albatts

Alliance for Batteries Technology, Training and Skills

2019-2023

Report on Creation/Adaption of Curricula/Training Course Content

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Deliverable 6.5

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Executive Summary

This internal deliverable summarises the work done and the achievements of work of Task 6.5 - Creation/adaption of curricula/training course content.

The main objective of this task was to prepare training materials and offer them in an online learning environment either for self-learning or for teaching/training purposes onsite or in a blended learning environment. The courses are freely accessible and promoted by the ALBATTS project and the Automotive Skills Alliance. The courses are accessible at https://learn.skills-framework.eu/

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Introduction

ALBATTS Education and Training Framework, as proposed in Deliverable 6.2 - Preparatory development of the education and training framework and choice of tools, identifies four central pillars that constitute the guiding principles for the battery sector:

- Pillar 1 – Curricula for all levels
- Pillar 2 – Innovative and flexible learning
- Pillar 3 – Competent trainers and tutors
- Pillar 4 – EU-wide recognition

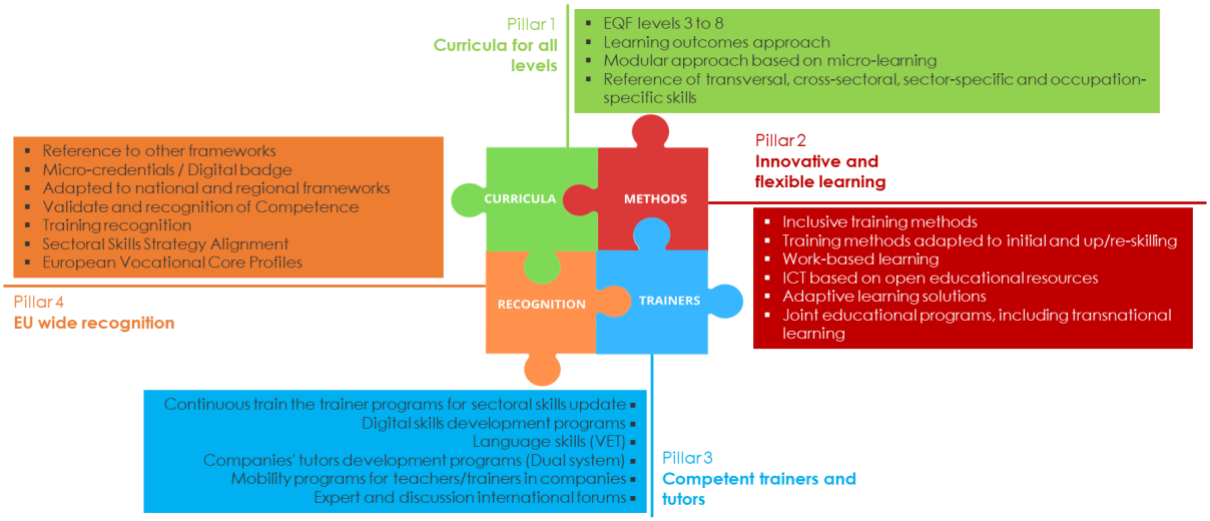

Figure 1 ALBATTS Education and Training Framework

Task 6.5 work was mainly focused on Pillar 2 by creating training material for the curricula proposed in Task 6.4, taking into consideration the guiding principles identified in the framework, namely:

- Inclusive training methods
- Training methods adapted to initial and up/reskilling
- Work-based learning
- ICT based on open educational resources
- Adaptive learning solutions
- Joint educational programs, including transnational learning

The training materials developed configure a pack of micro-modules that can be used by training providers in different settings and are intended to respond to the short-term needs of both education and training providers and the industry for the training of trainers and initial and up/reskilling purposes, as tested during the piloting phase (see Deliverable 6.6).

To guarantee the sustainability of the developed training materials beyond the end of the project, ALBATTS partners decided to make the training units available in the Automotive Skills Alliance learning platform (https://learn.skills-framework.eu/), encouraging all users to test and take advantage of

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these resources. As of the moment of writing this report, more than 1173 users have registered for the courses directly on the platform, and more than 100 have attended trainer training sessions or blended learning settings.

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List of Abbreviations and definitions

The abbreviations and definitions of terms used are a subset of the ones used in Deliverable 6.2, which contains a rich list. See Deliverable 6.2 - Preparatory development of the education and training framework and choice of tools., p11ff.

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1 Methodology

This section provides an overview of the methodological approach (Figure 2) used in the project to perform task 6.5 Creation/adaptation of curricula/training course content (OER). The main input for the task is the results of the curricula analysis from task 6.4 and the report from task 6.2 for the education and training framework.

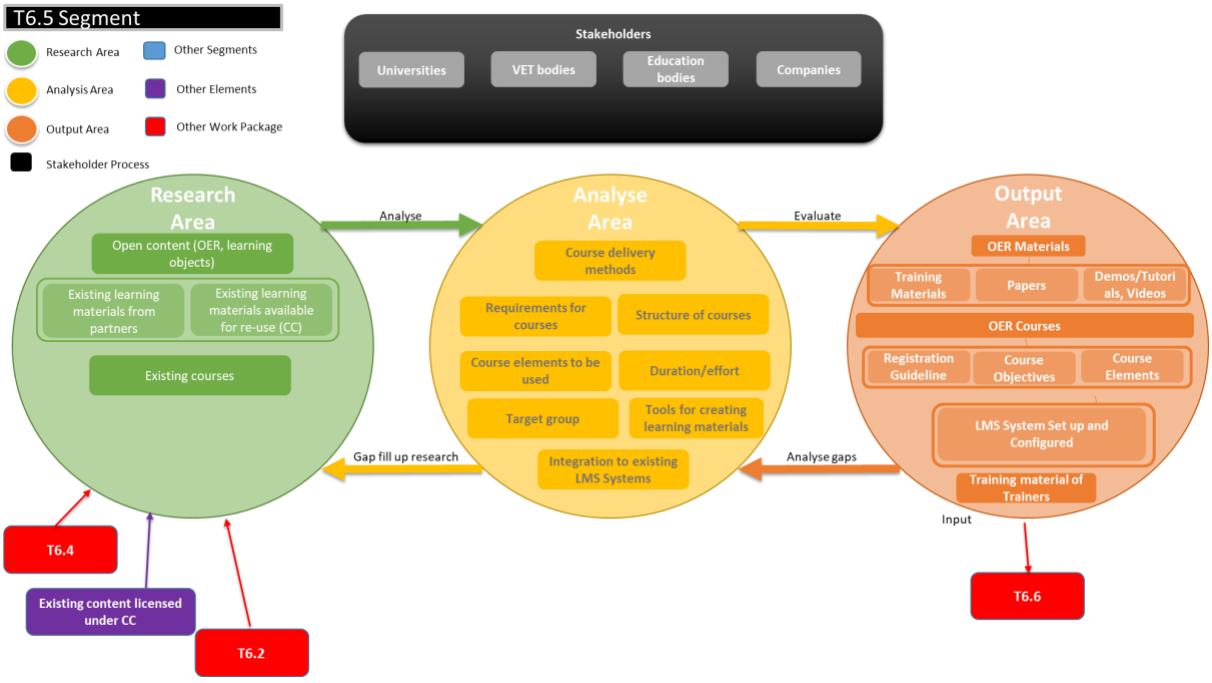

Figure 2 The Work process on curriculum analysis and proposed solutions

Taking into consideration the guidelines and principles from the ALBATTS framework, structure and formats (D6.2) and the available curricula (D6.4), task 6.5 will deliver training courses consisting of learning materials, videos, examples, relevant research papers and other open and available training materials. The courses are being developed based on the target group and the relevant EQF level. The existing reports from WP3, WP4 and WP5 were analysed and used as input for the Basic Battery course.

1.1 TRAINING MATERIALS FOR THE ADAPTIVE LEARNING APPROACH

Realizeit, founded in Dublin, Ireland, as CCKF Limited in 2007, is an online intelligent adaptive learning platform developed outside of the ALBATTS project. This commercial software, which is owned by CCKF, was made available to the ALBATTS project for the purpose of designing, building, and hosting courses and assessments for battery education, as well as providing a rich adaptive learning experience for students engaged in learning about batteries. Adaptive learning involves assessing the learner's knowledge continuously, allowing users to demonstrate and gain credit for their knowledge through testing without having to read through material they already understand. This allows Realizeit to meet learners where they are, rather than assuming that all students start courses with the same level of

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knowledge. Depending on the learner's prior knowledge this can lead to substantial time savings, in contrast to traditional 'one size fits all' systems that force every learner to consume all of the content.

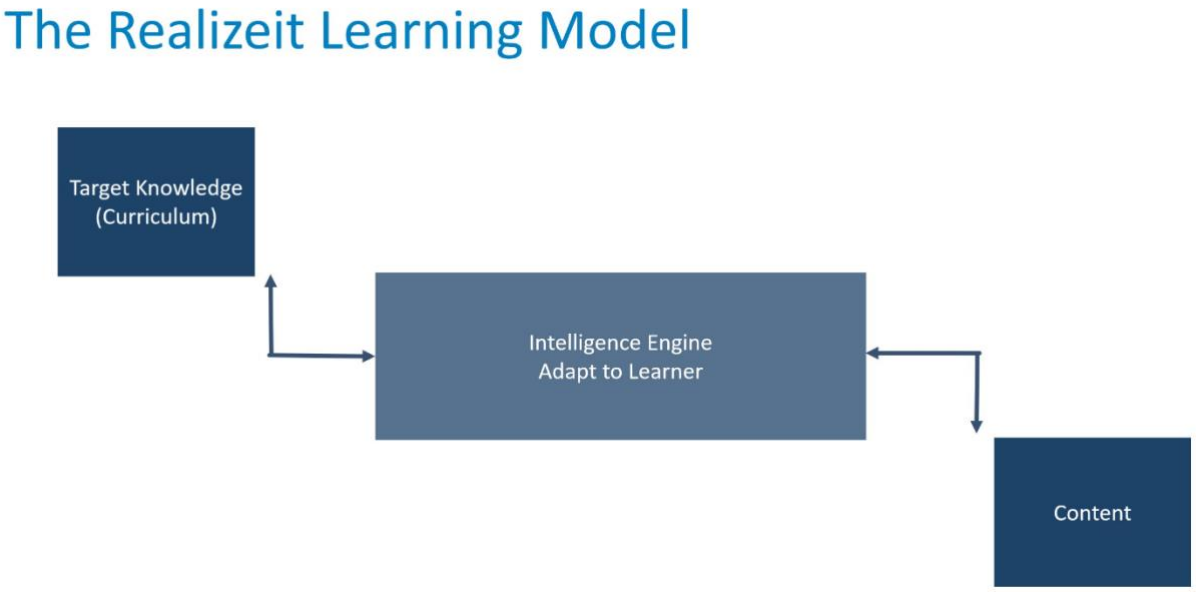

Figure 3 Depiction of Realizeit Learning Model

Realizeit can adapt to the individual and personalise their experience based on many different factors. These include learner characteristics and behaviours that the system infers as the learner engages with the content. The system continually gathers evidence and uses this in real time to adapt the content and questions that it presents to the learner (as illustrated in Figure 3)Figure 3 Depiction of Realizeit Learning Model. In this way, remediation of areas of weakness for each individual is carried out automatically by the system.

Courses in Realizeit start with an operation called Determine Knowledge – a generative assessment where students are tested on questions drawn from across a learning objective. If students do well, the system allows them to move ahead in their learning based on the knowledge they have demonstrated. This operation is repeated throughout the course at the beginning of each learning objective or unit, allowing learners to move quickly through areas they demonstrate knowledge in. This means that prior learning is respected, and learners don't need to spend time reviewing material that they already know. The system also continuously updates its calculation of the learner's knowledge, meaning that if the learner starts to struggle with learning content where they had previously demonstrated knowledge, they will be presented with material from earlier in the course to review; this should allow them to catch up where a gap has been identified.

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Realizeit engaged with ALBATTS, helping to identify open-source content for the Basic Batteries course and helping to convert and build these as adaptive courses starting with a curriculum for the courses that would be useful and beneficial to learners working to develop their competence in batteries.

For Realizeit's engagement with ALBATTS, it was decided that Realizeit would provide a standard commercial instance of the Realizeit SaaS solution that would host the ALBATTS Basic Batteries course. This instance was integrated with the ALBATTS LMS, meaning that learners could launch from the ALBATTS LMS directly into Realizeit and that grades from Realizeit would be passed back to the LMS from Realizeit. Several research and technical analysts of the Realizeit "Content Team" adapted the course materials provided by ALBATTS for Basic Batteries to implement adaptive components of content within Realizeit. The course was subsequently made available to learners from ALBATTS partner ATEC.

1.2 TRAINING MATERIALS FOR THE LEARNING PLATFORM PROVIDED BY THE AUTOMOTIVE SKILLS ALLIANCE

The ASA Learning platform https://learn.skills-framework.eu/ is based on the MOODLE Learning Environment offering and supporting different possibilities in offering courses. The training materials consist typically of a main module where the content is provided/presented (e.g. in the form of a PowerPoint presentation or as a Sharable Content Object Reference Model (SCORM) module) and additional supporting materials such as YouTube videos, reference to other publications or web pages, further reading suggestions or exercises in the form of multiple-choice text questions or quizzes. This was the courses can be used as:

- self-learning MOOC (Massive Open Online Courses) provides all relevant materials for the learner to self-study the content
- blended learning – combining face-to-face learning with self-learning through the usage of the online environment
- face-to-face learning – using the online environment only as a repository for the training materials

Access to all training materials is free, but the participant has to register only for the learning platform.

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2 Learning Management Platform

2.1 AUTOMOTIVE SKILLS ALLIANCE (ASA) LEARNING PLATFORM

2.1.1 Access to the platform

The ALBATTS courses are located at the Automotive Skills Alliance (ASA) learning platform: https://learn.skills-framework.eu/. In order to access the course materials and attend the courses, the participant has to register for the course.

Once the participant is registered to the ASA Learning Platform, he/she can enrol in any of the ALBATTS courses.

2.1.2 Roles in the ASA platform

2.1.2.1 Student

A user with the Student role in the ASA Learning Platform can participate in course activities and view resources but cannot alter them or see the class gradebook.

When a student first joins, they see all available courses. Once they have enrolled or been enrolled into at least one course, they may only see their own courses in the "My Courses" section of the navigation block or via their dashboard.

2.1.2.2 Teachers

Teachers can do almost anything within a course, including adding or changing the activities and grading students. By default, teachers can also assign a Non-editing teacher role and a Student role to other users.

In order to assign a user to the role of a teacher in a course, the following steps have to be performed:

1. The user needs to register to the ASA Learning Platform

2. The user has to contact the administrator of the ASA Learning Platform in order to be assigned the role of a teacher.

2.1.2.3 Course Manager

In order to administer a course, the participant needs to have the role of a Teacher. With this role, typically, the person can:

- Update training materials
- Add reference materials such as articles, YouTube videos, and links to web pages.
- Administer the discussion forum, e.g. remove posts, add new topics
- Evaluate the feedback form and export data
- See the results of the self-assessment quiz
- See the registered participants

2.1.2.4 Site Administrator

Is to be contacted in case of issues with the course or in order to assign a teacher for a course.

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2.1.3 Moodle Learning Environment

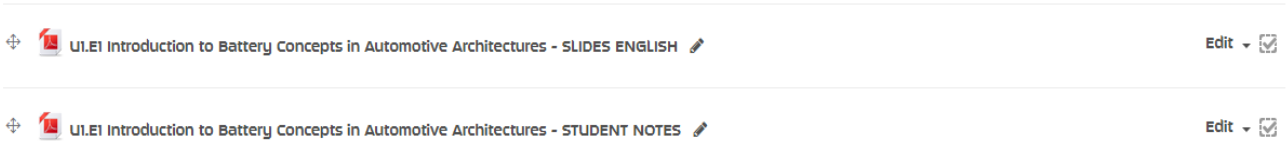
The ASA Learning Platform is based on the Moodle Learning Management System. Extensive documentation about Moodle and how to manage it is available at:

https://docs.moodle.org/39/en/Main_page

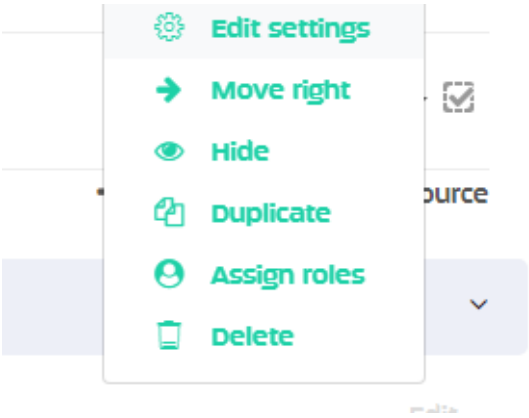
and on the Moodle YouTube Channel:

https://www.youtube.com/@moodle

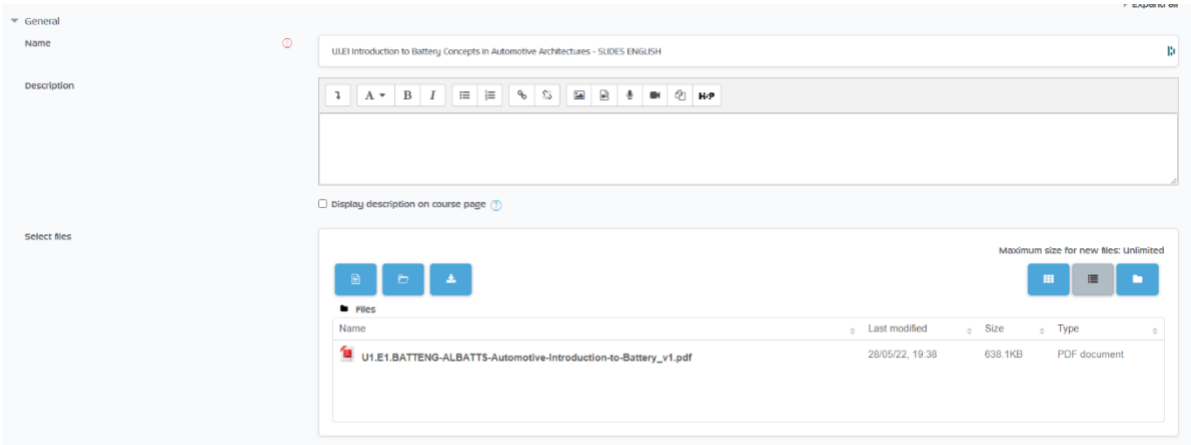
Next to the content which needs to be updated, e.g. training materials, an Edit possibility appears:



where the participant can edit the settings, hide, duplicate or delete the content:



With the edit settings option, the participant has the possibility to change/update the training materials (in our case, a PDF slide set).



By clicking on the file, additional options appear, such as renaming the file, changing the author, or deleting the file.

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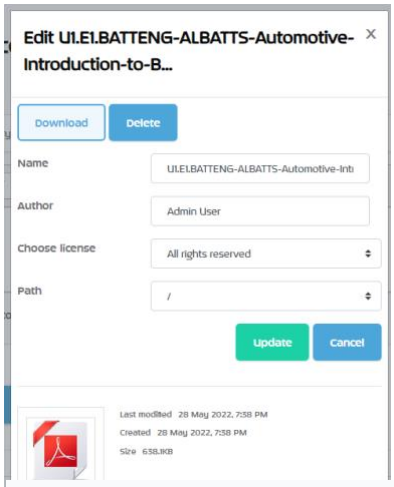
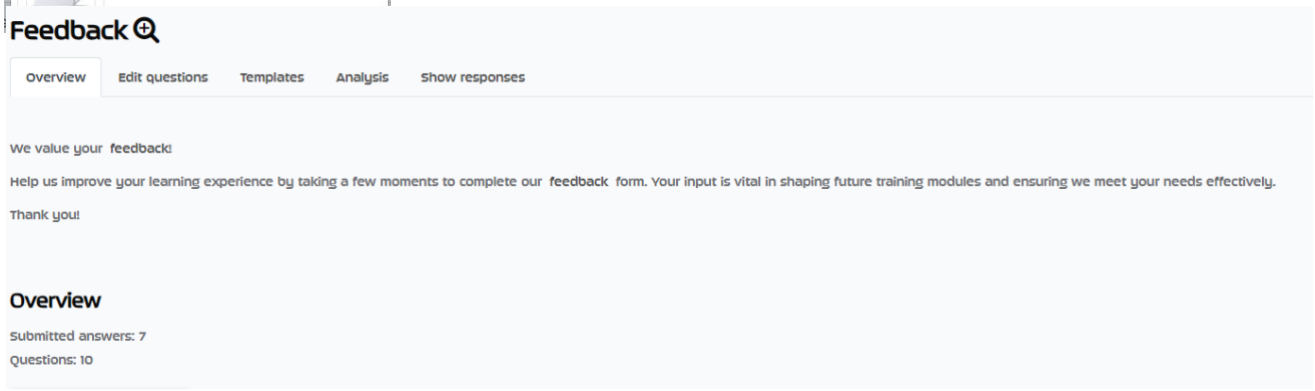


To update or add a new file, click on the upload icon  or drag and drop the file. You can remove the old file or set the new file as the main file.

Evaluation of the course

As a teacher, you can evaluate the course feedback by clicking on the feedback link and then selecting either Analysis or Show Responses.

With the Analysis option, the feedback can be exported easily to Excel.



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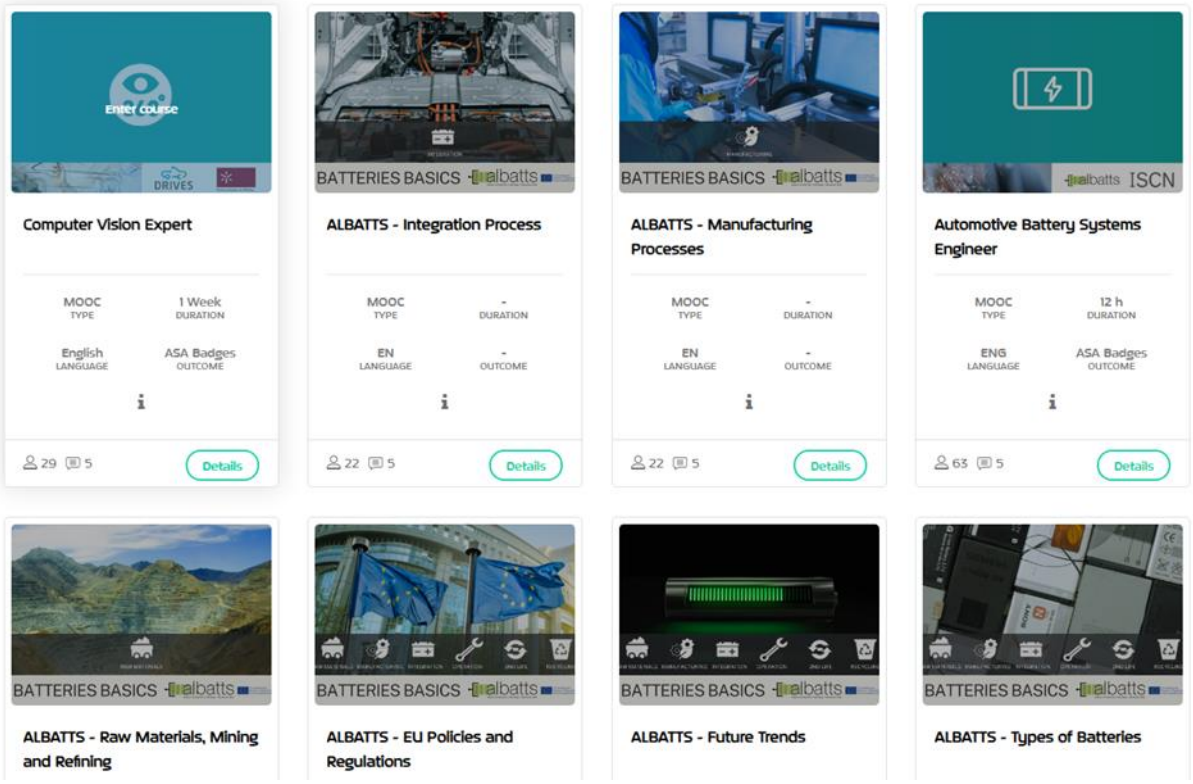
3 Courses in the ASA Learning Platform

The ASA Learning platform https://learn.skills-framework.eu/ contains several courses offered by the ASA. The battery-relevant courses are grouped into the Battery category.

In order to enrol in the courses, the participant has to register on the platform and manually enrol in the dedicated course. In the case of the Introduction course, each module of the course is configured as a separate course.

In order to administer a course, the participant needs to have the role of a Teacher or Manager. With this role, typically, the person can:

- Update training materials
- Add reference materials such as articles, YouTube videos, and links to web pages.
- Administer the discussion forum, e.g. remove posts, add new topics
- Evaluate the feedback form and export data
- See the results of the self-assessment quiz
- See the registered participants



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In the table below, it is possible to see the target groups, recommended prior knowledge and teaching methods recommended for each of the training courses developed by the ALBATTS project:

Table 1 Overview of ALBATTS' courses

Course	Target Group	Recommended prior knowledge	Teaching Method
Batteries basics	▪ Everyone wants to develop basic knowledge about the battery sector. ▪ No minimum EQF level is required. ▪ All job roles on the battery value chain are targeted.	▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills.	The course is designed for online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher.
English basic battery vocabulary	▪ Everyone who wants to develop basic battery vocabulary. ▪ No minimum EQF level is required. ▪ All job roles on the battery value chain are targeted. ▪ Specific units for Electricians, Automation, etc	▪ Basic English level (reading, writing and listening comprehension) ▪ Basic digital skills.	The course is designed for personal online learning.
Soft skills for the battery sector	▪ Teachers and trainers who want to help their students develop soft skills for the battery sector. ▪ The EQF level recommended is 6 or higher. ▪ Lower EQF levels may apply according to national requirements for being a teacher and/or trainer.	▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills.	The course is designed for personal online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher.
Batteries Safety	▪ Everyone who works within the battery and/or works with batteries and their materials and components. ▪ No minimum EQF level is required. ▪ All job roles on the battery value chain are targeted.	▪ Basic knowledge about batteries and the battery sector ▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills.	The course is designed for personal online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher.
Training machine operators for Northvolt Gigafactory	▪ Adults who want to work as machine operators in a battery plant (Gigafactory). ▪ The EQF level recommended is 4. ▪ Battery production operators' job roles on the battery value chain are targeted.	▪ Basic knowledge about batteries and the battery sector ▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills.	More so-called "blended learning" may be appropriate, as many learning tasks need equipment to practice skills, physically present instructors, etc.

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Course	Target Group	Recommended prior knowledge	Teaching Method
Automotive Battery Systems Engineer Course	▪ Students or workers in the automotive sector in a Research and Development department. ▪ Minimum bachelor level, master level preferred. ▪ Minimum five years of experience in the design of complex systems. ▪ EQF level 7 and 8, university degree required. ▪ HV Battery Requirements Engineer – E-Mobility, Battery Module Development Engineer and Battery Management System Engineer are examples of targeted job roles.	The participant should: ▪ Know the development process for an automotive mechatronic product. ▪ Be familiar with terms like system architecture, system testing, and validation. ▪	The course is designed for online teaching as it provides narrated slides. As the materials are also available in the form of a PowerPoint presentation, the course can also be taught in a face-to-face environment or blended learning.
Stationary applications course	▪ VET students. ▪ EQF levels recommended are 4 and 5. ▪ Planning, building, maintaining, servicing, and selling, among others, of battery-supported systems job roles are targeted.	▪ Basic knowledge about batteries and the battery sector ▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills ▪ Basic knowledge of electrical documentation	More so-called "blended learning" may be appropriate, as many learning tasks need equipment to practice skills, physically present instructors, etc.
Cell Preparation and Evaluation on a Lab-Scale	▪ VET students. ▪ EQF levels recommended are 4 and 5. ▪ Battery quality related job roles on the battery value chain are targeted.	▪ Basic knowledge about batteries and the battery sector ▪ Intermediate English level (reading, writing and listening comprehension) ▪ Basic digital skills ▪ Basic knowledge of lab working procedures	The course is designed for personal online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher, to include learning tasks in a lab.

Table 2 Links to courses available online

Course	Link
Batteries basics	The course is structured into different training units/modules, and each module is represented as its own course: Introduction to the battery sector https://learn.skills-framework.eu/course/view.php?id=56 Battery fundamentals https://learn.skills-framework.eu/course/view.php?id=71 Types of batteries

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Course	Link
	https://learn.skills-framework.eu/course/view.php?id=72 Future trends https://learn.skills-framework.eu/course/view.php?id=73 EU policies and regulations https://learn.skills-framework.eu/course/view.php?id=74 Integration Process https://learn.skills-framework.eu/course/view.php?id=92 Manufacturing processes https://learn.skills-framework.eu/course/view.php?id=76 Raw materials, mining and refining https://learn.skills-framework.eu/course/view.php?id=75 Batteries operation/applications https://learn.skills-framework.eu/course/view.php?id=93 Batteries second life and recycling https://learn.skills-framework.eu/course/view.php?id=94
English basic battery vocabulary	The course is structured into different training units/modules, and each module is represented as its own course: Battery English 1 - Terms and concepts https://learn.skills-framework.eu/course/view.php?id=96 Battery English 2 - Safety of batteries https://learn.skills-framework.eu/course/view.php?id=97 Battery English 3 – Quality https://learn.skills-framework.eu/course/view.php?id=98 Battery English 4 - Tools and equipment for electricians https://learn.skills-framework.eu/course/view.php?id=99 Battery English 5 - Tools and equipment for process operators https://learn.skills-framework.eu/course/view.php?id=100 Battery English 6 - Tools and equipment for automation and robotics https://learn.skills-framework.eu/course/view.php?id=102 Battery English 7 - Tools and equipment for maintenance https://learn.skills-framework.eu/course/view.php?id=101 Battery English 8 - Tools and equipment for logistics https://learn.skills-framework.eu/course/view.php?id=103
Soft skills for the battery sector	Soft skills course https://learn.skills-framework.eu/course/view.php?id=87

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Course	Link
Batteries Safety	The course is structured into different training units/modules, and each module is represented as its own course: Introduction to safety in batteries https://learn.skills-framework.eu/course/view.php?id=95 Battery Fires https://learn.skills-framework.eu/enrol/index.php?id=107 Electrical Safety https://learn.skills-framework.eu/enrol/index.php?id=106
Automotive Battery Systems Engineer Course	Automotive battery systems engineer https://learn.skills-framework.eu/course/view.php?id=57
Stationary applications course	Batteries stationary applications https://learn.skills-framework.eu/course/view.php?id=91
Cell Preparation and Evaluation on a Lab-Scale	Cell Preparation and Evaluation on a Lab-Scale https://learn.skills-framework.eu/enrol/index.php?id=89

3.1 BATTERIES BASICS COURSE

The batteries basics course gives an overview of battery technology and its value chain and can be used as an introduction course to anyone working or studying in the field.

It comprehends 10 different training units that can be delivered individually or combined to create different introductory approaches according to the different training paths.

Target Group

This course and all its training units address everyone who wants to develop basic knowledge about the battery sector, targeting all job roles on the battery value chain. No minimum EQF level is required.

Recommended prior knowledge

Participants should have intermediate English level (reading, writing and listening comprehension) and basic digital skills.

Teaching Method

The course is designed for personal online learning. However, the course can also be delivered in a face-to-face environment or as blended learning led by a teacher.

Course Structure and Training Materials

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The Batteries Basic Course incorporates the different training units:

- Introduction to the Battery Sector
- Battery Fundamentals
- Types of Batteries
- Future Trends
- EU Policies and Regulations
- Raw Materials, Mining and Refining
- Manufacturing Processes
- Integration Process
- Operation/Applications
- Recycling & Second life

Each training unit has its own Moodle Topics organised per learning outcome where all relevant training materials are stored.

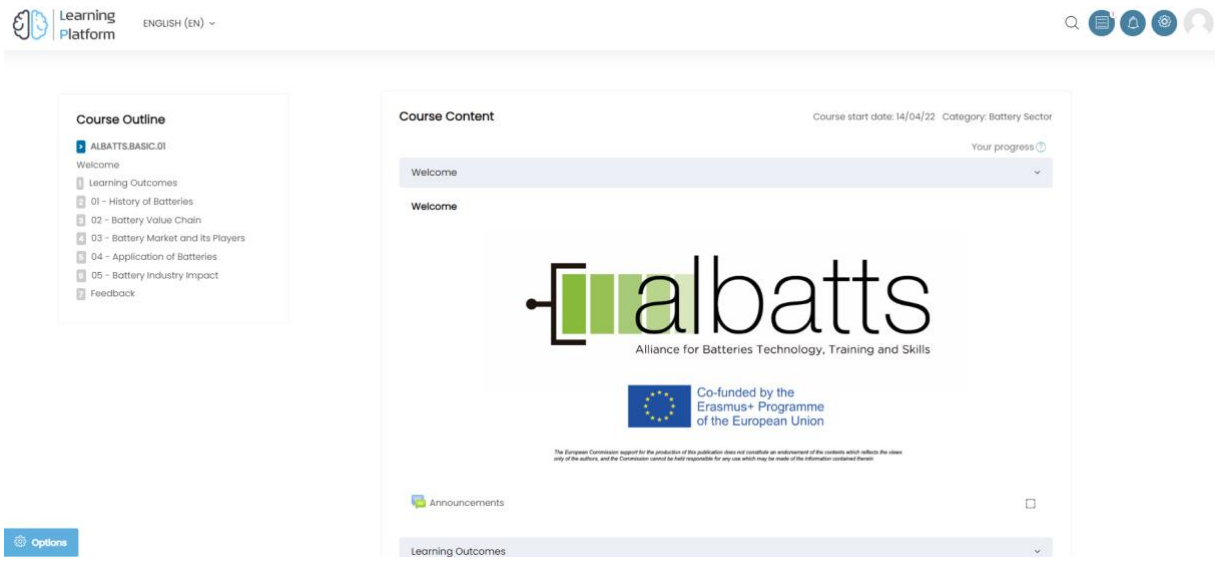

Figure 4: Example for the Training Unit on Introduction to the Battery Sector

For each learning outcome, a SCORM file was developed, and the participant could interactively go through each of them.

Figure 5: Example for the Learning element on the History of Batteries

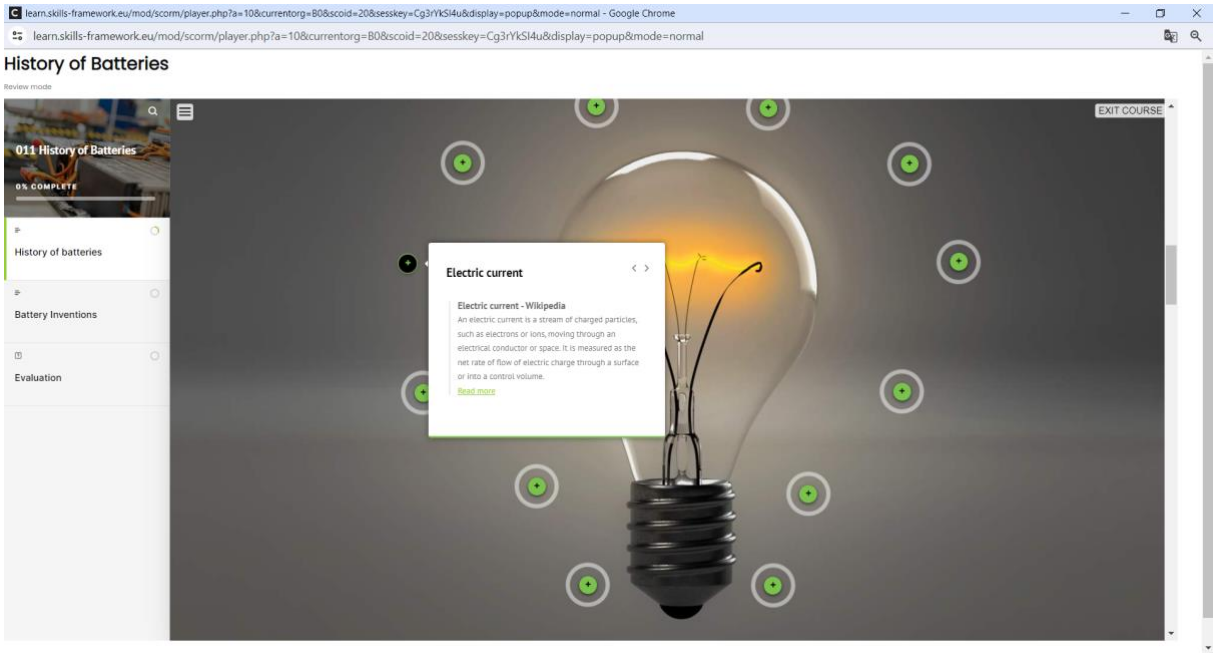

Figure 6: Example of the training materials

In addition, and where relevant, reference materials such as videos, articles or other freely available activities are added directly to the SCORM files.

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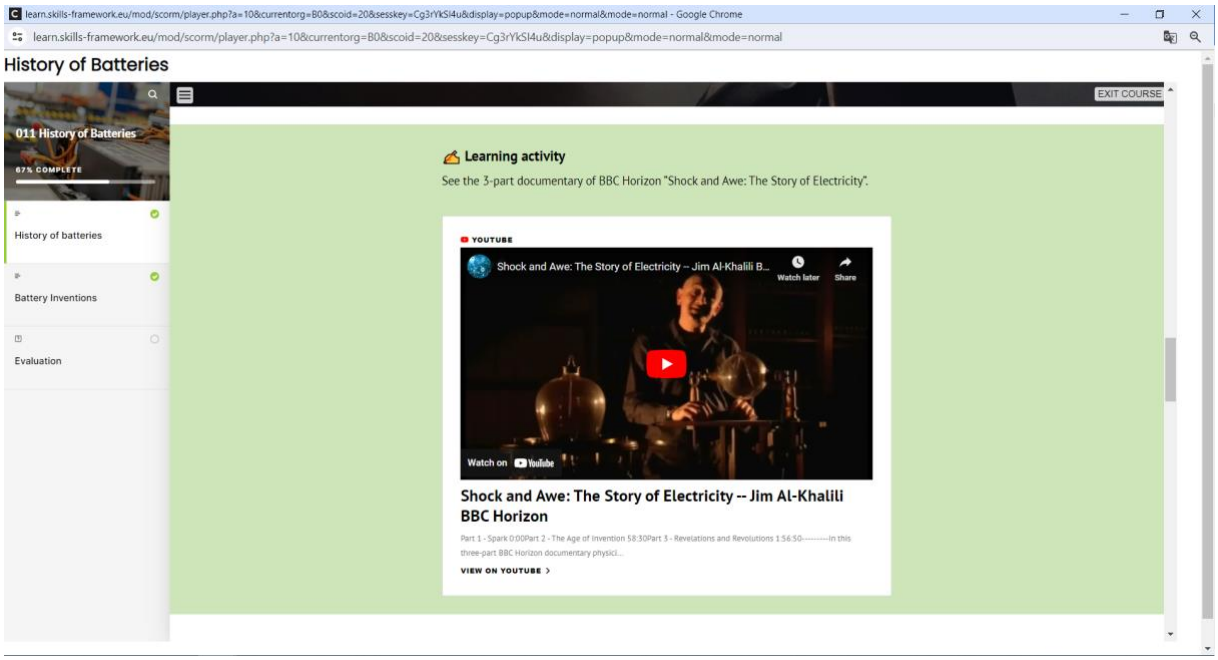

Figure 7: Additional materials

Each SCORM file also includes a final evaluation quiz to help the participant recap the information and check his knowledge.

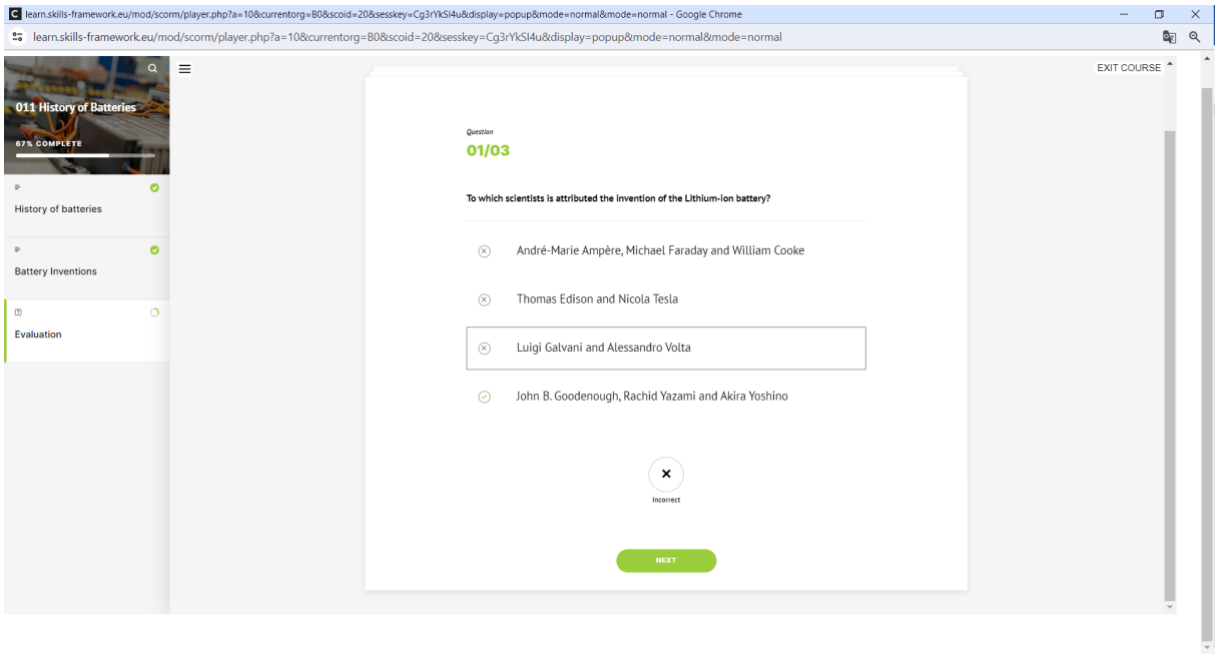

Figure 8: Example of the quiz

3.2 ENGLISH BASIC BATTERY VOCABULARY

The online English course is designed specifically for individuals working within or with the battery sector and related fields, catering to professionals seeking to enhance their industry-

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specific language skills and technical communication. No previous knowledge of the batteries or sectors' value chain is required, nor is a specific EQF level required. The course is divided into modules where the first three modules are common to all: basic battery, safety, and quality vocabularies are introduced in these modules. After these are completed, the student chooses a module of their choice. The modules that may be chosen are related to different areas and professions within the battery sector:

Battery English 4 – Tools and equipment for electricians

Battery English 5 – Tools and equipment for process operators

Battery English 6 – Tools and equipment for automation and robotics

Battery English 7 – Tools and equipment for maintenance

Battery English 8 – Tools and equipment for logistics

The English course is designed for personal online learning courses but may also be used as learning material in a face-to-face environment or blended learning led by the teacher.

Target group

Everyone who is interested in the battery industry and in enhancing their industry-specific language skills and technical communication. For those working in the battery industry or those who intend to move into the battery industry, the course will provide a good basis for the necessary language skills.

Recommended prior knowledge

Basic English level in reading, writing, and listening comprehension is required, and basic digital skills for the course completion are required.

Teaching method

This course is crafted to cater to a variety of learning preferences, offering a comprehensive, self-paced online learning experience. It is designed to function seamlessly as a standalone resource for individual learners, as well as integrate smoothly into synchronous teaching settings and blended learning curriculums. It is tailored especially for self-paced learning, where learners can progress through modules and receive immediate feedback on their tasks. This method is good for those needing flexibility in timing and paced learning, allowing students to apply learning techniques best suited for them.

The course may also be used as an effective workbook for teachers leading live, synchronous classes. This adaptability makes it an excellent resource for teachers looking to enrich their

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classroom interactions with prepared, structured content. For environments that blend self-paced and instructor-led learning, this course offers a seamless integration of both approaches. Instructors can assign modules as homework to be reviewed asynchronously and then use class time for interactive discussions, group projects, or deeper exploration of complex topics. This hybrid approach enhances learning by combining independent study with collaborative educational experiences.

Course structure and training materials

The course is constructed in a modular fashion, where the first three modules form the basics of battery vocabulary:

- Battery English 1 – Terms and concepts
- Battery English 2 – Safety of batteries
- Battery English 3 – Quality

After these modules, the student choose the module of the field they want to study further:

- Battery English 4 – Tools and equipment for electricians
- Battery English 5 – Tools and equipment for process operators
- Battery English 6 – Tools and equipment for automation and robotics
- Battery English 7 – Tools and equipment for maintenance
- Battery English 8 – Tools and equipment for logistics

Each module has its own Moodle Topics, which store all relevant training materials.

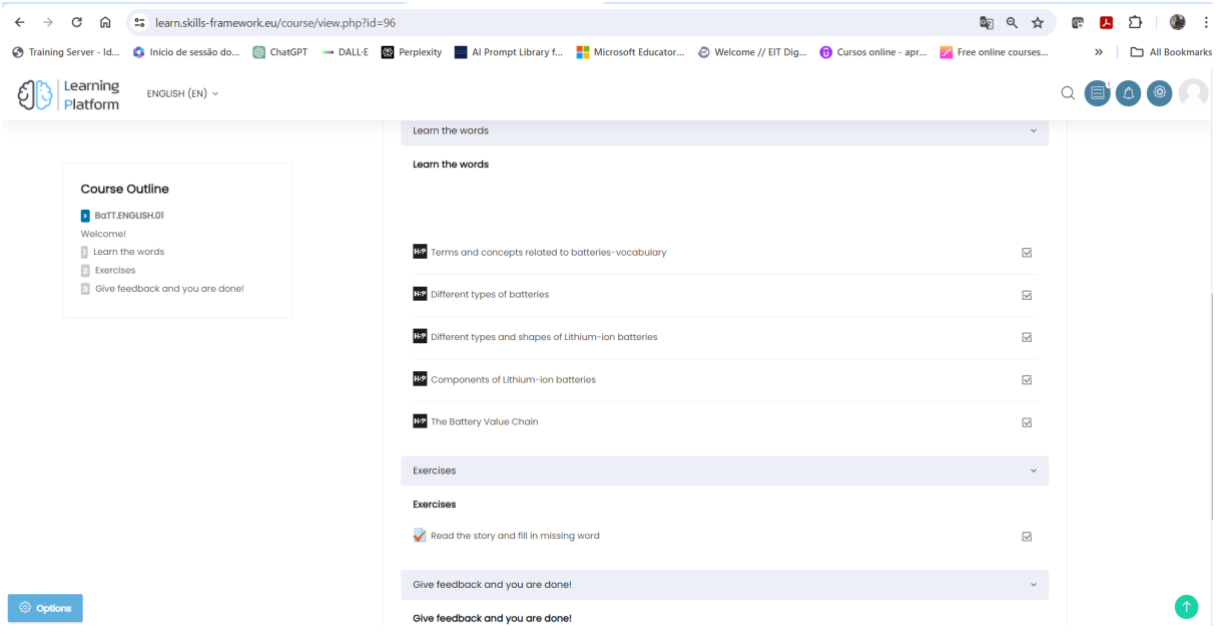

Figure 9: Example for the Module on Terms and Concepts

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Each module is constructed so that first, the new vocabulary is introduced in a way that a word, related explanation, picture, and an example of the word's pronunciation are given simultaneously. Students are allowed to use as much time and practice sessions as needed to achieve the learning outcomes.

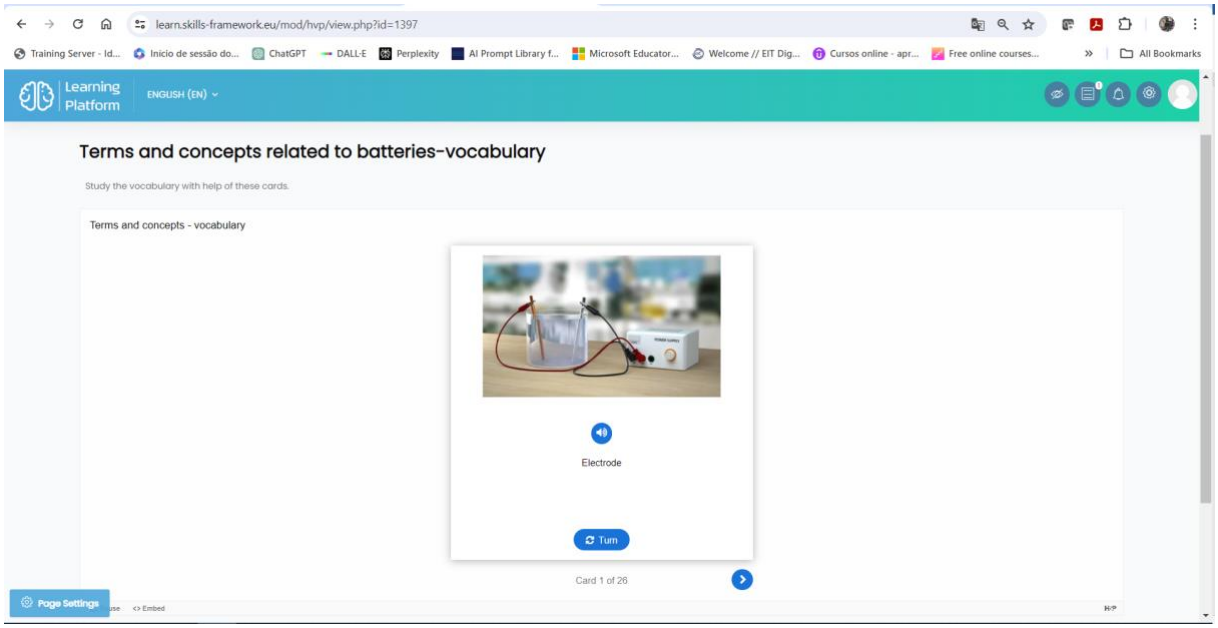

Figure 10: Example of the training materials

After this, the student may test his/her learning with tests where feedback is given simultaneously.

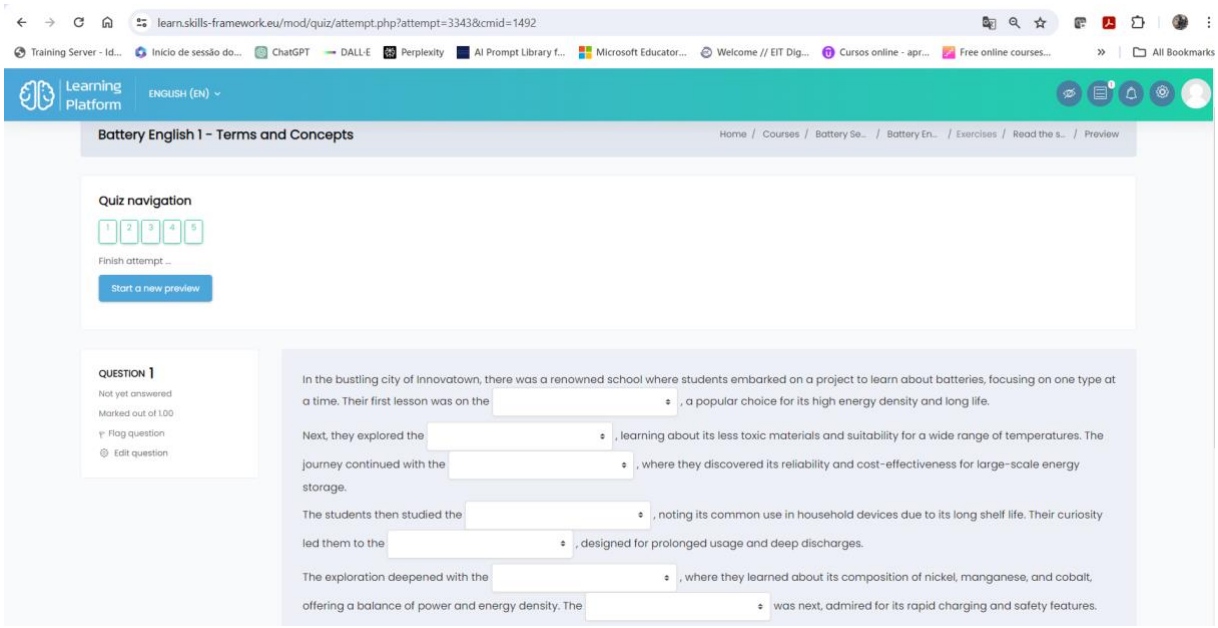

Figure 11: Example of the quiz

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3.3 SOFT SKILLS FOR THE BATTERY SECTOR

The soft skills for the battery sector course comprehend a wide range of learning material for teachers and trainers to capacitate them to help develop soft skills in young people and employees.

It gathers content for teachers and trainers to develop their knowledge around soft skills for the battery sector, as well as tools and exercises that they can use in class to develop their students' soft skills.

Target Group

This course addresses all teachers and trainers who want to help their students develop soft skills for the battery sector.

The EQF level recommended is 6 or higher. However, lower EQF levels may apply, according to national requirements for being a teacher and/or trainer.

Recommended prior knowledge

Participants should have intermediate English level (reading, writing and listening comprehension) and basic digital skills.

Teaching Method

The course is designed for self-directed online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher.

Course Structure and Training Materials

The Soft Skills for the Battery Sector Course includes technical content and additional resources that teachers and trainers may use in their classes, according to the objectives and scope of the training.

The course has its own Moodle Topics organised where all relevant training materials are stored.

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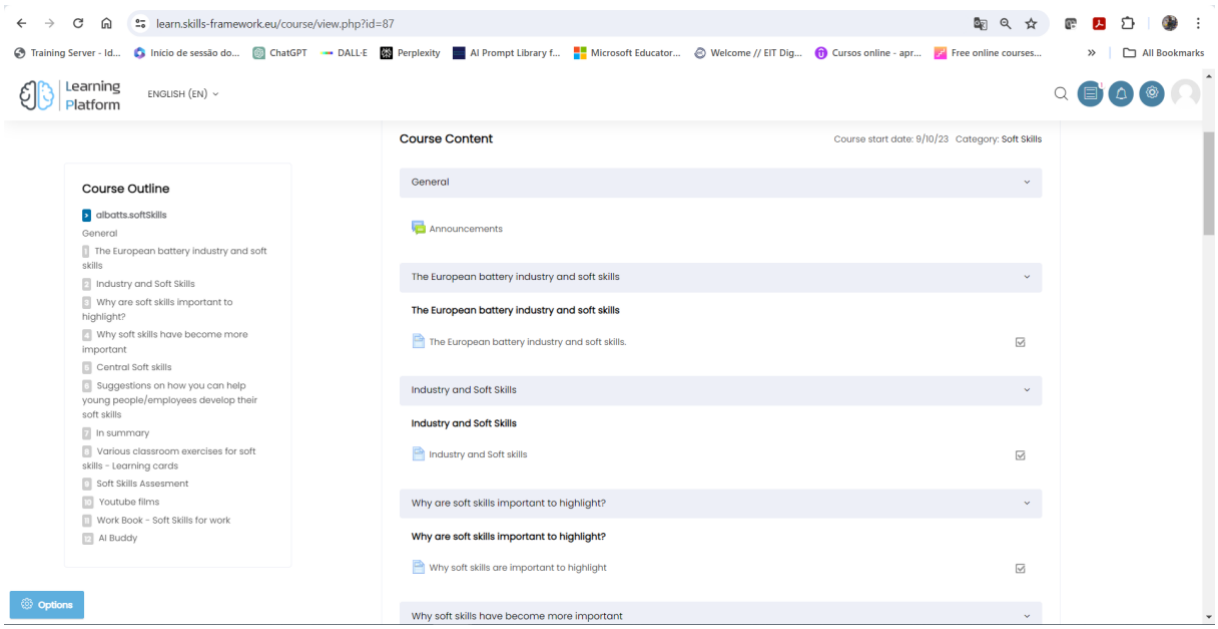

Figure 12: Structure of the Soft Skills for the Battery Sector Course in Moodle

The participant can go through each of the topics directly in Moodle.

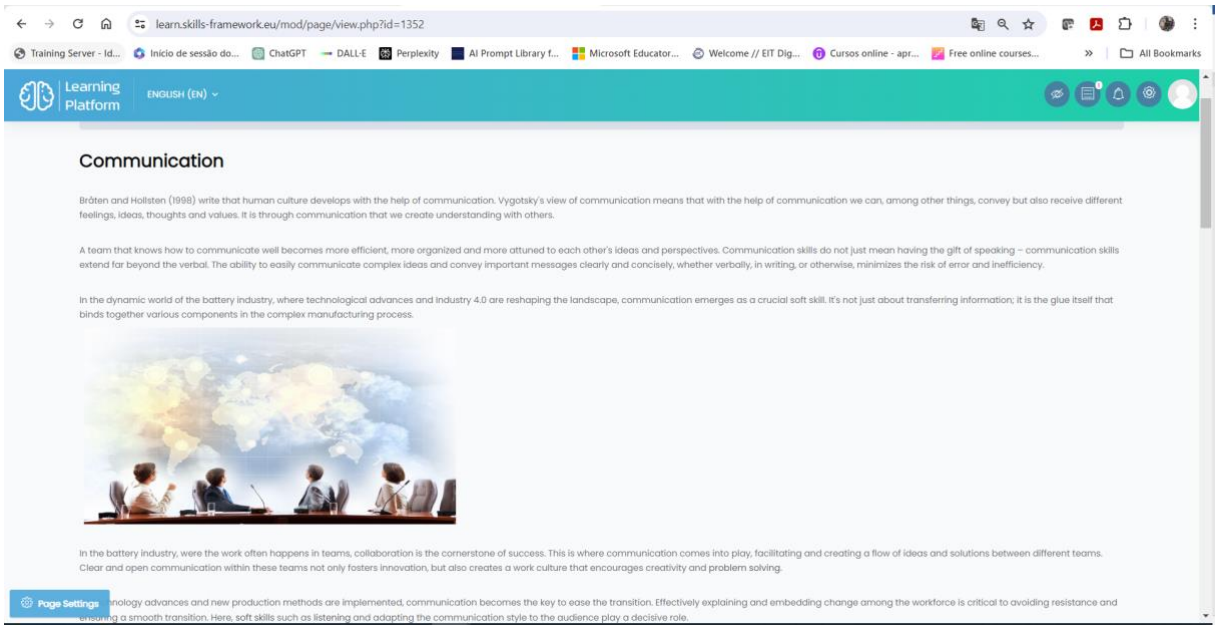

Figure 13: Example of the training materials

In addition, reference materials such as videos, classroom exercises, workbooks, and an Artificial Intelligence buddy test have been added to further facilitate the development of soft skills in class.

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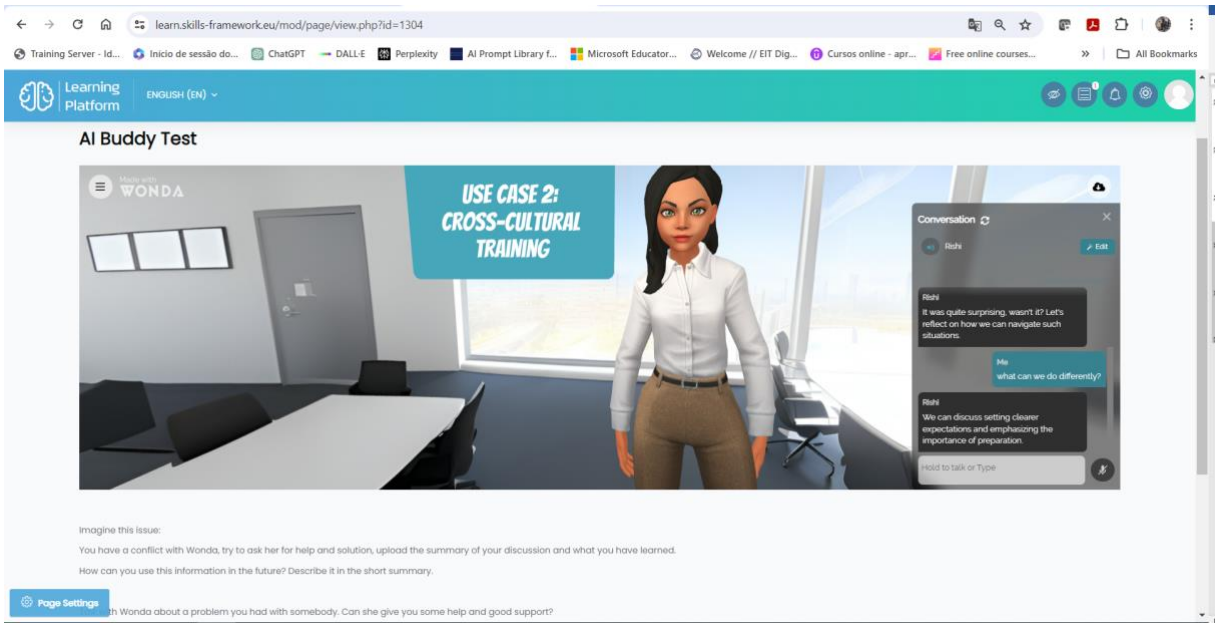

Figure 14: Additional materials

3.4 BATTERIES SAFETY COURSE

The course is aimed at anyone working in the battery sector and related fields. It is constructed in a way that basic knowledge of batteries and their value chain is assumed as background knowledge, but no minimum EQF level is required. The course content includes an overall view of different stages of the battery value chain while also diving a bit deeper into marine and EV applications. It is designed for personal online learning courses but may also be used as learning material in a face-to-face environment or blended learning led by the teacher.

Target group

All those interested in the battery industry and battery safety. For those working in the battery industry or those who intend to move into the battery industry, the course will provide a good basis for the necessary safety knowledge.

Recommended prior knowledge

Participants should have basic knowledge about batteries and the battery sector, along with intermediate English level (reading, writing and listening comprehension) and basic digital skills.

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Teaching method

This course is crafted to cater to a variety of learning preferences, offering a comprehensive, self-paced online learning experience. It is designed to function seamlessly as a standalone resource for individual learners, as well as integrate smoothly into synchronous teaching settings and blended learning curriculums. It is tailored especially for self-paced learning, where learners can progress through modules and receive immediate feedback on their tasks. This method is good for those needing flexibility in timing and paced learning, allowing students to apply learning techniques best suited for them.

The course may also be used as an effective workbook for teachers leading live, synchronous classes. This adaptability makes it an excellent resource for teachers looking to enrich their classroom interactions with prepared, structured content. For environments that blend self-paced and instructor-led learning, this course offers a seamless integration of both approaches. Instructors can assign modules as homework to be reviewed asynchronously and then use class time for interactive discussions, group projects, or deeper exploration of complex topics. This hybrid approach enhances learning by combining independent study with collaborative educational experiences.

Course structure and training materials

The Batteries Safety Course incorporates the different training units:

- Introduction to Safety in Batteries
- Electrical Safety
- Battery Chemicals
- Battery Fires

Each training unit has its own Moodle Topics organised per learning outcome where all relevant training materials are stored.

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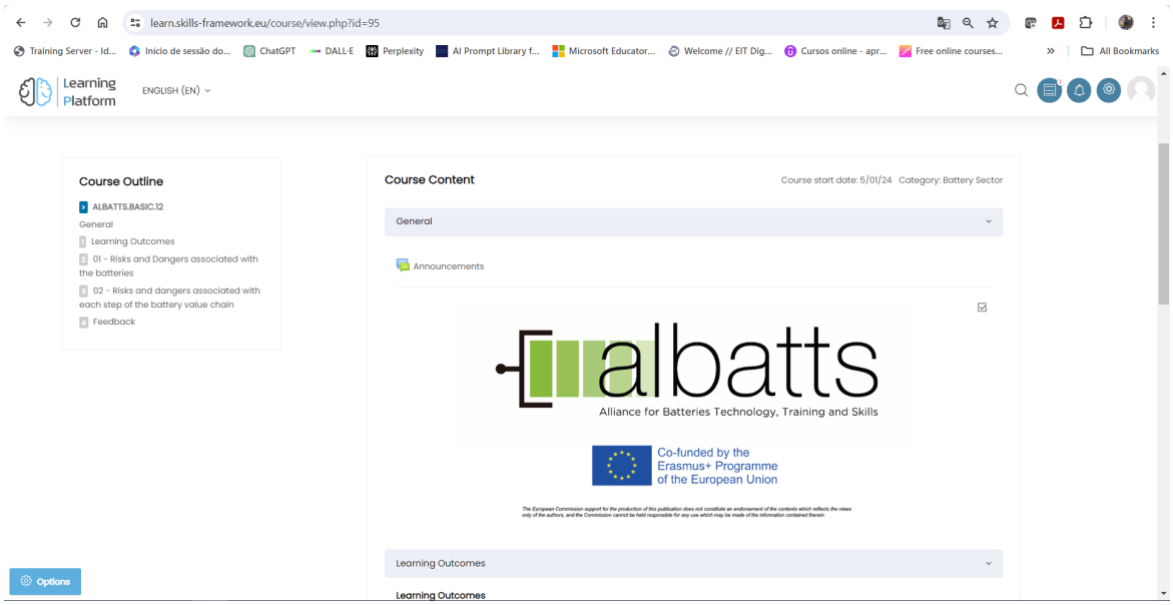

Figure 15: Example for the Training Unit on Introduction to Safety in Batteries

For each learning outcome, a SCORM file was developed, and the participant could interactively go through each of them.

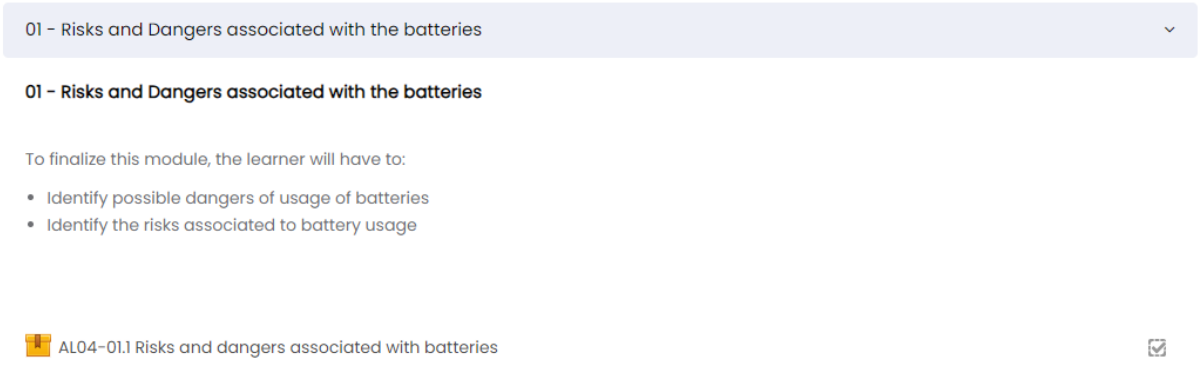

Figure 16: Example for the Learning element on Risks and Dangers associated with batteries

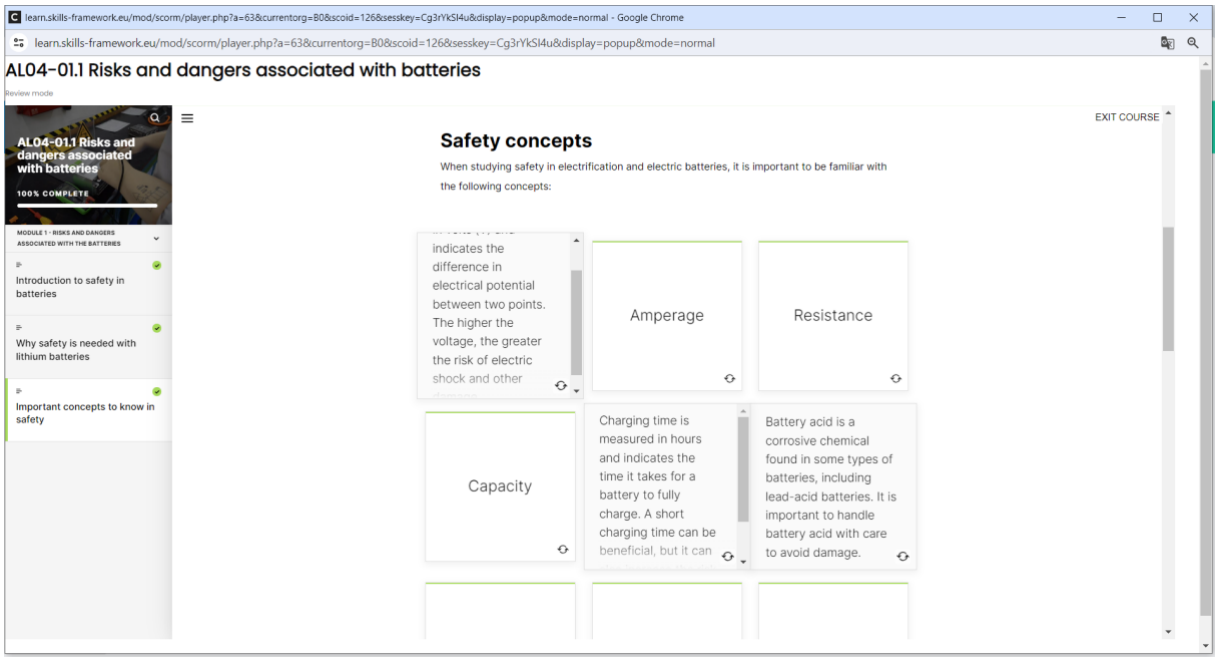

Figure 17: Example of the training materials

In addition, and where relevant, reference materials such as videos, articles or other freely available activities are added directly to the SCORM files.

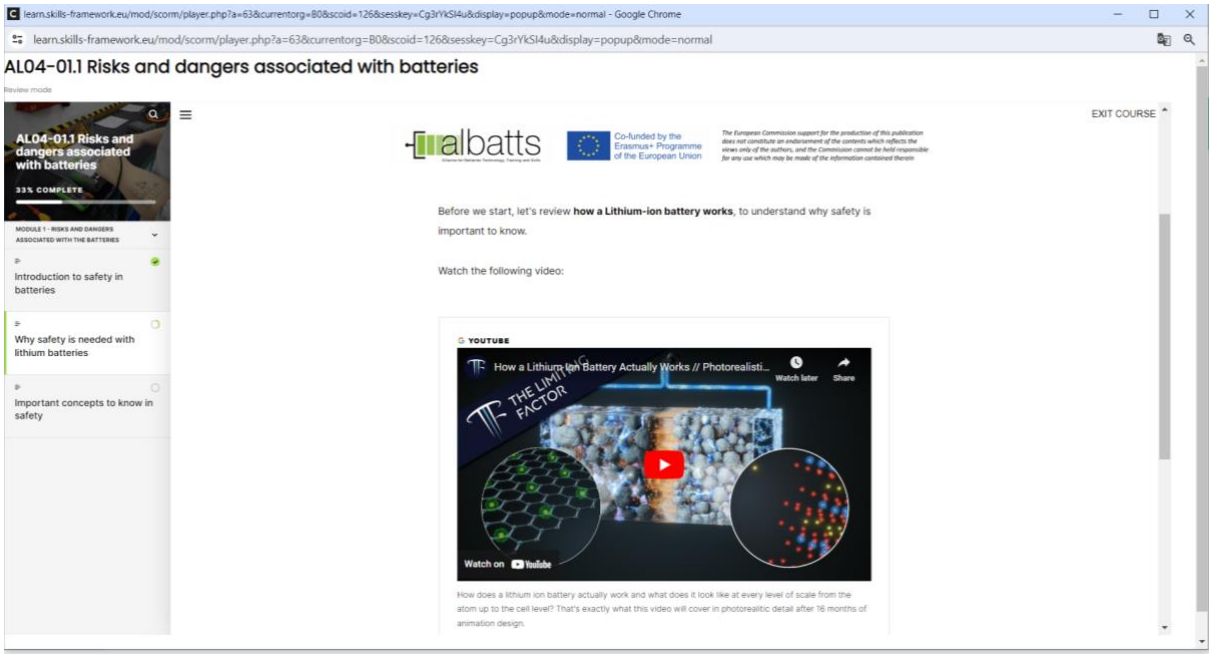

Figure 18: Additional materials

Each SCORM file also includes a final evaluation quiz to help the participant recap the information and check his knowledge.

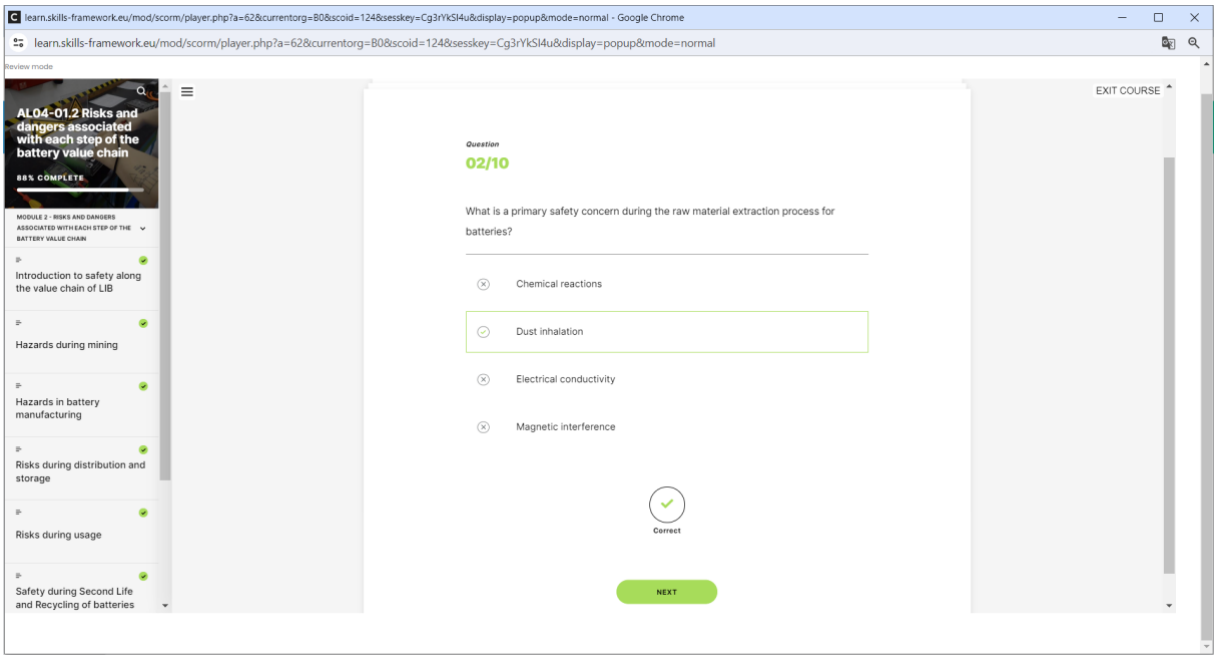

Figure 19: Example of the quiz

3.5 BATTERIES STATIONARY APPLICATIONS

This course will broadly cover a range of subjects, including battery storage developments, applications, safety, and business opportunities. This course will provide students with an in-depth understanding of energy storage solutions by gaining insight into how to design, obtain and maintain battery energy storage systems, i.e., from sourcing and utilising to recycling.

Target Group

This course addresses EQF levels 4 and 5 VET students, targeting planning, building, maintaining, servicing, and selling, among others, of battery-supported systems job roles.

Recommended prior knowledge

Participants should have basic knowledge about batteries and the battery sector, along with intermediate English level (reading, writing and listening comprehension) and basic digital skills.

Teaching Method

More so-called "blended learning" may be appropriate, as many learning tasks need equipment to practice skills, physically present instructors, etc.

Course Structure and Training Materials

The Batteries Stationary Applications Course is organised according to its different learning outcomes and has its own Moodle Topics organised where all relevant training materials are stored.

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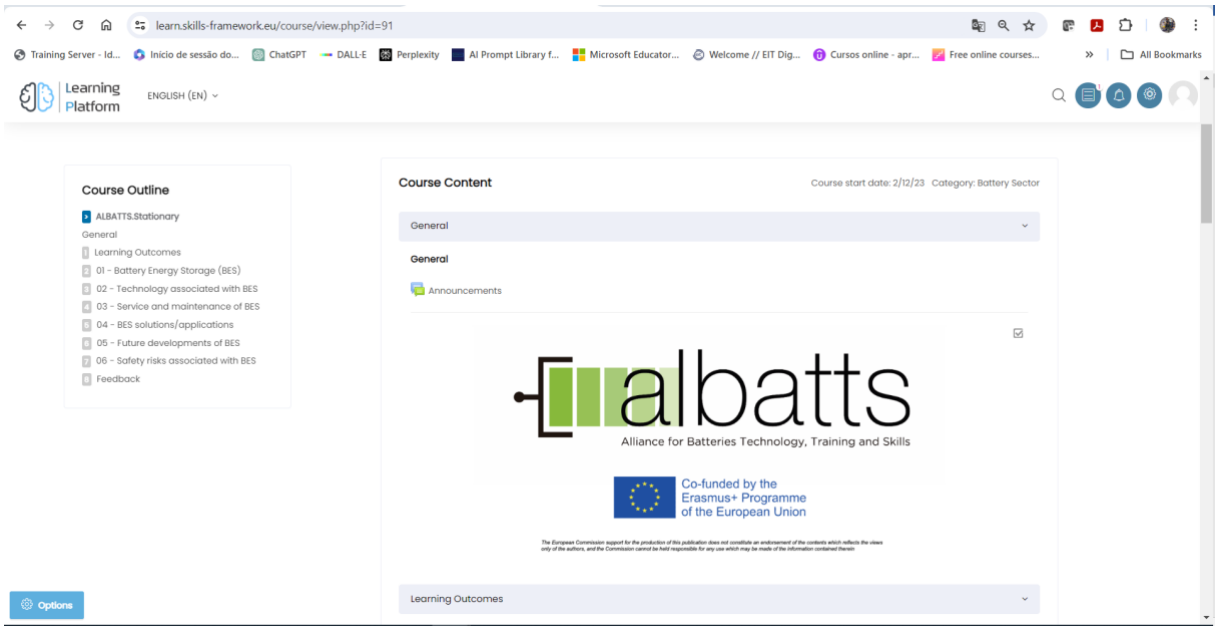

Figure 20: Structure of the Batteries Stationary Applications Course in Moodle

For each learning outcome, a set of theoretical content complemented with exercises is available.

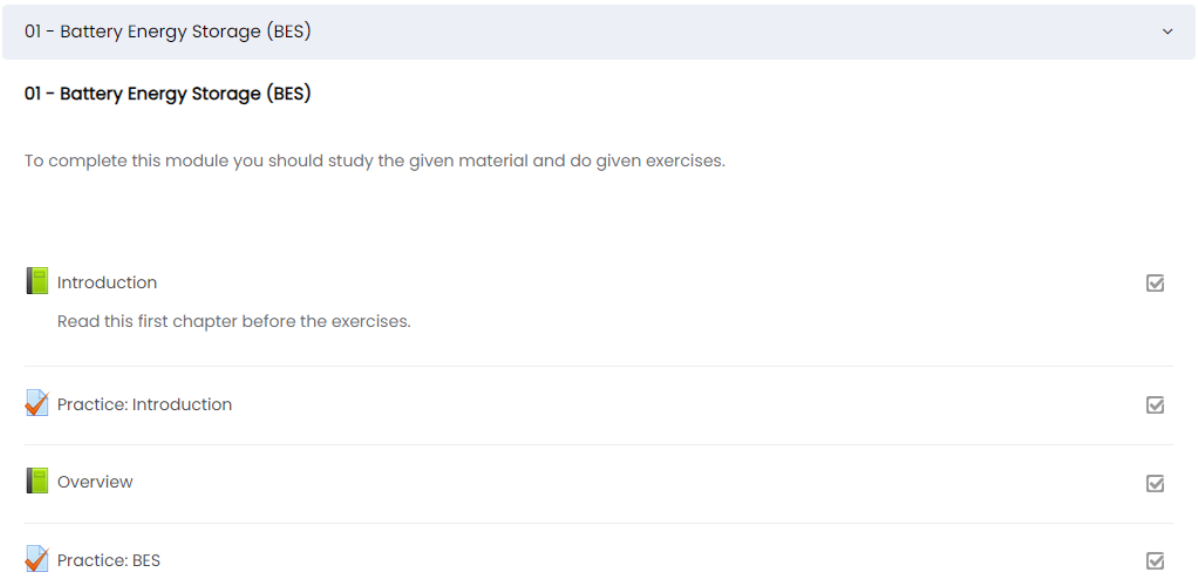

Figure 21: Example of the Learning element on Battery Energy Storage (BES)

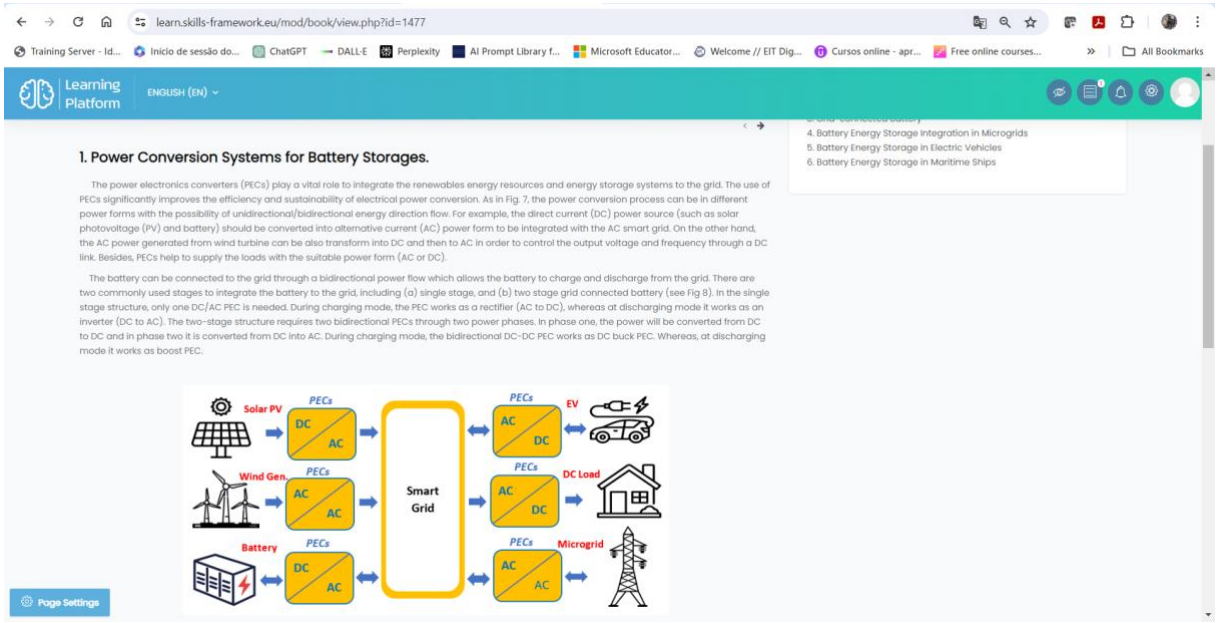

Figure 22: Example of the training materials

The practical exercises in the form of quizzes help the participant recap the information and check his knowledge.

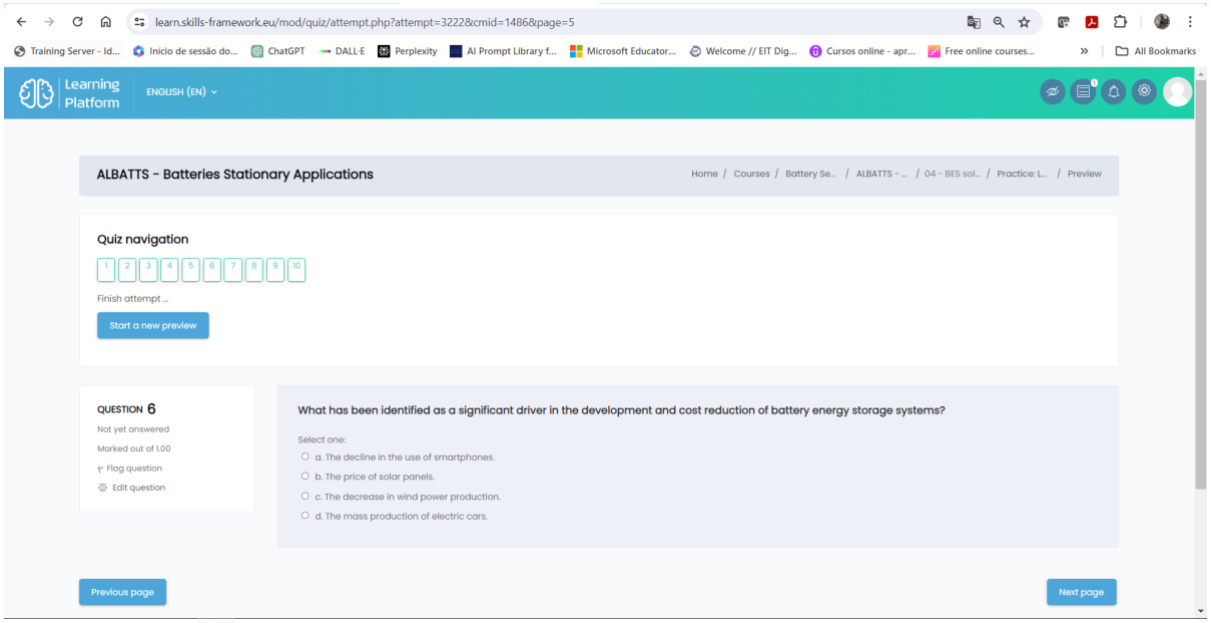

Figure 23: Example of the quiz

3.6 AUTOMOTIVE BATTERY SYSTEMS ENGINEER COURSE

The Automotive Battery System Engineer Course is targeted at system and software engineers from the automotive sector, coping with the development of whole battery systems as well as dedicated battery management systems. The course highlights the importance of functional safety and cybersecurity aspects in the development of battery management systems, as well as the testing and homologation procedures for battery packs and systems.

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Target Group

The course addresses new job role descriptions in the automotive industry. The skill level in car makers is defined as "minimum bachelor level, master level preferred, minimum 5 years' experience in the design of complex systems". Also, car makers search for PhDs from technical universities that are involved in battery design and development.

EQF level 7 and 8, university degree required.

Example job roles in one of the representative car makers:

- HV Battery Requirements Engineer – E-Mobility
- Battery Module Development Engineer
- Battery Management System Engineer

Recommended prior knowledge

The course is targeted at students or workers in the automotive sector in a Research and Development department. The participant should know the development process for an automotive mechatronic product and be familiar with terms like system architecture, system testing, and validation.

Teaching Method

The course is designed for online teaching as it provides narrated slides. As the materials are also available in the form of a PowerPoint presentation, the course can also be taught in a face-to-face environment or as blended learning.

Course Structure and Training Materials

The Automotive Battery Systems Engineer Course has the following structure:

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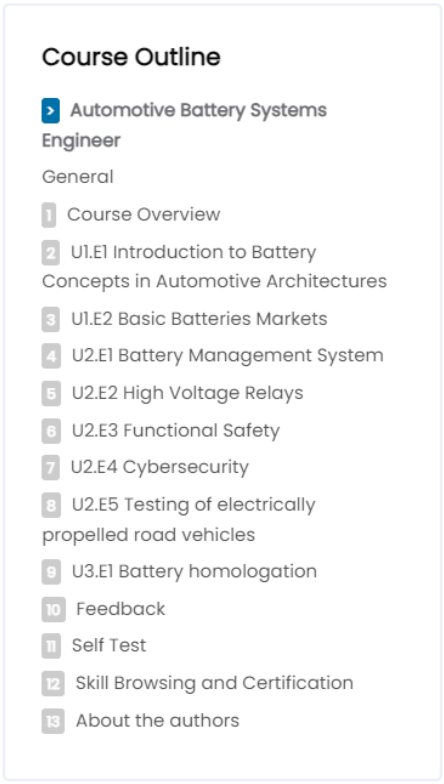

Each learning element has its own Moodle Topic, which stores all relevant training materials. For each learning element, a set of PowerPoint slides have been prepared and converted/narrated to mp4 videos. The participant can either go through the slides or listen to the explanations of each slide done in the narrated videos.

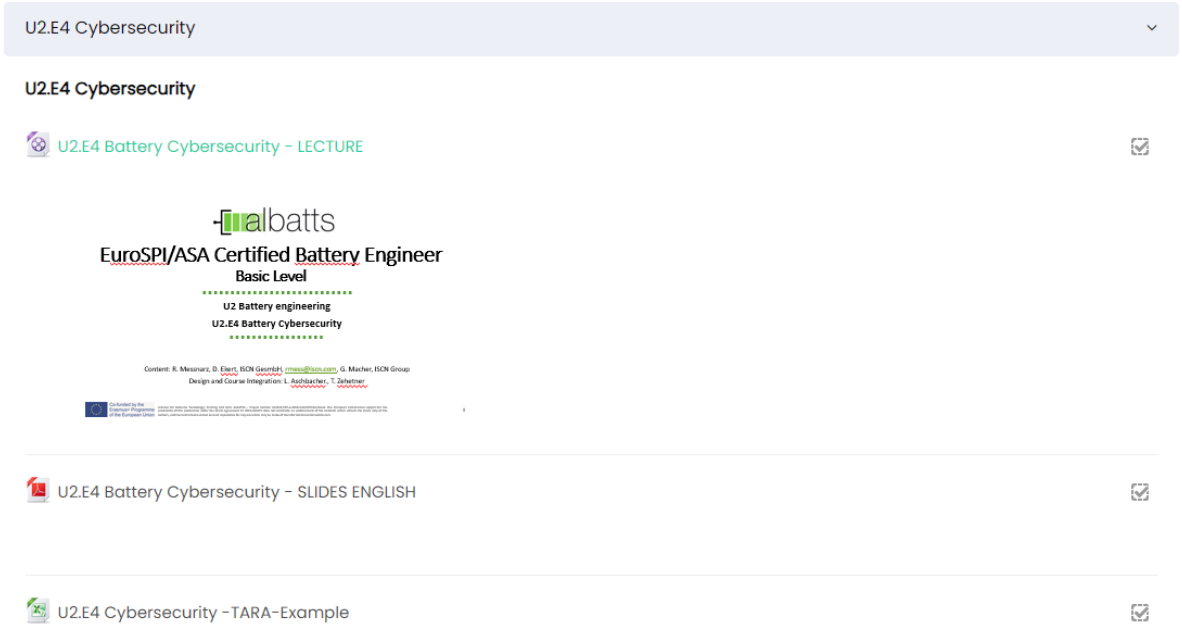

Figure 24: Example for the Learning element on Cybersecurity

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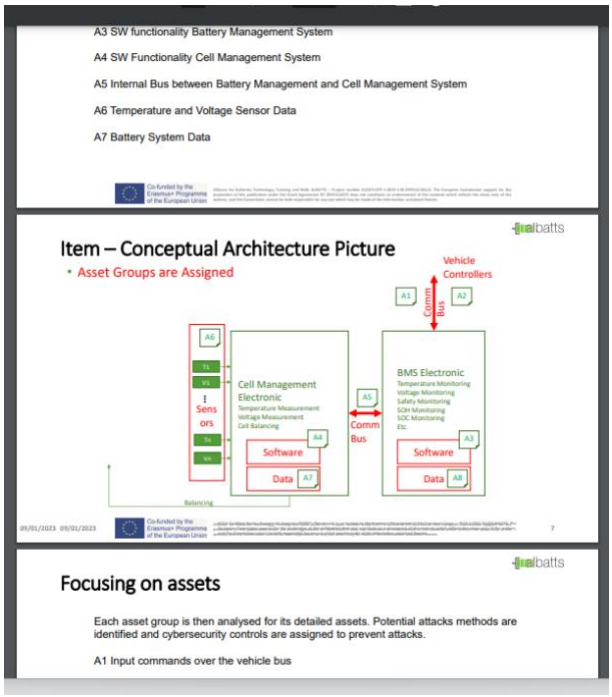

Figure 25: Example of the training materials

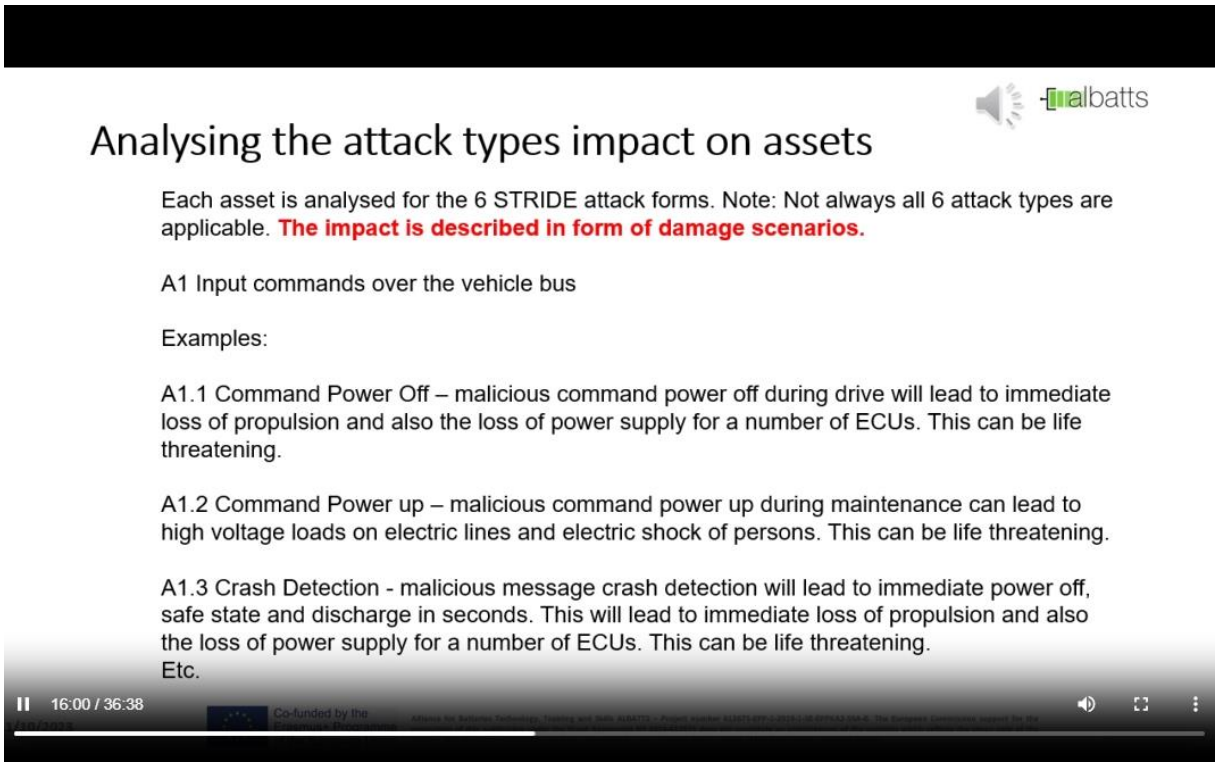

Figure 26: Example of a narrated video for the learning element of Cybersecurity

In addition, where relevant reference materials are added:

- Templates for performing a task (e.g. TARA or HARA)
- Articles and publication
- YouTube videos

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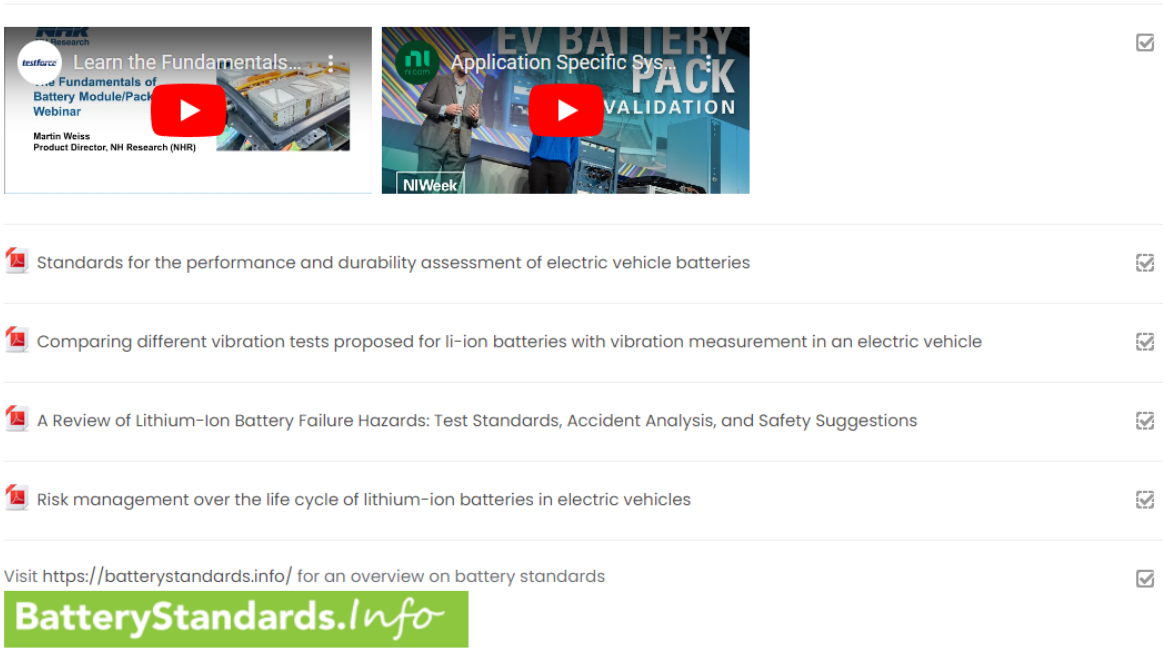
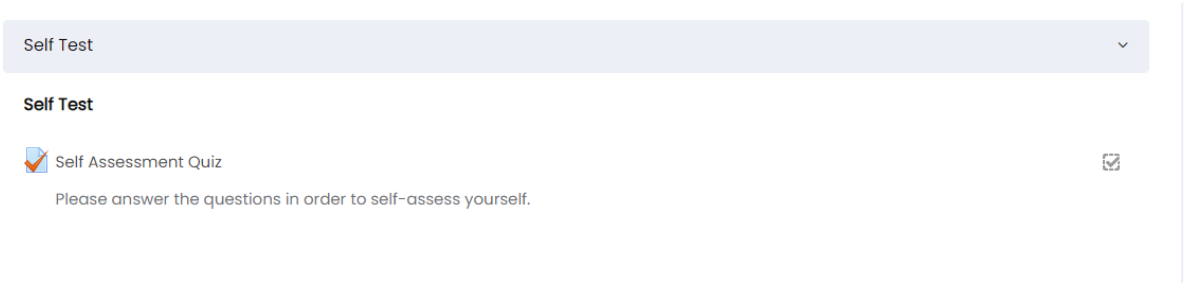


Figure 27: Additional materials

The course also includes a self-test to help the participant recap the information and check his knowledge.



In total, 15 questions are asked:

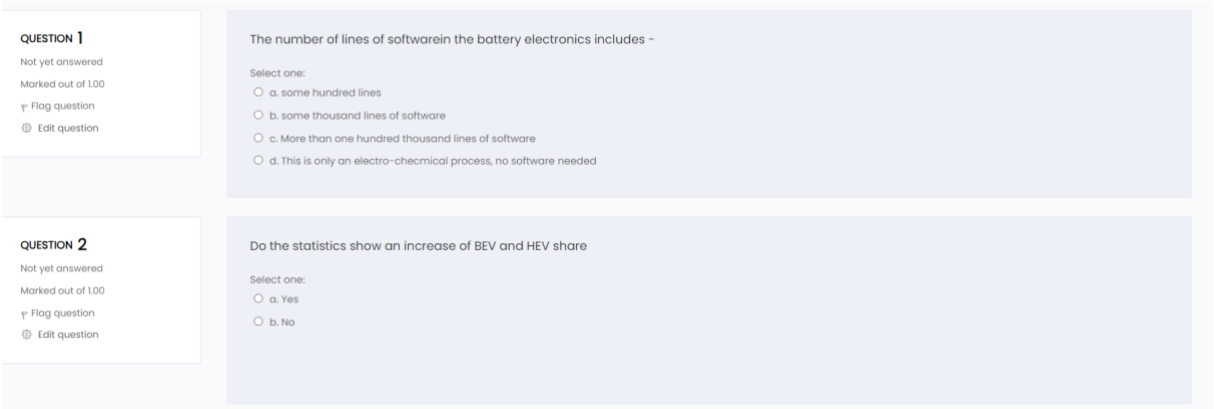


Figure 28: Example of the self-test

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3.7 CELL PREPARATION AND EVALUATION ON A LAB-SCALE

The Cell Preparation and Evaluation on a Lab-Scale course provides a comprehensive understanding of various aspects related to electrode materials and battery technology by exploring fundamental and applied methodologies, including battery production, characterization, manufacturing, and testing on a laboratory scale.

Target Group

This course addresses EQF levels 4 and 5 VET students, targeting battery quality related job roles on the battery value chain.

Recommended prior knowledge

Participants should have basic knowledge about batteries and the battery sector, along with intermediate English level (reading, writing and listening comprehension) and basic digital skills. Additionally, participants should also have basic knowledge of lab working procedures.

Teaching Method

The course is designed for personal online learning. However, the course can also be delivered in a face-to-face environment or blended learning, led by a teacher, to include learning tasks in a lab.

Course Structure and Training Materials

The Cell Preparation and Evaluation on a Lab-Scale Course is organised according to its different learning outcomes and has its own Moodle Topics organised where all relevant training materials are stored.

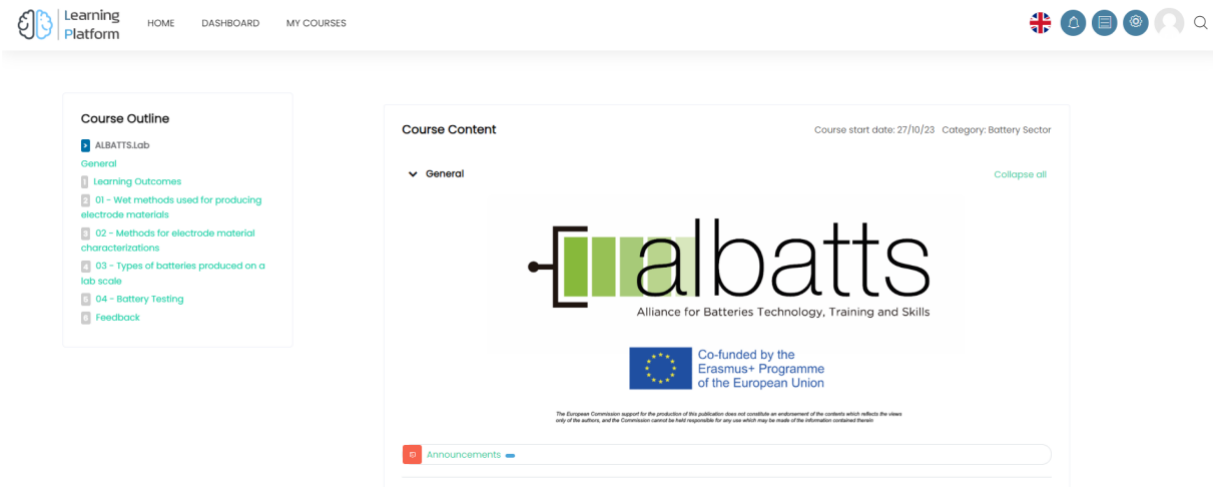

Figure 29: Example for the Training Unit on Introduction to the Battery Sector

For each learning outcome, a SCORM file was developed, and the participant could interactively go through each of them.

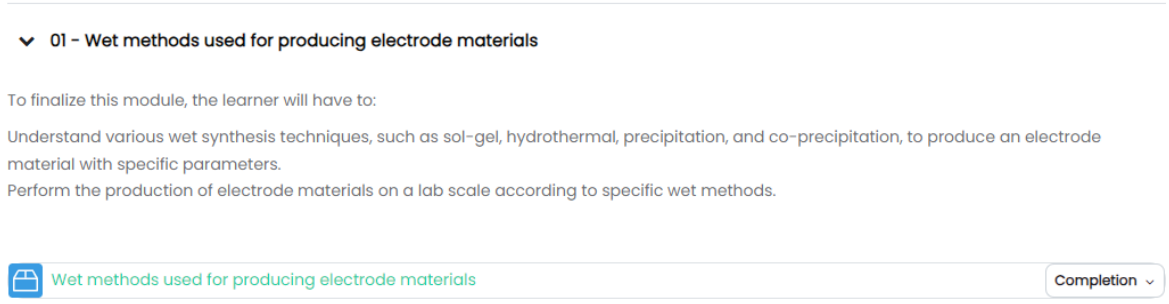

Figure 30: Example for the Learning element on the Wet methods used for producing electrode materials

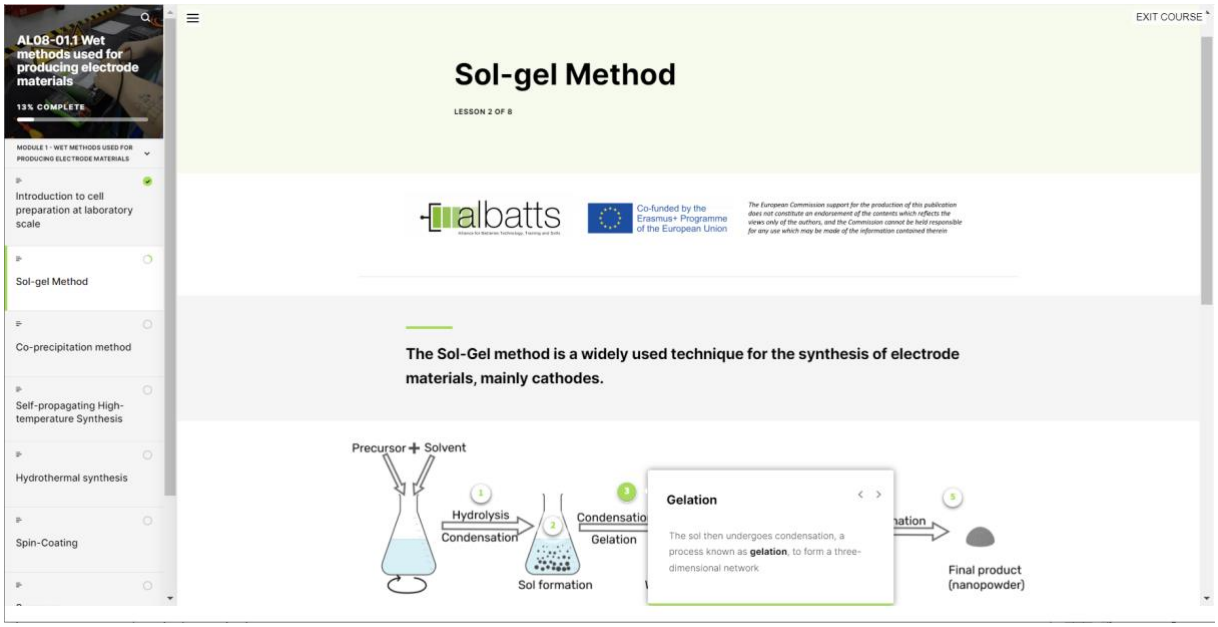

Figure 31: Example of the training materials

In addition, and where relevant, reference materials such as videos, articles or other freely available activities are added directly to the SCORM files.

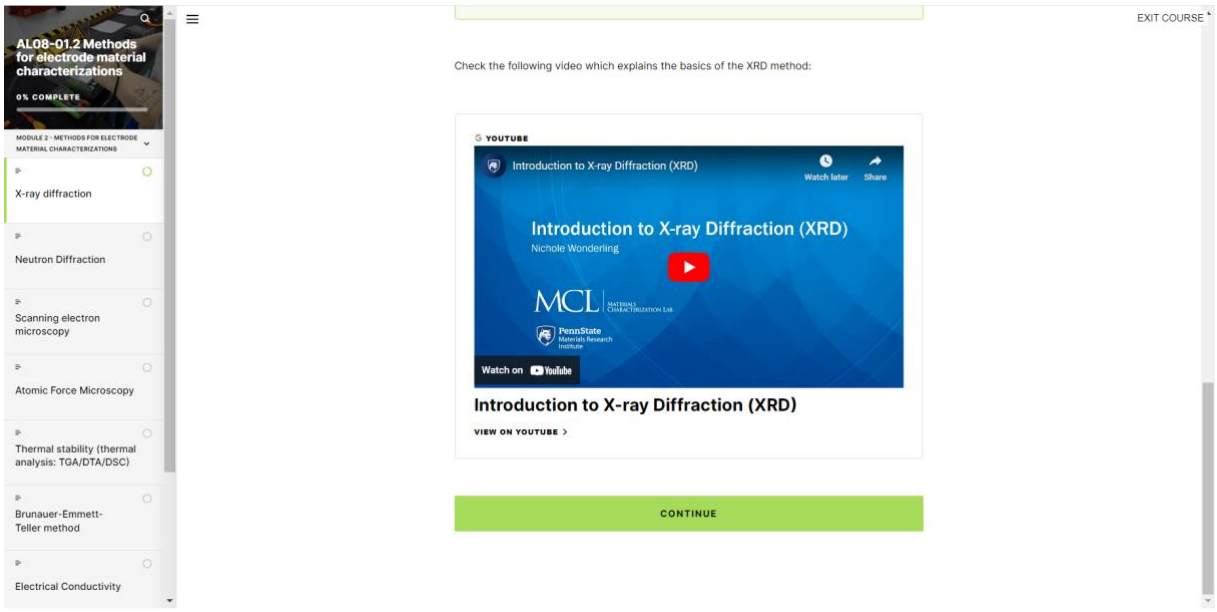

Figure 32: Additional materials

Each SCORM file also includes a final evaluation quiz to help the participant recap the information and check his knowledge.

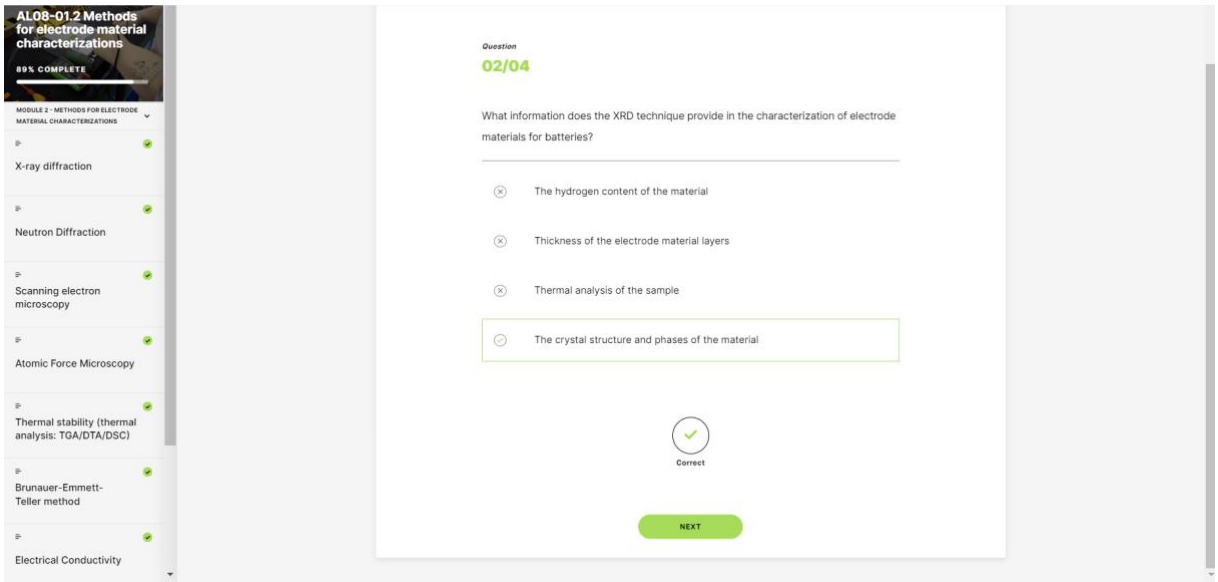

Figure 33: Example of the quiz

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4 Basic Batteries Course in Realizeit Online Adaptive Learning Platform

As is the case with the courses offered on the ASA platform, https://learn.skills-framework.eu/ hosts the Basic Batteries course offered through Realizeit. The Target Group, Recommended prior knowledge, Teaching Method, and Course Structure and Training Materials are the same as those detailed in section 3.1. The primary difference learners experience is that those learning the Basic Batteries course in Realizeit experience the benefits of the Adaptive Learning system.

If users select this course on the https://learn.skills-framework.eu/ website, they will be launched into the Realizeit platform. They are enrolled in the Basic Batteries – ALBATTS course in Realizeit and are presented with guidance for using the Realizeit Adaptive Learning platform most effectively (see Figure 34).

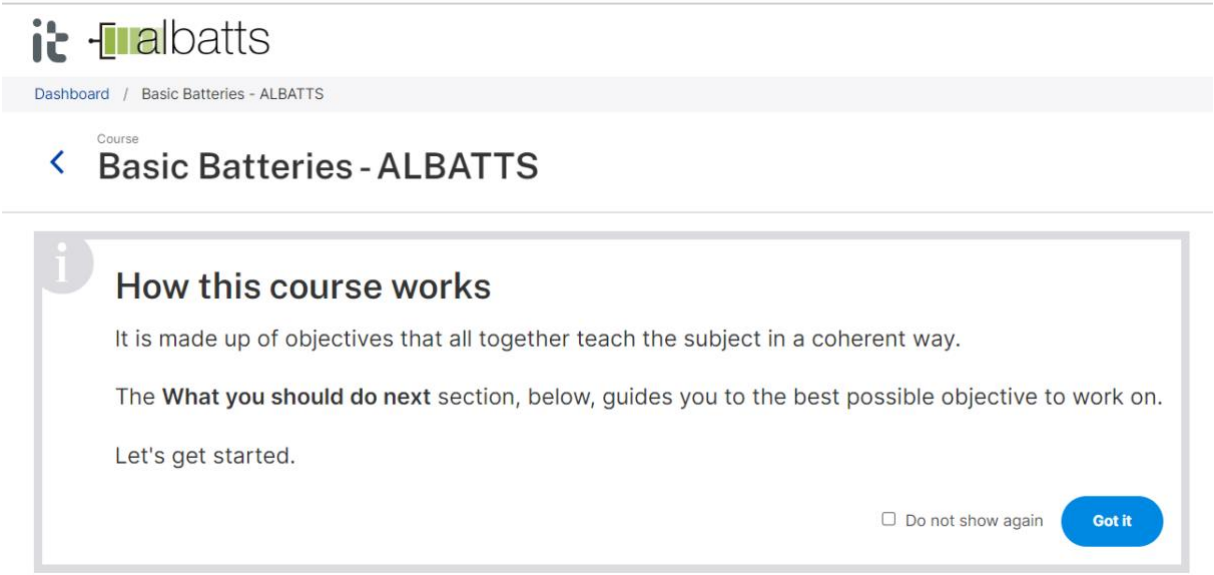

Figure 34 Realizeit platform with guidance on platform use

As the user progresses, the Realizeit Adaptive Learning platform provides metrics on their progress and guidance on what they should do next, as illustrated in Figure 35.

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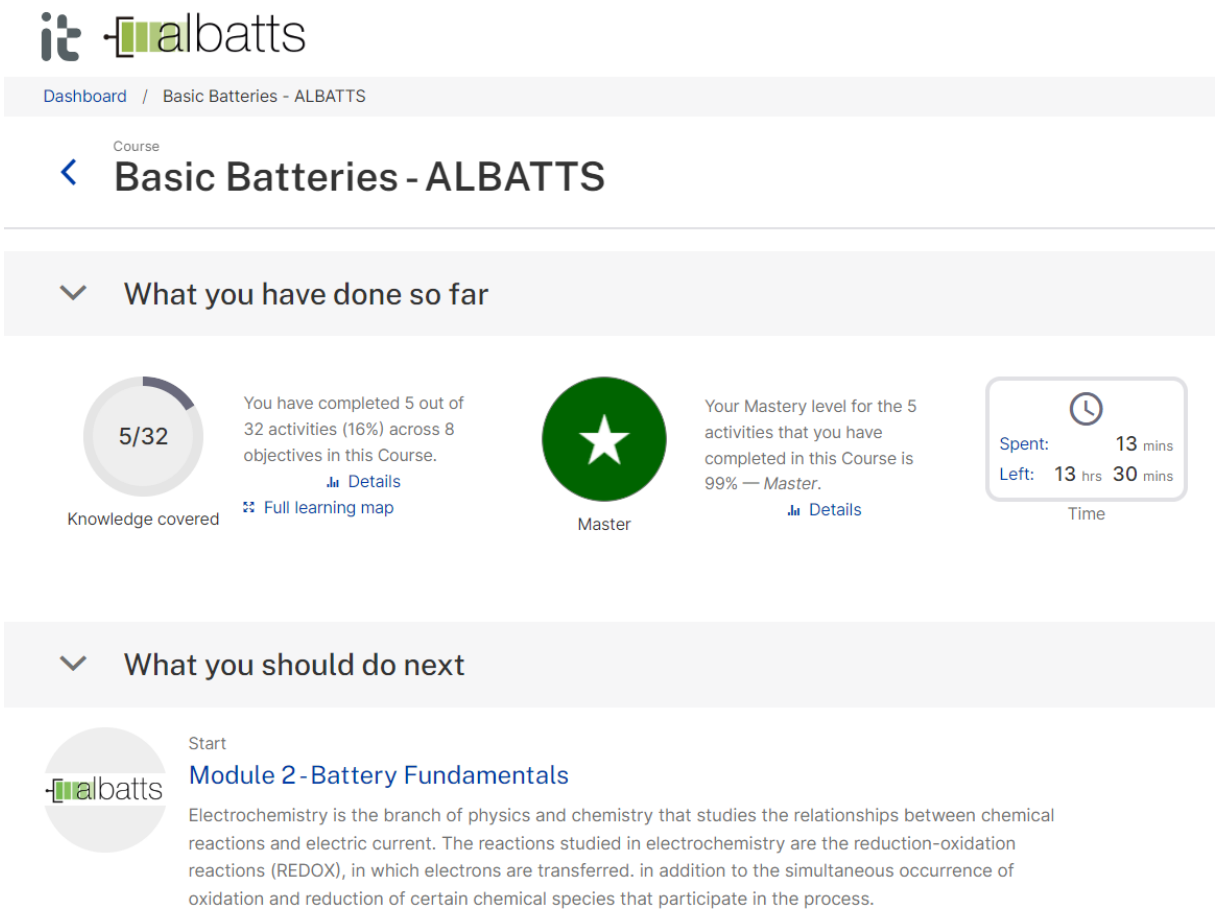

Figure 35 Realizeit platform with metrics and guidance for the next steps

This advice will develop and change as the system continuously changes its calculation of the user's ability and knowledge. This process is illustrated in Figure 36.

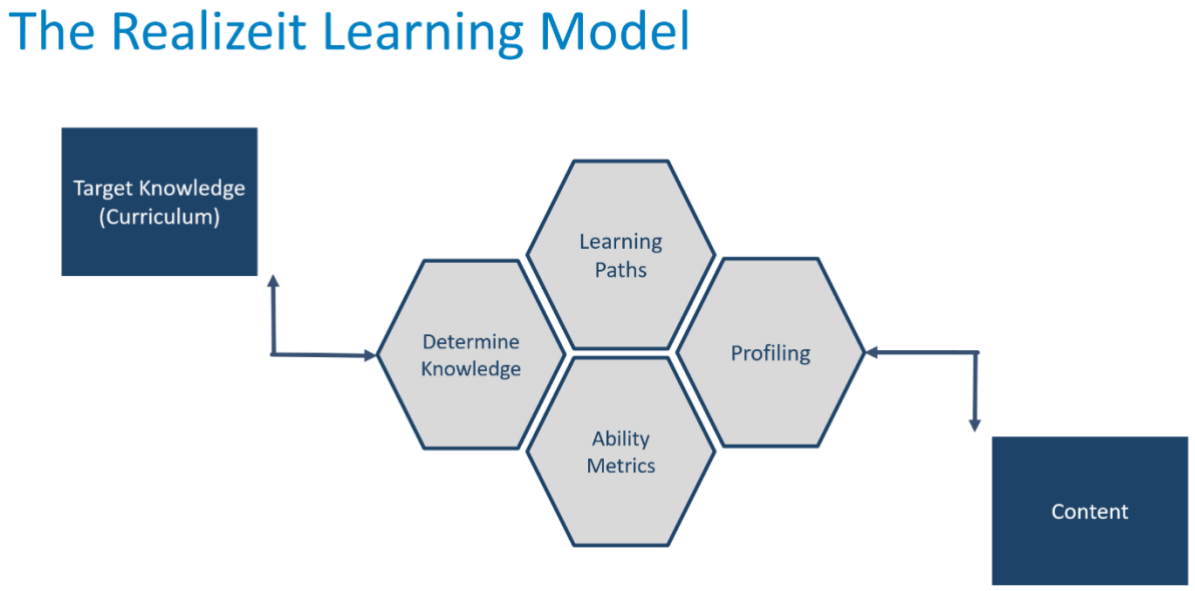

Figure 36 Illustration of Realizeit Learning Model, including Determine Knowledge, learning paths, ability metrics and profiling

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When the user selects a learning objective in Realizeit, they are presented with a suggested first step of completing Determine Knowledge (as in Figure 37). This operation draws questions from across the objective and tests learners on their knowledge. It is the recommended first step for every learning objective and allows learners to demonstrate their prior knowledge on a given objective before engaging in the learning content. This allows Realizeit to respect users' prior knowledge – if the system judges from Determine Knowledge that the user already has sufficient understanding of a lesson, the user won't need to complete the lesson and can progress to new material.

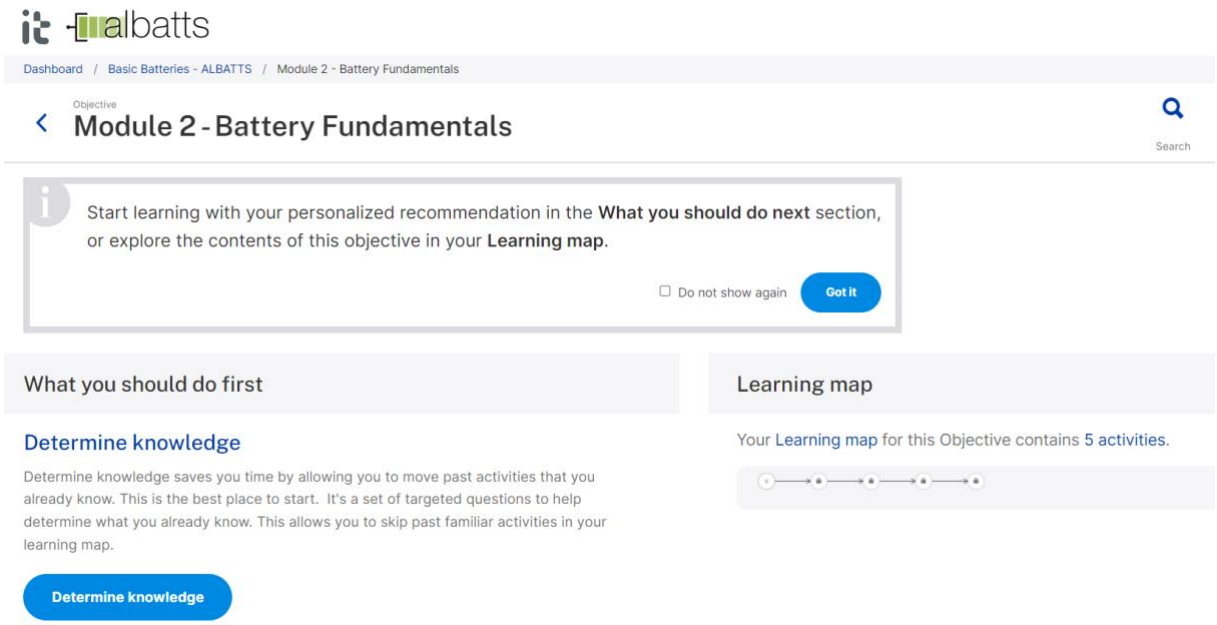

Figure 37 Realizeit platform with details on Determine Knowledge

After completing Determine Knowledge, the student can work on lessons, which can be accessed through the Learning Map (as in Figure 38). This feature provides a visual and theoretical display of the links between different learning concepts. The map provides further information to the system on the learner's understanding of the material – for instance, if a user demonstrates problems answering questions on one lesson, they may be having issues with a prerequisite concept, and Realizeit will deliver material from an earlier lesson to address that deficit.

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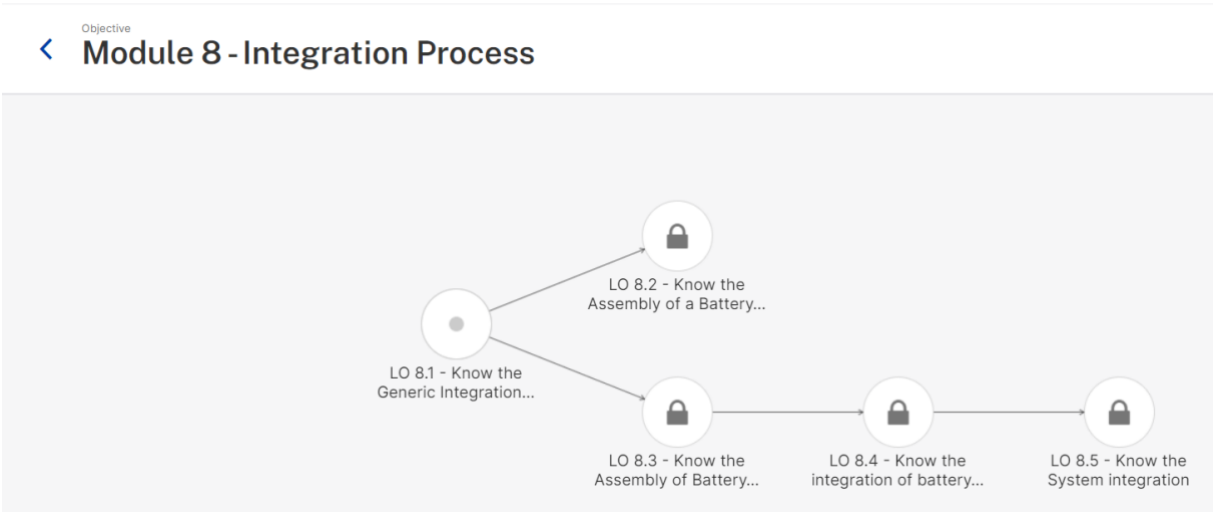

Figure 38 Realizeit Learning Map

Content is presented in the Realizeit Adaptive Learning platform (as in Figure 39). Content is presented in a variety of formats, including text, image, and video. Questions of various interactive forms have been defined, and the user's learning and knowledge are constantly measured as they work.

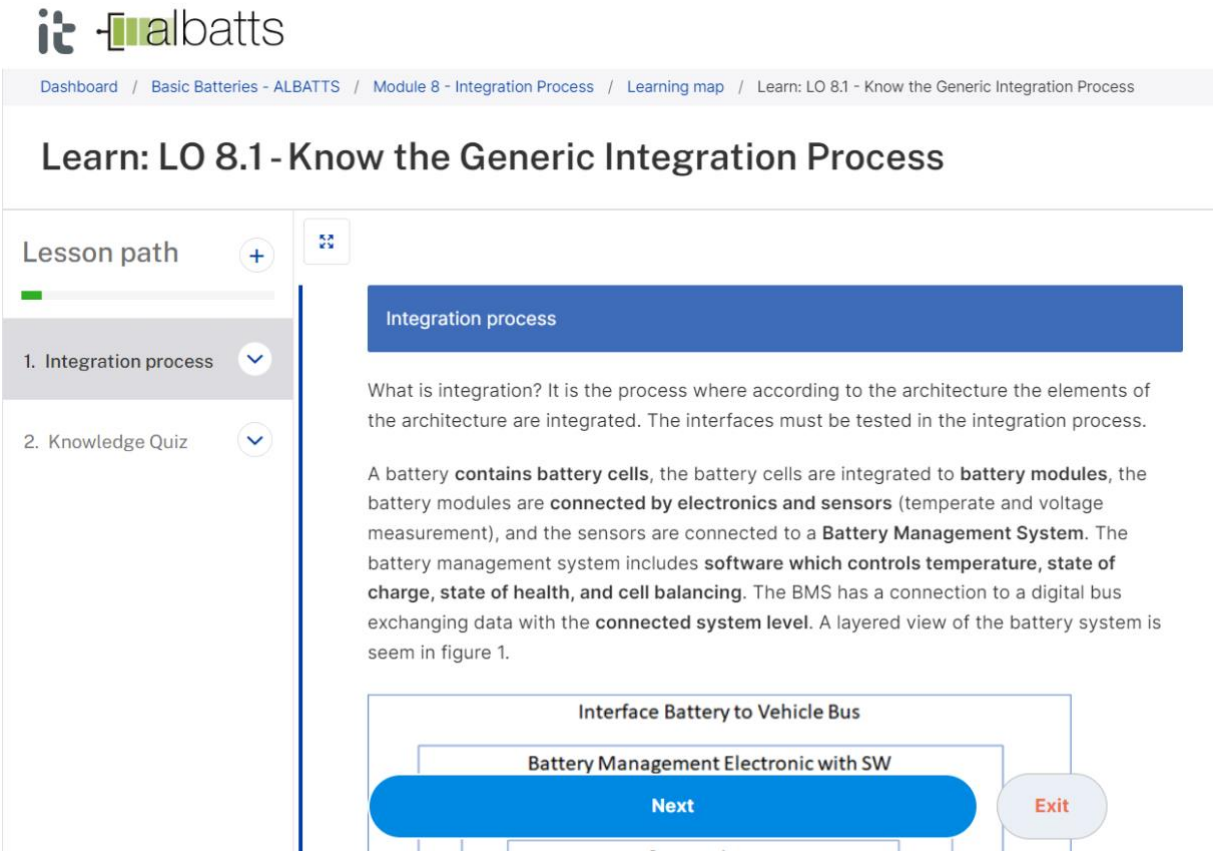

Figure 39 Basic Batteries content displaying in Realizeit

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5 Course Completion and Digital Badges Generation

5.1 DIGITAL BADGES

The system issues the Digital Badges through the Skills Hub (https://skills-framework.eu/) used by the Automotive Skills Alliance (ASA). Digital badges are micro-credentials that serve as a recognition of achieved competence or learning.

Digital Badges are a type of micro-certificate which may be shared online to prove competence (learning outcome) on a certain level, and it is issued by the Automotive Skills Alliance as a large-scale partnership in the automotive-mobility ecosystem under the Pact for Skills. An example of this micro-credential may be found here: Assertion - Skills Hub (skills-framework.eu). The overall guide to the ASA micro-credentials is available here: Wiki - Skills Hub (skills-framework.eu).

Badges may be decomposed into 4 layers:

- **Layer 1:** Maturity Level – (1) Awareness; (2) Practitioner and (3) Expert Level Badges
- **Layer 2:** Concept Type – (1) Skill/Competence or (2) Knowledge
- **Layer 3:** Type of Completion – (1) Attendance; (2) Exam;
- **Layer 4**: Recognition
  - **(1) Recognised** – certificate/training from a recognised entity (by DRIVES project) is provided for the completed training course; (Gold Color) – based on the recognition criteria
  - **(2) Unrecognised** – certificate/training is provided from an unrecognised entity or not provided at all; (Grey Color) – or DRIVES colour

Recognition criteria are the following:

- Conformity Assessment **ISO:17024**
  - To be specified for certain certificates provided for the training – certification is aligned with ISO:17024
  - Will result in Gold Badges issued upon training completion
  - Emblem is shown in the provider's detailed information
- **ECTS credits:**

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- If course completion is connected to the ECTS credits, trainees will obtain Gold Badges

- **EQAVET implementation:**
  - This is specified during the provider registration and has no effect on the badges
  - Emblem is only shown in the provider's detailed information

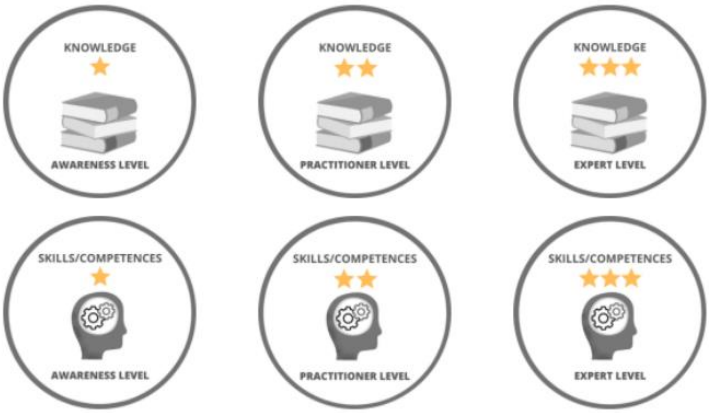

Figure 40: Grey Badges

Figure 41: Golden Badges

5.2 ISSUING THE DIGITAL BADGES

After all learning activities are completed, the Digital Badges are issued – the student studies all the relevant materials and learning resources, which concerns answering the feedback survey as well.

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A student will receive an email informing about the course completion and about the fact that the badges were issued in the platform - Home - Skills Hub (skills-framework.eu). The student will also be given the credentials to log in to the system to access the badges.

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6 Conclusions and further developments

ALBATTS has successfully developed comprehensive training materials that are immediately accessible through the Automotive Skills Alliance learning platform as MOOCs, or can be used for blended learning, and face-to-face sessions. These materials, freely available on the learning platform, provide valuable resources for education and training providers, industry professionals and enthusiasts, ensuring wide accessibility and flexibility in learning. More information on how to utilize ALBATTS training material is available in the Handbook for training in the Battery Industry – Why? What? Where? How? (deliverable D6.7).

Moreover, the issuance of digital badges to participants not only recognizes their efforts but also enhances their professional credentials.

Moving forward, to keep pace with the rapid advancements in battery technology, it is advisable to continuously update and expand the training content for the sector. Additionally, efforts will be directed towards enhancing the Adaptive Learning solution to provide more personalized learning experiences. Collaborations with industry experts and educational institutions will be sought to refine the curriculum and incorporate emerging trends, ensuring that the training remains relevant and cutting-edge.

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