Co-funded by the Erasmus+ Programme of the European Union

METALS
MachinE Tool ALliance for Skills

Deliverable 3.2: METALS Quality Assurance Guidelines

METALS: MachinE Tool ALliance for Skills

Grant Agreement no:	2015 – 3377 / 001-001
Call Identifier	EAC-A04-2014
Project Start Date	1 November 2015
Duration	36 months

Deliverable No.	D.3.2
Deliverable Title	METALS Quality Assurance Guidelines
Work Package No.	3
Author(s)	Emanuela Luppino, Martina Manfredda
Task Leader	ECOLE
Dissemination Level	✓ Public · Restricted to the other programme participants · Confidential, only for members of the consortium
Status	· Draft · Version for Review ✓ Final
Deliverable Due Date	February '18
Revision	1
Version	Final
Submission Date	October 2018

Contents

1. Introduction and description

The METALS Quality Assurance Guidelines (QAG) draw the framework for the development of the METALS contents (learning outcomes, learning materials and assessment) to make sure that these materials meet the quality requirements expected by users of the e-platform and to guarantee the coherence of the work of all partners of the consortium. METALS QAG have been designed contemplating **EQAVET principles** (the European Quality Assurance in Vocational Education and Training). In particular, **METALS QAG** used:

- The EQAVET Quality cycle divided into 4 stages: planning, implementation, evaluation and review
- Some of the indicative descriptors and indicators suggested by the EQAVET community.

Regarding the 4 stages cycle:

- The planning, or first phase of the project, allowed to conduct the analysis of trainings needs of the machine tool Industry and to determine the macro and micro planning of the training programme.
- The implementation regarded the definition of contents, training approach and tools.
- The evaluation included the assessment of METALS from a learning point of view and by the learners' supervisors. It took into account knowledge acquired after the completion of the training programme and stakeholders' satisfaction. Tools defined for WP5 - Pilot test - helped to collect information to assess METALS.
- The review phase considered feedback collected within the pilot testing in order to carry out corrections to learning materials.

The first version of these QAG (D3.1) proposed to use 2 indicators for measuring VET quality improvement (Indicator no 4. *Completion rate in training programme* and *Indicator* no 6. *Utilisation of acquired skills at the workplace*); both of them have been used but in some cases with a limited field of application.

The following paragraphs describe how EQAVET principles have been applied.

2. EQAVET quality cycle and METALS project

2.1. Planning

In this phase consortium worked to set up clear, appropriate and measureable goals, determining procedures, policies, resources and tasks of each partner. It was articulated into 3 phases, **preliminary analysis, macro-planning and micro-planning**.

2.1.1 Preliminary analysis

It included:

- Collection of training needs (WP2 'Occupations and skills gap analysis' 's outcome)
- Definition of general objectives of training
- Analysis of financial and organizational resources needed for course implementation

The scope of the **Preliminary analysis** was first of all the analysis of entrepreneurial skills needs of the European machine tool industry and the definition of a EU machine tools skills panorama that described the skills needs of now and of 2025 in line with emerging technologies. Firstly, the consortium identified what skill set is required. Second, the consortium assessed existing skill levels of machine tools industries, and lastly, determined the training gap. The METALS consortium selected Additive Manufacturing as key technology to be further investigated through a format defined and developed within WP2.

This format aimed at the definition of training needs with the specification of knowledge, capabilities and entrepreneurial skills to be developed. Following the definition of training needs, it was easy to define the general objectives of training.

The analysis of skills gaps was conducted through surveys which included training experts in the field of emerging technologies, managers and entrepreneurs of the machine tool sector.

2.1.2 Macro-planning

It included:

- Analysis of skills to be developed. The analysis of training needs in terms of knowledge, capabilities and entrepreneurial skills allowed to build the EU machine tool skills panorama and was compared with the results of surveys of training experts, managers and entrepreneurs carried out. The comparison aimed to give evidence of the training gap and allowed the definition of skills to be developed through a training programme. So, the definition of EU machine tools skills panorama and the comparison with training needs that emerged through the survey allowed to build a formal bridge between the available design data and the training objectives.
- Definition of the indicators able to measure knowledge and skills achieved (EQAVET). In this phase, the consortium reviewed and selected the EQAVET Indicators to be used in the following phases. The indicators selected were: indicator no 4. Completion rate in training programme and Indicator no 6. Satisfaction rate of individuals and employers with acquired skills/competences.
- Creation of the macro-evaluation system. The macro-evaluation system was defined as follows:

- **Subjects involved:** 15 VET learners and 10 adults who work for a European machine tool company or company using Additive Manufacturing technologies
- Division among partners: Germany: 5 VET Learners + 4 Adults; Italy: 5 VET Learners + 3 Adults; Spain: 5 VET Learners + 3 Adults
- The Evaluation system was defined to asses METALS learning experience **from a learner point of view** and **by the learners' supervisor.** For more details, please see the following paragraph entitled "*Evaluation*".

- Design of the virtual learning environment. Nachwuchsstiftung Maschinenbau Bielefeld and ITB Uni HB defined a sort of guideline that each partner followed in developing learning materials (also to a big extent related to copyright issues):
  - Usage of own material or freeware material;
  - Attention with links (separate tab) to websites;
  - Free pictures (©, private use, copyleft);
  - Links to videos only with credits and permission of the owner
  - Usage of the same structure for each learning unit (starting with a comprehensive overview)
  - Embedding of all videos, pictures, sketches, histograms, etc. in the units
  - Only 3 kinds of links: to external pages, to internal pages (e.g. Learning Unit (LU) 1 reference to LU 15 for more specific information), to *.pdfs
  - Number of content slides for each LU: 10-20
  - Only 1 final assessment for each LU;
- Definition of the architecture of the training course. The consortium defined 3 pillars:
  - Additive Manufacturing (AM) units: articulated in 9 learning units (LUs)
  - Work-process oriented units: articulated in 10 LUs
  - Entrepreneurship units: articulated in 8 LUs (7 in the English version of the course)

  The structure of each LU was defined as follows:

  - Welcome page
  - Page named: how to use this Learning Unit
  - Page named: Introduction
  - Page named: Learning Objectives
  - Slide: Contents
  - Final slides: Test
- Co-ordination with all stakeholders. The system of coordination used included conference calls, e-mail, tutoring online and project meetings.

2.1.3 Micro-planning

This phase regarded the definition of objectives and contents of each LU of each pillar and involved different partners following instructions specified in 1.2 in order to give coherence to the platform. The activities of this phase were the following ones:

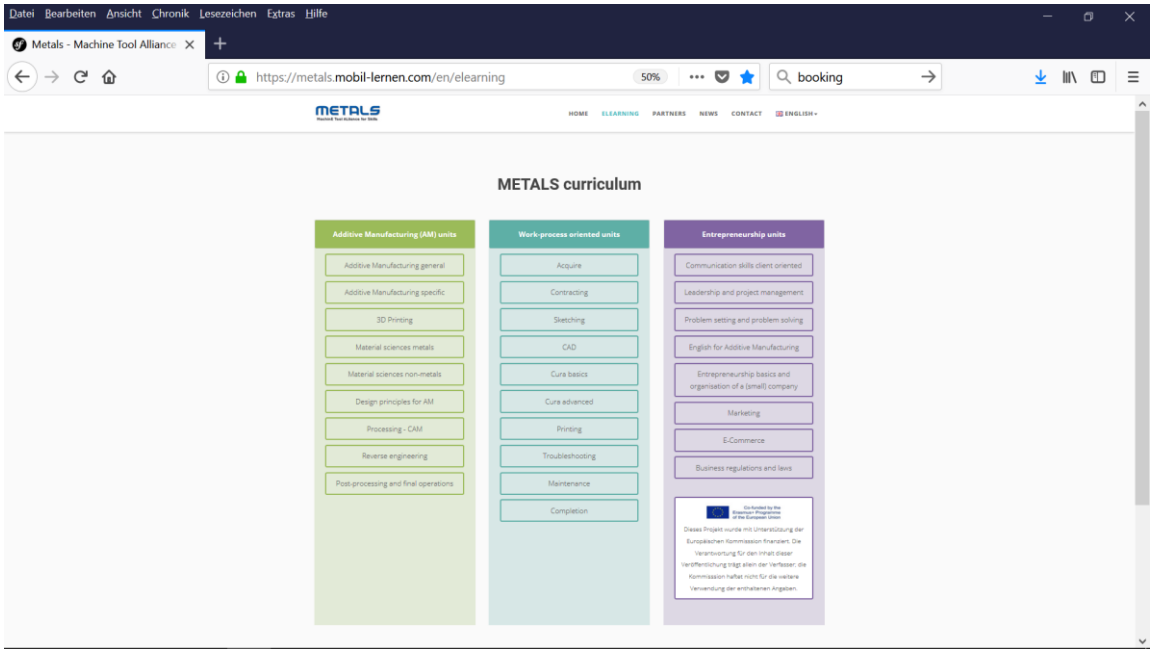
- Definition of learning objectives. It regarded the definition of what LU wanted to teach to trainees and the way to measure this. To this respect, some questions guided the partners, for example: what are the most important concepts or skills that trainees need to understand by the end of the LU? Why are these concepts and skills important? How will you know that they have understood these correctly?
- Clarification of key topics and related concepts. It regarded the identification of a few central ideas or skills and the concepts related to them to reach the learning objectives defined previously;

- Collection and organization of training material.
- Definition of assessment test. It regarded the definition of learning checks and question-and-answer to evaluate students.

2.2. Implementation

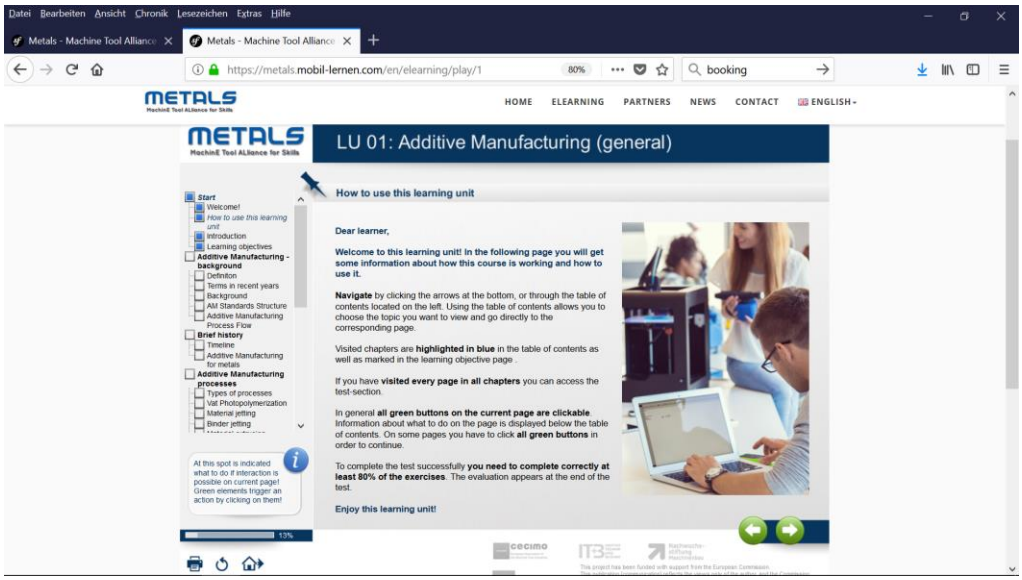
This phase involved the introduction of the training contents within the e-learning platform available at this link: https://metals.mobil-lernen.com/en/elearning .

Training materials consists of 27 Learning Units (LU) divided along three main knowledge areas: work process-oriented area, AM-specific area and entrepreneurship-oriented area. Learning material covers both technical and soft skills needs in 3D printing, otherwise known as additive manufacturing, and is targeted for knowledge and skills needs at EQF (European Qualification Framework) level 5. Partners selected this EQF level with a view to provide a common ground between skilled workers and advanced apprentices.

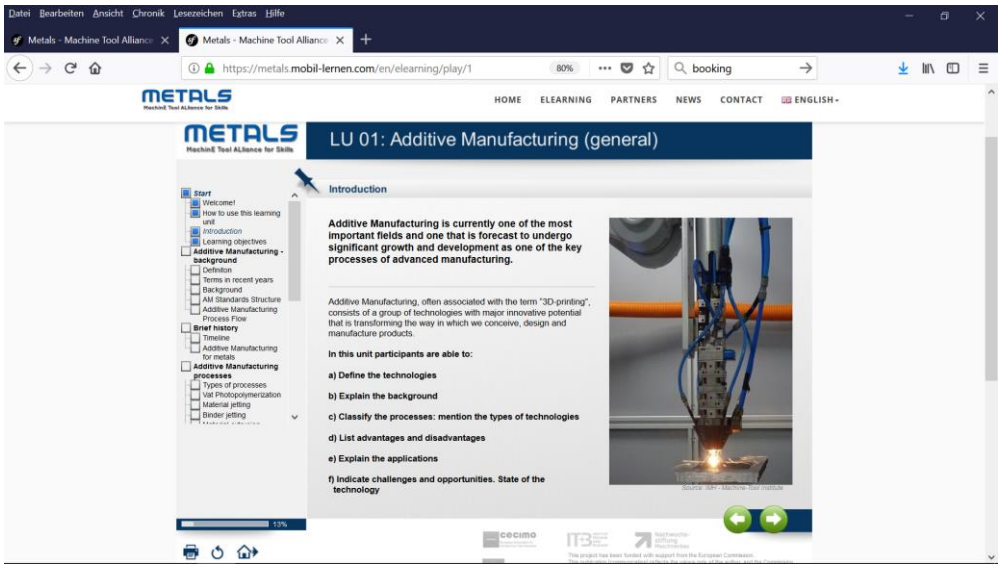


Some rules were defined to give coherence to the structure of each LU (definition of a storyboard).

Each Learning Unit (LU) starts with a comprehensive introduction on how to navigate:



Followed by an introduction of the content:



The METALS consortium decided to use the following media within the training course:

- Texts, sketches, graphs, and tables
- Links to web-resources
- Links to videos
- Links to other LUs
- Embedded pictures
- Links to pdf documents
- Animations

At the end of each LU participants learners will have to pass a test.

To ensure a smooth development process, a corporate design, and the technical functionality, it was agreed that content developing partners would send their materials, using one of the (out of 19) standardized

templates for each slide as a *.ppt file to German partners. The Nachwuchsstiftung Maschinenbau was responsible for the design and ITB Uni Bremen for the technical animation of all 27 units.

Once the the learning units were implemented in the platform a final check was done in order to ensure coherence between the content of the LUs and to identify any possible mistakes (spelling errors, broken links, etc).

2.3. Evaluation

This phase defined a process evaluation with the aim to determine effectiveness of training and customer satisfaction.

The evaluation system was defined in order to asses METALS learning experience **from a learner point of view** and **by learners' supervisors.**

Regarding the first aim, two tools were defined:

- An evaluation of knowledge acquired through an assessment at the end of each LU. The consortium agreed to the following evaluation criteria, where X is the % of right:
  - If X < 50%: repeat the LU
  - If X is >= 50% or < 80%: repeat (only) the test
  - If X >= 80% positive evaluation
- An evaluation of the contents and platform through a questionnaire at the end of the training, using Google forms (https://goo.gl/forms/FYrox3FMFalkViR32).

The evaluation of the METALS e-learning course **by the learners' supervisor** had the aim to evaluate the effectiveness in the work environment of METALS Learning experience through a questionnaire. The results of this evaluation are included in D 5.1 METALS platform pilot test evaluation.

2.4. Review

This phase regarded the review of the contents of each LU throughout input coming from METALS partners, studentsinvolved in the pilot test, the METALS Advisory Board and other METALS stakeholders.

First of all, each LU was reviewed by CECIMO before starting the pilot test. This type of review helped to remove some mistakes, avoid duplication and to assure homogeneity in language (especially in the usage of some technical terms).

Each partner gave input and suggestions in the development of contents of each LU which were discussed in several virtual meetings (Skype calls) and in the last meeting in Brussels.

Skype calls and the last meeting were also an opportunity to share feedback received by students involved in the pilot test.

Other important inputs in the review phase were the results and information collected through the survey, both of students and supervisors. Indeed, surveys offered an overall evaluation of METALS and also some suggestions for improvement.

This phase included different types of review:

1. **Quality check**. This check aimed at finding spelling, grammar or punctuation mistakes, technical issues (bugs) and to understand if the language was simple and easy to understand.
2. **Design analysis.** This type of review was guided by some questions: does the structure of training course make sense? Do the topics flow logically from one to the next? Is the course easy to navigate? Can you quickly find information on a specific sub-topic? Is the look & feel of the course appropriate (e.g. the appropriate colors, fonts & images for the subject matter)? Is the look & feel cohesive (e.g. do the colors, fonts & pictures work well together)? Will the resources meet the learning objectives of the project? Are the resources engaging? Will learners be bored or overwhelmed?
3. **Subject matter review.** It regarded contents developed, for example:
    a. Is the information presented accurate?
    b. Have all the relevant points on this topic been discussed? Is any information missing?
    c. Are the most important points given the most attention?
    d. Are complex and confusing topics given enough attention?

Have appropriate scenarios or activities been included? Do they relate to what the learners do in their day-to-day work?

3. EQAVET indicators used

The consortium approach in developing the project was very practical with the aim of obtaining the maximum number of participants and stakeholders. This meant that not all indicators which METALS Consortium proposed to use at the beginning of the project could be used. In addition, some indicators regarding individual criteria of participants cannot be used because of privacy issues: this meant that elements such as gender, age, name and surname of participants cannot be registered by the portal.

A detail of indicators follows.

Indicator no 4. Completion rate in training programme: Number of persons having successfully completed/abandoned the training programme, according to the type of course and individual criteria. All participants involved in training program follow all learning object f each pillar. So the rate between:

- Numerator: Number of successful programme completers
- Denominator: Total number of participants entering courses

Is 100%. For reasons explained in the previous paragraph, it is no possible specify this rate in considerations of age and gender of participants.

Indicator no 6. Utilisation of acquired skills at the workplace: Satisfaction rate of individuals and employers with acquired skills/competences. This indicator was applied through a specific survey proposed to both students and supervisors. Satisfaction expressed was very high. Suggestions proposed regarded details of contents or not relevant mistakes; this can be read as a fact that training course developed is a valid training course.

4. Conclusion

This document has outlined the guidelines of the METALS consortium that have been used within the project. The project had a duration of three years but its outcomes and operation will continue in the future through the actions of each of the partners.

The document is based on the quality certification system aligned with the EQAVET framework, showing itself to be a **dynamic document in its essence, open and shared**. The approach that characterised the definition of METALS' QAG was very practical and concrete.

QAG allowed to give rules to all partners in order to assure and guarantee coherence in the developing of the project. Not only, QAG helped to build a circular process in developing METALS: no phase was thought in a singular way; but also, each phase (corresponding to the EQAVET cycle) was connected with the other. This also reminded the partners to think about the effects that changes could have on the overall project.

METALS' QAG has to be thought as the **conceptual architecture that gives useful meaning to the actuation and operationalization of each of the indicators presented.** It is a **guidance document for action** and a fundamental tool for the continuous improvement of the results obtained.