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Alliance for Batteries Technology, Training and Skills 2019-2023

* Report on on piloted, demoed and

delivered courses or modules*

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Deliverable 6.6



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



Report Title:	Report on piloted, demoed and delivered courses or modules						
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Date of changes	to document:						

	File name:	D6.6 - Report on pi courses or modules	loted, demoed	and delivered	
Document data:	Pages:	42	No. of annexes:	3	
	Status:	Final	Dissemination level:	PU	
Project title:	Alliance Technolo	for Batteries gy, Training and Skills	GA No.:	2019-612675	
WP title:	WP6 – Tr Offer	aining and Education	Project No.:	612675-EPP- 1-2019-1-SE- EPPKA2-SSA- B	
			Deliverable No:	D 6.6	
Date:	Due date:	31-05-2024	Submission date:	31-05-2024	
Keywords:					
Reviewed	Sanna Ka	angasvieri	Review date:	29-05-2024	
by:			Review date:		
Approved by:	Katarina	Sandbacka	Approval date:	31-05-2024	







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Executive Summary

All the new courses and modules created in ALBATTS are piloted, and the piloting methodology and process will be described, and the pilots evaluated and reported in this deliverable. Previously in ALBATTS, a group of European teachers formed of ALBATTS project partners both from VET and HE worked together in creating learning objectives, educational materials and finding the right teaching/learning methods (T6.4, 6.5), and also performed self- and peer-evaluation. For great contribution to piloting and the course development was the Batteries Teachers and Trainers' Forum (BATT Forum), which is a network created in ALBATTS, for training the teachers to be able to educate for this new industry. We received lots of valuable feedback from these experienced VET (and HE) teachers, as well as feedback from learners who studied courses and modules of different sizes on their own as self-study or in blended learning.

Constructive alignment was our pedagogical background theory. The iterative feedback suggested that more effort must be put into interactions and knowledge construction. This kind of collaboration with other teachers was a valuable exchange of thoughts.

In the Education and Training work package (WP6), special attention was put on finding suitable solutions to educate workers with new skills and knowledge for the needs of the Battery industry, especially for work in vocations like machine operator, with vocational qualifications background whether it was from another technical field or a career change from service to factory work. Also, teachers and engineers with longer / higher education were taken into account, because they are also needed, but the focus was on the blue-collar workers, who form around 80% or even more of the industry's needs. To get blue-collar workers and white-collar staff for the establishing industry, reskilling and up-skilling, continuous learning, is important. We wanted to pilot with different target groups.

The feedback showed that the new vocabulary and terminology of the industry must be used clearly and well explained. Educating continuous learning students was also a new learning experience for the teachers used to working with youngsters. Heterogenous student groups with versatile educational backgrounds, different ages and learning skills are a challenge for teachers.

Most of the learners were male in their 20ies and 30ies. However, amount of female learners who completed modules and courses was quite high.







Introduction

ALBATTS Education and Training Framework, as proposed in <u>Deliverable 6.2 - Preparatory</u> <u>development of the education and training framework and choice of tools</u>, 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

As part of the Education and training framework in ALBATTS, the Piloting and evaluation task (T6.6) belongs to the Innovative and Flexible Learning Pillar, as a quality assurance task on the implementation side of the PDCA (Plan-Do-Check-Act) cycle. In ALBATTS, courses, modules and training programs have been developed for degree students, continuous learning and teacher training, taking into consideration innovative and flexible learning aspects that are seen as essential for educating for the needs of the new battery industry. The piloting methodology and process will be described, the pilots evaluated and reported, and the results and lessons learned discussed and concluded in this deliverable.

ALBATTS took into account the competence and skills needs of the entire value chain, by providing training on EQF levels 2-7. Focus in the training, and in the piloted training, is in VET, EQF level 4-5, based on what we learned in previous work packages. However, some courses and pilots target the HE target group. The courses that have been created are delivered on a web platform to secure good availability and lifespan after the project, and learning is free of cost.







List of Abbreviations and definitions

Abbreviations used are in accordance with the ones defined in <u>Deliverable 6.2 - Preparatory</u> development of the education and training framework and choice of tools.







This Chapter presents the Piloting and Evaluation methodological framework and describes the work methodology done in task 6.6. The theoretical, yet practical in nature, Constructive alignment that is behind the methodology and the evaluation criteria, is presented shortly. The different research topics and learnings from the previous studies in the ALBATTS project for this task are summarized.

The Piloting and Evaluation work is visualized in the picture below and was formed together with the main partners and all WP6 partners could comment on the plan. This work took place in early 2022.



Figure 2 - The Piloting methodology.

The image shows that the Pilot work is structured into three main parts: Research area, Analysis area and Output area, according to the model used in WP6. It also describes the **feedback loops** with other tasks essential to this work. Skills needs were studied in other WPs and were materialized as job roles and skill cards in Task 6.3. Curricula and learning outcome work were conducted in Task 6.4, and the Preparatory development of the education and training framework and choice of tools (T/D6.2) are of relevance to this task. On the other hand, Task 6.6 provides feedback for the educational material creation, learning outcomes (T6.4) and teaching method improvements (T6.5), including Adaptive learning, and for the Teachers' training (T6.7) and dissemination of results (WP 2).







1.1 PURPOSE OF THE DOCUMENT

This deliverable describes, analyses and reports the work done and findings in ALBATTS task 6.6, Piloting and Evaluation of courses and modules. The feedback provided by the pilot training gives information to:

- the improvement of the learning and learning solutions and methods on courses and modules, to offer flexible and meaningful learning to people;
- the validation of training content, suitability and usability of training materials.

Most of the T6.6 collaboration took place in online joint task meetings of tasks 6.4, 6.5 and 6.6. Some WP6 meetings were dedicated to going through the situation of Piloting and progress in more detail, and some additional planning and support sessions online were organized. Also, piloting ALBATTS courses was one of the topics in face-to-face partnership meetings and the Battery Teachers and Trainers' Forum workshops. TEAMS collaboration tool was used for collaboration outside of meetings as well. Preparatory and final data was collected using online questionnaires.

1.2 COHERENCE WP6 TASKS

Task 6.6 is in close connection with tasks 6.4, 6.5 and 6.7, which are related either by giving inputs for its work or receiving its outputs to the work that follows. This can be seen in Figure 3 which shows how all the tasks interact with each other.



Figure 3 Work package 6 Training and Education structure

Task 6.6 started as one of the last tasks of the project, by using the available learning outcomes and curricula from T6.4 Curricula for all levels and piloting the training material delivered by the work done in Task 6.5, with different target groups and settings. These pilot actions were the ingredients for





evaluating the ALBATTS courses and guaranteed to close the quality cycle, by providing recommendations for the improvement of the courses.

1.3 CONSTRUCTIVE ALIGNMENT

The teaching assessment was based on the feedback, using a constructive approach, that was collected from the learners on the (web-based) courses and the teacher's experiences of the student learning and suitability of the methods. The Constructive alignment model aims at a profound understanding of the learning topic. According to Biggs, when a learner actively constructs the information, he brings his own previous knowledge and background assumptions, motives and intentions to the information. A good teacher supports the learning process towards profound understanding aligning the teaching accordingly, setting the learning objectives, teaching methods and learning assessment in line.¹²

The constructive alignment model is based on a constructivist view of learning. The core of the constructivist view is that the students make the content meaningful to themselves. This is done by using active cognitive processes, creating and editing, through active information selection and construction both alone and in groups¹.

These essential theories represent modern pedagogy, and the models, quality criteria, and canvases that were used in ALBATTS are based on them. We had plenty of teaching scientific knowledge and practical experience in the group, both from Academia and Vocational Education. Like the alignment model and their view on development suggest, task 6.6 wanted to share some best practices, and offer some planning canvases, and quality criteria, we find useful and are good to consider, and in line with the evaluation we plan on using. The canvases helped in structuring the online course into modules and on the other hand, encouraged the creation of learning tasks and group assignments that can be added to the blended learning course to promote deep learning.

Web-based learning supports a learner-centric approach by allowing the learners to progress based on their timetable (to some extent), and the teacher then supports the learning by encouraging them to share the learnings with peers and so on, promoting knowledge construction and deep learning. Students might have surface learning which means they don't make an effort with the information like



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¹ Biggs, John (1996). Enhancing teaching through constructive alignment. Higher Education 32: 347-364, 1996. Kluwer Academic Publishers. Available online

https://teaching.helsinki.fi/system/files/inlinefiles/Biggs1996 Article EnhancingTeachingThroughConstr.pdf Cited 13.2.2024

² Löfström, Erika; Kaisa Kanerva, Leena Tuuttila, Anu Lehtinen and Anne Nevgi (2010). Quality Teaching in Web-Based Environments: Handbook for University Teachers. University of Helsinki, Administrative Publications 73, Reports.



in deep learning but just try to remember. Web-based learning enables different learners to repeat the part that was difficult to understand³.

When assessing the teaching, teachers should consider the alignment of the learning objectives, topics taught, teaching methods and assessment of learning all supported the same goal or whether they were in conflict. When it comes to a web-based course, the focus is on the meaningfulness of the learning experience³. This might be something more for the university teachers and students, but at least in the Nordic schools, self-directivity is being promoted from the early school years. Meaningfulness is evaluated by following pedagogical concepts:

- Activity how independently students have acted during the course,
- Intentionality how goal-oriented they have worked towards the objectives,
- Contextuality how well the subjects taught have been linked to contexts relevant to students
- Transfer how successfully students can apply the material learned to different situations
- Constructivity how successfully the learned material has been linked to prior knowledge
- Collaboration to what extent students have cooperated to achieve common goals
- Interaction how students have succeeded in using open, but constructively critical, discussion in the web-based community and
- Reflection how successfully they have analyzed their learning³.

Also, the functionality of the web-based learning environment is considered. Teachers should also collect feedback from the students. All in all, this set of feedback is considered for the development of the course and web-based teaching. It is recommended that teachers keep track of the web-course solutions and best practices to support their learning and development, collaborate to develop online learning, and are aware of their own pedagogical and technical skills they need in online teaching.³



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³ Löfström, Erika; Kaisa Kanerva, Leena Tuuttila, Anu Lehtinen and Anne Nevgi (2010). Quality Teaching in Web-Based Environments: Handbook for University Teachers. University of Helsinki, Administrative Publications 73, Reports.



2 Evaluation methodology and Pilots selection

In this chapter, we introduce the methodologies used to evaluate the ALBATTS courses and to identify and select the different piloting actions during the project implementation, using partners' resources and the opportunities created with the development of the Batteries Teachers and Trainers Forum (see Deliverable D6.7).

2.1 EVALUATION METHODS

The evaluation of the courses was done in 3 different phases whenever possible, to guarantee input information for the developers at the earliest moment possible. The following phases and methods of evaluation were used for the ALBATTS training courses:

Phase 1 – During the development of the courses

Project staff used checklists to self-evaluate the created materials throughout the design phase. The learning outcomes and the training content were analyzed by the partners involved in the development of the ALBATTS courses.

Phase 2 – Before the pilots take place

Flexible personal interviews of peer-reviewers were conducted and allowed further questions and clarifications of the developed training materials, directly in the development application (Articulate Review). These peer-review sessions were organized in groups during the Batteries Teachers and Trainers Forums (BaTT Forum), enhancing co-creation and peer learning.

Phase 3 – Pilot training implementation

A set of pilot training was undergone to gather feedback from the perspective of the user. Online feedback questionnaires were used to collect data systematically from learners, meaning both in-class and online implementations.

All these data were analyzed, to conclude and proceed in the collaboration to gain improvements to courses, learning, methods, etc. The idea was to use the feedback and create better learning objectives, course materials and online deliveries, with ideas for blended learning and classroom implementations as well.

2.2 EVALUATION CRITERIA (FEEDBACK FORMS)

The quality criteria for online course assessment to set joint standards for the piloting of the ALBATTS courses were integrated: i) in the Student feedback questionnaire formulation and; ii) in the Teachers' feedback form for pedagogical evaluation.





The forms used are presented in Appendix 1 and 2.

The Quality criteria used were:

- Pedagogy, appropriate pedagogical models, ways of working and methods
- Description of the online implementation
- Structure and usability of the online implementation
- Online tools, appropriate and support learning and learning outcomes
- Materials, support reaching the learning objectives
- Interaction, appropriate interaction
- Online learning tasks, are justifiable, take learning forward, take into consideration students' personalities
- Feedback of learning is right-time and continuous
- Assessment is multifaceted and evaluation develops reflection

After designing the methodology, the student feedback form was conducted for review. It comes from the Finnish universities model which highlights learning and own efforts. This kind of Constructive alignment was defined as important from the early stage. Later on, a little bit more comprehensive student form was conducted, to enable all the course feedbacks to be answered on the same form using one link.

Student form

The student's feedback form was proposed in Spring 2021. In teamwork, we got a couple of small changes. In addition to giving a grade to the course, the form encourages learners to reflect.

An electronic version of the form – the feedback is part of the EU project funded by ERASMUS+ and this must be filled in.

- How would you grade the ALBATTS modules
 - (1 weak 5 excellent)
- The module contents corresponded the intended learning outcomes set for the course.
 (1 did not correspond 5 corresponded fully)
- I put enough effort into achieving the learning objectives of the modules
 (1 I did not put enough effort 5 I put enough effort)
- Evaluate the total workload required for completing the modules. How many hours? How many modules?

(1 The total workload is significantly too low- 3 the total workload corresponds the ECTS or similar credit points granted for the course – 5 the total workload was significantly too high)





- Verbal feedback. Evaluate the contents, assessment methods as well as the course material of the course. Please give constructive and well-founded feedback.
- Which factors promoted your learning, what went well?
- How do the module contents connect to your earlier experience?
- Do you have any specific reflection, specific interesting, or something you didn't know?
- Technical functionality of the course on ALBATTS learning environment.
 (1 weak 5 excellent) what was the problem?
- How would you improve the e-learning course?

During the development of the training courses, the partnership decided to integrate the training units into the Automotive Skills Alliance learning platform, to guarantee these results are sustained. The student feedback questionnaire was then slightly shortened taking advantage of the learning platform resources already available. The feedback included 4 main quality descriptors, that have been used since then, together with open questions to gather more descriptive and qualitative feedback:

- Clarity of the learning materials
- The usefulness of the MOOC
- Relevance of the learning experience
- Recommendation MOOC to others

We wanted to keep the feedback anonymous, but to collect some demographics for knowing our audience better and reporting purposes. The learning platform had some established ranges and organization type and size questions that we kept.

Student demographics.

Please tell us a little bit about yourself. Which age range fits you best?

- 17 or younger
- 18-20
- 21-29
- 30-39
- 40-49
- 50-59
- 60 or older

To which gender identity do you identify? This is required for EU Statistics.

Female





- Male
- Other

Your nationality

Write your nationality:

Which organizational type fits your occupation best?

- Vocational education and training
- Higher Education (University, Polytechnics, FH)
- SME (up to 250 staff headcount)
- Large company (>250 staff headcount)
- Public Sector/National Authorities
- Research institute/centre
- Sectoral/Industrial Association
- Accreditation, certification or qualification body
- Unemployed
- Other

Highest level of your education

- Primary education
- Lower secondary education
- Upper secondary education
- Post-secondary non-tertiary education
- Short-cycle tertiary education
- Bachelor's or equivalent education
- Master or equivalent education
- Doctoral or equivalent education

2.3 PILOTS MAPPING

Through our partners, we had access to pilot the training on different EQF levels as most of our partners in this task are educational institutions. VET partners educate on EQF levels 3-5, depending on the country, HE partners train mostly Engineers and other training companies and also develop re-skilling and up-skilling training solutions directly to the industry market in all different EQF levels. Some of the partners had several possibilities of what kind of target groups they would have for piloting, like youngsters doing their initial training, adults, third-country nationals studying in English, and immigrant students.







The educational materials were created in English, meaning that, if the partners trained in the local language, they had to translate the materials to their language.

We also believed these materials would benefit the teachers and they would be useful and ease the workload. This is certainly true in many countries. In some countries, the curricula are very regulated and this kind of external content cannot be added to the programs. In some countries and educational levels, it is easier to add some of the topics to the matching existing courses. It is also extra work for the teacher who is not getting paid for this extra work. Then, the solution would be to offer these modules for piloting voluntarily, so that the pupils/students would get some extra certificate that might be valuable to show the competence for Companies. This input was considered eventually in the development of Learning Badges.

To ease instructing the partner teachers, a letter was designed (Appendix 3) aiming at instructing uniformly. The idea was to have the pilots as similar as possible, meaning the contents/materials of each module that is being piloted would be used the way it is. However, it is up to the partner, which and how many modules they can pilot, and if they are being offered as self-study or in blended learning or which of the alternatives.

To conclude, the early interests, ideas and plans based on each partner's profiles and strengths were studied in a questionnaire so that we could find the best set of piloting organizations and methods. Some of the organizations had many courses that would fit for collaborating with piloting, while some of the courses were such that not many had a suitable one to offer, at least not at the right time.

The plan was to have 3 countries to pilot each course, taking into account different central target groups to get experiences of them, and with some geographical spread as the educational systems and cultures are different.

The plan was to pilot the modules in good time in 2023 to allow time for implementing the pilots, collecting feedback and making changes to courses and final reporting.

Since there were various educational levels and institutes from Europe working on the project we used some support material to help with the ideation and evaluation to improve the courses and to stimulate the work. In FITech, Finnish Institute of Technology, a network of the Technological Universities in Finland, Pedagogical materials have been created. The learning design informatory texts and canvases are based on a selection of quality criteria, handbooks, and academic literature. The manual is systematic with its checklists and practical in nature and ready to be used⁴.



⁴ Available online on <u>fitech.io</u>, in English, Finnish, Swedish



During the Planning phase of the Pilot implementation process, the following questions were answered:

Descriptor	Description
What?	The courses and modules created in ALBATTS will be piloted and evaluated, and
	the feedback will be used to improve the learning objectives, learning materials,
	methods and motivational aspects of learning.
Who?	All the partners of the project WP6 will participate in pilots, especially VET
	partners since blue-collar vocations are in the majority in the Battery industry.
	The HE will also run pilots, online, and in continuous learning. A more detailed
	Piloting plan with responsible partners is provided in this deliverable.
How many?	We have promised to implement 6-10 pilots. The number of students varies, from
	a few to tens on a course.
To whom?	Based on the Sectoral collaboration and Skills needs tasks lessons previously in
	the project, we will concentrate on VET level education. The training will be
	piloted with different target groups, to gain learnings of suitable methods for
	each audience.
How?	The pilot implementations are planned based on the mapping of partners'
	profiles and student groups they have, to guarantee a set of different target
	groups and some geographical spread around Europe. We will use online forms
	to collect feedback that has a standardized set of questions and which based on
	Constructive alignment will also make the learner reflect their learning and
	MOOC
	 MOOC Adaptive learning
	 Classroom study
	 Full online
When?	The pilots will start as soon as the courses and modules are ready, to have enough
	time for improving the courses based on the feedback. Practical things like the
	timing of a suitable collaboration course implementation during the School year
	where the new modules can be included need to be taken into account.
Students	Student groups that we have identified are:
	 VET young students
	 VET adult students
	 VET immigrants
	 VET 3rd country
	 Train the trainers
	 Higher Education students
	 Learning in companies: Adult learners
	 Learning in companies: Different nationalities
	 Continuous learning (project)
	The pilots will be planned so that we can have different target groups piloting.
	For instance, we assume that young VET students and continuous learning adult
	students learning on the side of working life probably have overall different
	needs, different motivations, time to use and self-directiveness, and require
	different kinds of methods. Also learning on non-mother tongue causes extra

Table 1 – descriptors identified for the implementation of the pilot actions







Descriptor	Description
	challenge so it would be beneficial to pilot with immigrants as well. Train the
	trainers means piloting the teacher training network model, BaTT Forum, created
	in the project. Their expertise will also be used in piloting and improving other
	courses in the project.
Teacher/trainer	Teachers and trainers of VET will evaluate courses and the BaTT Forum training
	model that was designed to develop the knowledge of the Battery Industry
	teachers, so that they know more about the industry needs, working methods
	and working environment and challenges of the industry, and can educate
	students.
Company	Interaction with the industry and learning about industry needs is required. This
	kind of feedback we have got from company partners already in previous tasks
	and from learners in piloting who already are working in the industry. In the
	piloting task, we have a couple of companies as partners, a Gigafactory, an
	auditing and training provider, and an educational platform provider.
EQF level	ALBATTS works for European Qualification Framework (EQF) levels 3-8 which
	means from initial-VET to doctoral level. The Sectoral skills work has shown us
	that most of the jobs in the battery sector require vocational education and
	training, so the offering created in the ALBATTS project also strongly focuses on
	VET level education and re-skilling and up-skilling, so EQF 4-5 or 3-5, depending
	on the country.
Technical issues	The learning environment is one place for all trainings so that they are easily
and	available and accessible to the training providers and learners. The platform
Accessibility	provider also collaborates with similar skills projects. The learner must learn only
	this platform, which is quite intuitive, and then he can concentrate on learning,
	instead of having to log on to several platforms. Some accessibility functionalities
	are provided by the platforms, and the usability is tested in piloting rounds.







3 Evaluation of ALBATTS courses and pilot implementation

According to the evaluation methodology in Chapter 2, a 3 phase evaluation was identified as the preferable process for the developed ALBATTS training courses, consisting of a review from project partners (Phase 1), a review from external Peers (Phase 2) and an external evaluation through the implementation of training pilots (Phase 3).

The planning and implementation of the evaluation of the training courses and dedicated partners were discussed, presented and followed up in monthly meetings from the end of the Year 2022 on.

3.1 PHASE 1 – DURING THE DEVELOPMENT OF THE COURSES

As an overall review, all training courses went through **Phase 1**, where all education and training providers in the project had the opportunity to discuss and review the learning outcomes and content of the different training courses, guaranteeing alignment with the identified needs and standardization. For that, templates were implemented and used (Figure 4) allowing the existence of a continuous feedback loop during the implementation phase, by using a specific Microsoft Teams collaboration space.

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All syllabus and content unit documents are publicly available through, respectively, Deliverable D6.4 and the ASA Learning Platform.







3.2 PHASE 2 – BEFORE THE PILOTS TAKE PLACE

Taking advantage of the implementation of the BaTT Forum during the ALBATTS project (see <u>Deliverable D6.7</u> for more information), **Phase 2** was integrated into the evaluation process where the courses were evaluated by Peers during the development process, to integrate several contributions at an early stage.

For this, partners used the Articulate Review application (Figure 5), which allows the teachers to give direct feedback on the training material as a comment.

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Batteries Basics - 04 Future Trends Updated by João Alves + Current Version ~			REVIEW FEEDBACK	SHARE **	. Až 🚺
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	Evaluation				
	Good questions				

Figure 5 – Example of feedback collected using the Articulate Review application

The collected comments were used to improve the training materials before they were released to the public on the pilot training implementation.

3.3 PHASE 3 – PILOT TRAINING IMPLEMENTATION

Phase 3 was planned to be implemented for all developed courses. However, due to different kinds of situations, as mentioned in Chapter 2, the solution to get a bigger amount of feedback about the developed training modules was to offer these modules for piloting voluntarily, by registering in the ASA learning platform and using the partners as a way to reach the different target groups, whenever possible. Even so, it was not possible to pilot all the developed training courses/material.

The following table presents a summary of all the pilot ALBATTS training executed during the implementation of the project.







Table 2 Pilot trainings executed

Batteries basics	Vamia		
	Vanna	Continuous learning (project)	Blended learning
	University of Maribor	Higher Education students	Workshop
	ATEC	level 5 students of Automotive	Blended learning
	BaTT Forum	Teachers	Blended learning
_	University of Porto	Higher Education students	Classroom study
	All partners	General public	MOOC
Batteries basics – Adaptive learning	ATEC	VET: Level 4 students of Automotive	Blended learning
	BaTT Forum	Teachers	Blended learning
	All partners	General public	MOOC
English basic battery	BaTT Forum	Teachers	Blended learning
vocabulary	All partners	General public	MOOC
Batteries safety	Vestland	VET: above upper secondary level	Blended learning
	Vamia	Continuous learning (project)	Blended learning
	University of Maribor	Higher Education students	Classroom study
	BaTT Forum	Teachers	Blended learning
	All partners	General public	MOOC
Batteries stationary	Vamia	Adult education	Blended learning
applications	University of Maribor	Higher Education students	Classroom study
	All partners	General public	MOOC
Automotive battery systems engineer	ISCN	Continuous learning (EQF 6,7,8)	MOOC
	University of Maribor	Higher Education students	Classroom study
Cell Preparation and Evaluation on Lab-Scale	University of Porto	Higher Education students	Classroom study
Batteries Teachers and Trainers' Forum	All partners	Teachers	Blended learning

A total of 23 different pilot trainings were done, which were organized as Massive On-line Open Courses (MOOC), as blended learning, and as Classroom study.

The number of students and teachers piloting varied in each partner country, from a couple to some tens. The teachers were mainly VET teachers, as well as some HEs. Students were both degree students in VET (youngsters) and especially continuous learners, with both VET and HE backgrounds. Although most learners were men, typically in their 20ies and 30ies, the amount of women who completed

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courses and actively gave feedback was high, around 40%. Also, online, most self-learners were from large companies. At educational organizations, VET educates typically in blended learning and classroom, and the ALBATTS online modules and courses were used as part of these blended courses in groups, or extra materials were offered for self-study online when the educational system didn't allow adding topics off curricula.

During **Phase 3**, it was possible to collect **434** feedback forms, of which 396 were from the online form available through the ASA learning platform and 38 from paper forms from blended courses. It's important to mention that this represents roughly 30% of the total of registered learners in the different trainings promoted by ALBATTS.

The feedback was overall very positive with the quantitative evaluation being systematically around **4**, on a scale from 1 to 5, as can be seen in the next figure:



Figure 6 Overall quantitative evaluation of the ALBATTS courses during the Piloting phase (source ASA learning platform)

From the qualitative side of the evaluation, taken from the open questions and the oral feedback from the learners participating in the pilot training, the overall view was also very positive, confirming the quantitative evaluation.

Teachers who participated in the pilots welcomed the materials and all the collaborations with evaluating teachers were highly appreciated. Learners found the modules suitable for self-learning, saying the modules were of the right size and you could use them for acquiring the knowledge you need on the theme, enabling microlearning. Some suggestions were proposed to clarify some topic







contents and learn new terminology, and technical functionalities. Adjustments were made continuously based on the feedback.

Also, the Batteries Teachers and Trainers' Forum was under development and it was also one of the pilots as such. First, the teachers' needs for Future workshops were in a bigger role, in addition to the Industry interactions. The working model was improved along the way, e.g. implementation of the Preassignments and the introduction of flipped learning, the later added to the 3rd BaTT Forum already developed under the new Erasmus+ project CaBatt, to ensure well-prepared teachers.

3.3.1 Batteries Basics

The Batteries Basics training units were the first ones to be available for testing, thus allowing them to go through the 3 evaluation phases, as identified in Chapter 2.2:

- Phase 1 During the development of the courses, by the project staff.
- Phase 2 Before the pilots take place, during the BaTT Forum events by teachers and trainers (Peers).
- Phase 3 Pilot training implementation, done as blended learning and as MOOC.

The Batteries Basics course is divided into 10 different training units that were evaluated in 6 different pilot trainings. It's important to mention that not all training units were evaluated in all pilot trainings, as the development of the modules was done in different phases. During these piloting trainings it was possible to collect feedback from 365 learners.

The target groups that piloted the Batteries Basics course were:

- Continuous learning (project)
- Higher Education UAS students
- Level 5 students of Automotive
- Teachers
- General public

Quantitative Evaluation

The feedback was overall very positive with the quantitative evaluation being on average **4,1**, on a scale from 1 to 5. The differences between target groups, types of learning and training units weren't clear, with values varying from 3,3 and 4,3. However, the lower level was not representative as it had in consideration only 5 answers.







Qualitative Evaluation

In the open questions, we got some improvement ideas and requests for clarifications that were informed to the teachers creating the materials for consideration and eventually used to improve the materials. However, the majority of comments were very positive confirming the overall quantitative evaluation. Examples such the following one form the training EU Policies and Regulations could be found: The course presented the most important issues of European battery policy and regulation in a very reliable, factual and brief manner. In my opinion, there is no need to add more.

Recommendations

From the perspective of the areas from which the learners would like to receive more information, the following ones were identified and not developed during the project implementation:

- Sodium-ion batteries for ESS
- Battery passport

3.3.2 Batteries Basics – Adaptive learning

The Batteries Basics – Adaptive Learning version was the first course, together with the MOOC version to be available for testing, thus allowing it to go through the 3 evaluation phases, as identified in Chapter 2.2:

- Phase 1 – During the development of the courses, by the project staff.
- Phase 2 – Before the pilots take place, during the BaTT Forum events by teachers and trainers (Peers).
- Phase 3 Pilot training implementation, done as blended learning and as MOOC.

The Batteries Basics – Adaptive Learning version was evaluated in 3 different pilot trainings. It's important to mention that not all modules were evaluated in all pilot trainings, as the development of the modules was done in different phases.

The target groups that piloted the Batteries Basics course were:

- Level 4 students of Automotive
- Teachers
- General public

Quantitative Evaluation

Despite the efforts made to get feedback from the participants in the different pilot trainings, it wasn't possible to collect any quantitative feedback.





Qualitative Evaluation

During the BaTT Forum, the Batteries Basics - Adaptive version got many positive remarks from the teachers. Adaptive learning was considered a level-based means that can be started with no knowledge of batteries and a nice learning experience that motivates the student further. Simplicity in learning was a bonus, and short text modules. Testing learning outcomes immediately was also liked. It was also evaluated that there are topics and content that will give valuable new knowledge to persons with different background and skills.

3.3.3 English Basic Battery Vocabulary

The English Basic Battery Vocabulary training units were tested during **Phase 1 – During the development of the courses**, by the project staff, and **Phase 3 – Pilot training implementation**, done as blended learning and as MOOC.

English Basic Battery Vocabulary course is divided into 8 different training units that were evaluated in 2 different pilot trainings. It's important to mention that not all training units were evaluated in all pilot trainings, as the development of the modules was done in different phases. During these piloting trainings it was possible to collect feedback from 33 learners.

The target groups that piloted the English Basic Battery Vocabulary course were:

- Teachers
- General public

Quantitative Evaluation

The feedback was overall very positive with the quantitative evaluation being on average **4,2**, on a scale from 1 to 5. The differences between target groups, types of learning and training units weren't clear, with values varying from 4,1 and 4,3.

Qualitative Evaluation

In the open questions, we got some improvement ideas and requests for clarifications that were informed to the teachers creating the materials for consideration and eventually used to improve the materials. However, the majority of comments were very positive confirming the overall quantitative evaluation.







From the perspective of the areas from which the learners would like to receive more information, the following ones were identified and not developed during the project implementation:

- Cell chemistry
- Fire in batteries

3.3.4 Soft Skills

The Soft Skills training material was one of the last to be available for testing and, unfortunately, it wasn't yet possible to collect feedback from external parties to the project. Thus, this course was only evaluated during **Phase 1 – During the development of the courses**, by the project staff.

3.3.5 Batteries Safety

The Batteries Safety training units were evaluated during **Phase 1 – During the development of the courses**, by the project staff, and **Phase 3 – Pilot training implementation**, done as blended learning and as MOOC.

Batteries Safety course is divided into 4 different training units that were evaluated in 5 different pilot trainings. It's important to mention that not all training units were evaluated in all pilot trainings, as the development of the modules was done in different phases. During these piloting trainings it was possible to collect feedback from 34 learners.

The target groups that piloted the Batteries Safety course were:

- VET: above upper secondary level
- Continuous learning (project)
- Higher Education UAS students
- Teachers
- General public

Quantitative Evaluation

The feedback was overall very positive with the quantitative evaluation being on average **4,1**, on a scale from 1 to 5. The differences between target groups, types of learning and training units weren't clear, with values varying from 4,0 and 4,2.





Qualitative Evaluation

In the open questions, we got some improvement ideas and requests for clarifications that were informed to the teachers creating the materials for consideration and eventually used to improve the materials. However, the majority of comments were very positive confirming the overall quantitative evaluation.

Recommendations

From the perspective of the areas from which the learners would like to receive more information, the following ones were identified and not developed during the project implementation:

Safety on the user perspective

3.3.6 Stationary Applications (& Stationary Business)

The Stationary Applications course was one of the last to be available for testing and, unfortunately, it wasn't yet possible to collect enough feedback from external parties to the project, to draw any conclusions. Thus, this course was only evaluated during **Phase 1 – During the development of the courses**, by the project staff.

3.3.7 Automotive Battery Engineer

The Automotive Battery Engineer course was evaluated during **Phase 1 – During the development of the courses**, by the project staff, and **Phase 3 – Pilot training implementation**, done as MOOC.

The Automotive Battery Engineer course was piloted through the ASA Learning Platform. However, although the course had more than 130 registrations, during this piloting period it wasn't possible to collect any feedback.

3.3.8 CELL PREPARATION AND EVALUATION ON A LAB-SCALE

The Cell Preparation and Evaluation on a Lab-scale course was evaluated during **Phase 1 – During the development of the courses**, by the project staff, and **Phase 3 – Pilot training implementation**, done as a Classroom study.

The target groups that piloted the Batteries Safety course were:

Higher Education students





No quantitative evaluation was performed.

Qualitative Evaluation

Students had the opportunity to ask questions and express their opinions about the project and the educational materials presented. During the discussion, the importance of such initiatives in expanding students' knowledge and preparing them for work in the field of advanced battery technology was emphasized.

Students appreciate the fact that the ALBATTS project materials are available for free on the project website. In addition, they appreciate the division of the prepared courses into basic courses, which allow them to understand basic information about batteries and the materials used to make them, and more advanced courses, where they can see the practical application of these materials in energy storage. Students use various materials to learn - some prefer to listen and take notes, so webinars and interviews with experts are ideal. Others find that they learn most effectively with graphic materials, such as iconography with descriptions or diagrams, which they find lacking in the battery information available online.

3.3.9 Batteries Teachers and Trainers' Forum

Vamia, ATEC, Skellefteå kommun, Vestland and the University of Ostrava have studied the possibility of arranging joint training programmes. This had to do with training VET teachers on an international exchange and job shadowing programme to learn from colleagues at partner VET schools or in the industry that might exist in the partner location as it does in Skellefteå, but not yet in the own area. These programmes aim to bring practical knowledge at an early stage to battery teachers.

This kind of concrete working-life experience supports the work tremendously, as practical working environments are essential in VET. Existing international mobility grants are necessary tools to finance these exchanges.

The Batteries Teachers and Trainers' Forum was evaluated during **Phase 3 – Pilot training implementation**, as a Blended learning.

The target groups that piloted the Batteries Teachers and Trainers' Forum were:

Teachers





No quantitative evaluation was performed.

Qualitative Evaluation

The Teacher forum members have given valuable insights during the project. The first BaTT Forum took place in Skellefteå, Sweden, in October 2022, the teachers participated in a workshop on how the training of students could be carried out for the battery industry. They gave ideas on six workshop stations and the answers have been used for both developing the BaTT Forum's way of working, what kind of support it offers and for the training modules as such.

The BaTT Forum teachers have also piloted many of the modules created in ALBATTS project. The Basic course / Battery Fundamentals was tested first, at an early phase, at the first BaTT Forum. The teachers were divided into two groups, one focused on Adaptive learning, and the other on MOOC. The teachers could give feedback on the learning platform and they had canvases to inspire for pedagogical evaluation.







At the final stage of the Piloting, we collected Lessons learned regarding Piloting and feedback from the ALBATTS project partner teachers.

The ALBATTS partners felt that the piloting feedback was valuable. They appreciated the discussion and interaction with other teachers. As one of the teachers called it, the implemented pilots and collecting feedback was "a Base for discussion". Interaction with teachers of the Battery Teachers and Trainers' Forum meant creating an understanding of what the teachers need to know, and what the development of the battery industry is going to be. This meant many discussions and exchanging thoughts, important vice versa. The discussions also gave a view on the diverse knowledge of the teachers, where some of them were experienced Chemistry teachers for instance.

The feedback that we got in personal interaction was usually very positive, and if there was some criticism, some learning happened anyway. It was good to get feedback that something was too easy or some technical functionality didn't work the best way. For example, the automotive applications engineering course was fully online, and the official feedback collection was done online. The partner works in interaction with companies and has in everyday life got positive verbal feedback.

We received feedback that the materials were very welcome, especially from the teachers. It is also relevant to mention that there are organizations that took some of the courses/modules into use. From single learners, we received spontaneous feedback on how they found the courses interesting and useful in starting their career in the Battery industry. This was very meaningful feedback to us personally.

The feedback also helped to improve the blended learning courses by wishing to have more interaction. This can be changed for future courses. Learning completely new terminology can be a challenge and got some comments. Special attention must be put on supporting the learning of terminology, in learning materials and teacher support, maybe with some flash card exercises where one must explain and get to rehearse the concepts more.

Some of the teachers felt it wasn't easy to get busy teacher colleagues to try new things. In everyday life, you easily continue using the course that you have created. We tried to keep the feedback collection quite short and practical but it was still extra work. Maybe it will be easier to take new materials into use when they are fully ready.







Using online resources varies greatly in different countries. For some young VET students, EQF4-5, this was the first time they studied MOOC with the support of a classroom environment. They found it nice to learn about the big battery industry, which is relevant to their study field but not quite its core and some of them had an interest in working in some way with the battery sector. The technical challenges had to do with things like the sensibility of typing errors or different spellings in the open answer fields of a learning platform. This had to be considered in the choice of question types and platforms which on the other hand is negative regarding constructive pedagogy, when more versatile knowledge constructing should be done by the learners.

VUX in Skellefteå has Machine operator training programs, that are not only for the Battery sector but are meant for training the whole region. However, Northvolt is an appreciated partner for visitor lectures. We have got some learnings from this collaboration to use in ALBATTS.

Teaching new kinds of heterogeneous groups also brings challenges and learning to teachers. The teachers got positive experiences from teaching motivated and self-directed people who wanted to re-skill and up-skill. Continuous development of teaching is required in busy everyday lives, hopefully by being active in best practices and taking into use new methods and tools.

We may expect some challenges when it comes to ICT skills or language skills, but so far, the experiences are very positive.

Battery educational materials have now been piloted and are ready to be used by learners and teachers. Some partners and external organizations have already started using the modules.







5 Conclusions and further developments

A lot has happened in online learning since the ALBATTS project was kicked off at the turn of the year 2019-2020. The COVID-19 pandemic meant a giant leap for online learning. More online courses available meant a great opportunity for adult learners in higher education and self-directed continuous learning. For vocational education and training this meant a great challenge, since vocational education requires more practical assignments and working-life training in the industry surroundings, and because all youngsters don't yet have the self-directness required. However, to all the teachers in the project, this shift meant a tremendous extra workload, which affected the work in ALBATTS and caused delays for the huge and demanding tasks of education material creation, which were ready later than first expected.

The modules and courses not being ready as early as expected then harmed Task 6.6 Piloting and evaluation when the implementations took place later than expected. Also, the severe changes in the investment environment due to the War in Ukraine, Energy prices increase and high inflation meant that some of the battery investments were postponed, and so some educational collaborations. VUX VET institute and Northvolt Gigafactory in Skellefteå, Sweden, gave fascinating learning opportunities we could use in the project when creating courses and training for both students and teachers, in VET, re-skilling and up-skilling contexts that was our main focus. As more mature partners they had recent experiences in this fast-developing industry, but factory environments also included restricted company secrets.

The feedback helped the ALBATTS teachers to improve their learning and to create better courses for audiences. Interaction and joint activities are needed when creating new ones, and coworking in piloting was part of it. Also, the learners appreciated interaction and hoped that blended learning courses could have more of it. Batteries Teachers and Trainers' Forum was central in piloting. The Training model was designed in the project and piloted and developed, and those teachers had a tremendous role in piloting and evaluating the courses.

Some new topics for development, such as Sodium-ion batteries for ESS, the Battery passport and cell chemistries arose from the evaluation process that can be an important input for new or future developments and projects at European and/or national levels.

In conclusion, the ALBATTS courses evaluation process that was implemented during the project was flexible enough to guarantee information to partners for the successful development of the training







curricula and materials. Overall quantitative and qualitative feedback gives us confidence about the **clarity** of the learning materials, the **usefulness** of the MOOC and the **relevance** of the learning experience, independently of the target groups and the type of learning, and that they should be **recommended** to others.









List of Appendixes

- APPENDIX 1 Student Feedback form
- APPENDIX 2 Teachers Feedback forms
- APPENDIX 3 Letter for teachers







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Appendix 1 – Student Feedback Form

ALB_Student_feedback

The course materials were created in the ALBATTS project financed by ERASMUS+ by the European Commission. Student feedback is part of the project's evaluation. The project team uses student feedback for the development of the course.

https://link.webropolsurveys.com/S/B852F58CC13CFD6E

- 1. The ALBATTS course I piloted
- Battery Basic Course
- Safety course
- Automotive applications / Battery Systems Engineer
- Stationary battery

2. How would you grade the ALBATTS modules?

- 1 Weak
- 0 2
- 0 3
- 0
- 5 Excellent

3. The module contents corresponded the intended learning outcomes set for the course.

0 1	L did	not	correspond
-----	-------	-----	------------

- O 2
- 0 3
- 0 /
- 5 corresponded fully

4. I put enough effort into achieving the learning objectives of the modules.

\cap								
¥.	11	hih	not	nut	enou	σh /	effort	ł.
	- L I	uiu	not	put	CHOUS	511 1	CIIUI	L.

- Ο,
- 0₃
- ο,
- ~ 4
- 5 I put enough effort.

5. Evaluate the total workload required for completing the modules. How many hours?

4	
How many modules?	
1	





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6. Evaluate the total workload required for completing the modules.

- 1 The Total workload is significantly too low.
- 2 too low
- ^O 3 The Total workload corresponds the ECTS or similar credit points granted for the course.
- 4 too high
- 5 The Total workload was significantly too high.

7. Verbal feedback. Evaluate the contents, assessment methods as well as the course material of the course. Please give constructive and well-founded feedback.



8. Which factors promoted your learning, what went well?



9. How do the module contents connect to your earlier experience?



10. Do you have any specific reflection, specific interesting, something you didn't know?



11. Technical functionality of the course on ALBATTS learning environment.

- 1 weak
- Ο2
- 0
- Ο,
- 5 excellent

12. Technical functionality of the course. What was the problem?

-
-



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13. How would you improve the e-learning course?



14. Please tell us a little bit about yourself. Which age range fits you best?

- 17 or younger
- O 18-20
- O 21-29
- O 30-39
- O 40-49
- O 50-59
- 60 or older

15. To which gender identity do you identify? This is required for EU Statistics.

- Female
- Male
- O Other

16. Country

The country of residence:	
	h.

17. Your nationality

Write your nationality:

				▶

- 18. Which organisational type fits your occupation best?
- Vocational education and training
- Higher Education (University, Polytechnics, FH)
- SME (up to 250 staff headcount)
- Large company (>250 staff headcount)
- Public Sector/National Authorities
- Research institute/centre
- Sectoral/Industrial Association
- Accreditation, certification or qualification body
- O Unemployed
- O Other
- 19. Highest level of your education







- Primary education
- Lower secondary education
- O Upper secondary education
- Post-secondary non-tertiary education
- Short-cycle tertiary education
- Bachelor's or equivalent education
- O Master or equivalent education
- O Doctoral or equivalent education







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Appendix 2 – Teachers Feedback Form

ALB Teacher's feedback

https://link.webropolsurveys.com/S/2A19ECA0ACCBAB60

The course materials were created in the ALBATTS project financed by ERASMUS+ by the European Commission. Student and teacher feedback is part of the project's evaluation. The project team uses the feedback in the development.

1. The main student group(s) on my pilot course

- VET, young VET-students
- VET adult students
- VET immigrants
- VET 3rd country
- Higher Education UAS/FH/University students
- Learning in companies: Adult learners
- Learning in companies: Different nationalities
- Other, which:

2. The course I piloted with the group was: (This question was modified when more courses were developed.)

Battery Basic Course

Safety course

Automotive applications / Battery Systems Engineer

Stationary battery

English course

Soft skills course

3. PLEASE DESCRIBE HOW YOU PILOTED THE COURSE. DID YOU USE MOOC, ADAPTIVE LEARNING, BLENDED LEARNING, CLASSROOM STUDY? HOW MANY STUDENTS? PLEASE ALSO TELL THE DURATION AND TIMING OF THE PILOT.

(This question was modified to clarify due to the final reporting.=duration, amount)











4. Did you use it in English or in local language, which?

Write your answer:

5. Motivation. Did the learning method, learning environment, contents and materials motivate the target group? How did the students find the course?

	<u> </u>

6. What was difficult for the group in this theme/subject?

- Language
- Understanding text

Producing text

Digital skills

Other, what:

7. Please describe.



8. What can be improved?





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9. Learning environment: Was it student friendly and accessible to students with special needs? Did it support

the achievement of learning outcomes?



10. Did the modules promote learning key competences/soft skills?



11. Does the course fit to working life and regional needs?



12. Do you think the course was equal and sustainable? Please describe your thoughts.



13. Are you satisfied with how the students receive feedback on the platform? Do you have some expectations regarding the assessment from the project?

shara	 and		suggestions	and	bost	prostional
		<u> </u>				

Project/group work - description, where to apply, method?











15. Individual assignments - description, where to apply, method?

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Appendix 3 – Letter of teachers



The Alliance for Batteries Technology, 'Training and Skills (ALBATTS) is a European funded project with the objective of contributing to the electrification of transport and green energy in Europe, by designing a blueprint for competences and training schemes of the future, in the battery and electromobility sector. More information about ALBATTS project on our website https://www.project-albatts.eu/en/home-fl

¶

ALBATTS-Project-Piloting-of-the-Battery-courses¶

Description¶

In-ALBATTS-project, -a-handful-on-courses-have-been-developed-to-train-students-and-workforce-for-the-newbattery-sector.-¶

A-group-of-Teachers-and-Battery-specialists-from-both-vocational-education-and-universities-all-over-Europehave-collaborated-with-the-industry-to-support-the-new-industry-to-create-courses-and-training-material-foryoung-students-and-people-who-want-to-re-skill-or-up-skill.-The-mix-of-courses-consist-of-different-kinds-ofonline-learning-for-self-study-as-well-as-modules-to-be-used-in-classroom-or-in-blended-learning,-helping-theteachers-by-providing-with-the-materials-of-the-battery-basics-and-more-advanced-and-specialized-themes.-¶

You-have-an-important-role-in-giving-us-feedback-and-helping-us-to-improve-the-courses-with-your-valuablecomments-and-ideas.-We-appreciate-filling-in-the-form-and-kindly-giving-us-verbal-feedback-in-contact-withyour-dedicated-ALBATTS-partner.-The-evaluation-of-the-materials/courses-by-teachers-and-their-students-ispart-of-the-project-evaluation.-¶

In-order-to-guarantee-uniform-evaluation, we appreciate you-using the modules as such, without making changes in the piloting phase. If the course is too-broad for your needs, feel-free to choose which modules you evaluate. We provide you with short-feedback form for the students and for teacher. ¶

Please-contact-your-partner-or-piloting-responsible,-if-you-have-any-questions.-¶

Thank-you for your help-and-expertise. ¶

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Best-regards, ¶

NN-¶

the ALBATTS-team¶

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Contact-information:¶

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