [c-E].

The relevance of interactive tasks

Based on the key approaches of EDU-VET Curriculum the didactical conception of innovative and modern learning resources for each of the nine EDU-VET Learning Modules plays a very relevant role. Therefore, EDU-VET intends to develop interactive tasks, especially via H5P, and integrate it into the EDU-VET Learning Platform.

In EDU-VET the course pages provide a core tool for VET teachers and learners which allow them to add, remove and structure activities flexibly. Quizzes and assignments help to structure the

courses. At the end of a course or module a general overview is provided to the learners which allows for self-reflection and offers them the opportunity to evaluate their knowledge in the wider context of the whole curriculum. Therefore, the courses and modules are interlinked but designed to fit the needs of the learners and their own learning paths as well as their learning pace.

Moreover, the partners will create these online tasks via the H5P platform. In total the partners will create at least 80 H5P tasks. Initially, all these tasks will be created in English, and they will then be translated into the languages of the partner institutions (cf. H5P 2020).

The objective of H5P is the creation of new types of digital learning and teaching material. The following section will give an insight into selected task formats. The platform offers approximately 40 different interactive task types, such as multiple-choice questions, gap filling tasks, arithmetic quizzes, word quizzes, image sliders, and so on (cf. IBID.).

Below, four task types are explained in detail. These tasks have already been created within project activities.

Multiple Choice

Regarding Module 1, basic and theoretical knowledge can be tested through multiple choice questions. The image below shows an example in which the learners have to name the correct elements of a machinery manufacturing process. There are four response options. The difficulty is that one or more answers might be correct. After selecting possible answers, the learners can check their knowledge by clicking on the “Check” button. They receive feedback immediately and can see the correct answers. All H5P tasks can be repeated indefinitely depending on the learner’s needs. The following H5P task is carried out within the Learning Module 1 – Entry Milling.

Drag the words into the correct boxes

The cutting width is also known as the . It also named as , which indicates how wide the mill cuts the workpieces. The material removal rate Q in cm^3 the workpiece volume removed per minute.

indicates
 milling width
 engagement width

Gap filling

As well as multiple choice questions, the interactive task “Gap filling” is also a suitable task for testing basic and theoretical knowledge. Figure 6 gives a first impression of the possibility to check the knowledge taught in module 3, the milling process. The answer options highlighted with a grey box have to be dragged into the blue boxes. One advantage of this task type is that the degree of difficulty can be very easily adapted to the learners’ requirements. Moreover, the scope of the task can also vary as required. The learners receive feedback and the correct answer by clicking on the “Check” button. The following H5P addresses the Learning Module 1 – Entry Drilling.

What are the correct machinery manufacturing processes?
More than one answer could be correct.

drilling

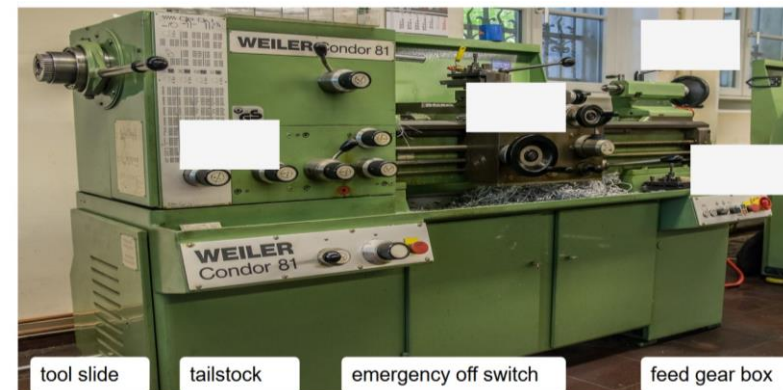
screwing

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Drag and Drop

The integration of images with H5P offers a wider range of possible tasks which promote concentration and increase learning success. The task type “Drag and Drop” allows the combination of theoretical knowledge with practical examples. The following task refers to Module 2. Learners are challenged to correctly label a universal lathe. The answer options provided have to be added via drag and drop and placed in the white boxes on the image. When the learners click the “Check” button they will receive the correct answers and brief feedback. The H5P task below is designed for the entry level.



Course Presentation

H5P can also be used to integrate learning videos into interactive learning materials. The task type “Course Presentation” allows the embedding of videos and audios. The task below shows an example for turning (Module 2). Within the following task, the learners become familiar with the different tools of the turning processes, and especially the different types of milling cutters. Due to the transmission of knowledge via multiple senses, the video helps the learners to improve their knowledge effectively. The advantage of this task type is that they can watch it at any time, as often as they choose and can thus learn at their own pace. The following task contains the turning process at the entry level (Learning Module 3).

Nähere Informationen zum EDU-VET Curriculum erhalten Sie auf unserer EDU-VET Website. Dort steht Ihnen das EDU-VET Curriculum zum Download bereit.

Besuchen Sie uns auf der EDU-VET Website unter:

<https://eduproject.eu/eduvet>



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