BUS LEAGUE

Dedicated to stimulate demand for sustainable energy skills in the construction sector

www.busleague.eu

Report:	**D4.6 Overview of applied eLearning interactions**
Prepared by:	Jan Cromwijk & Carmen Poort, ISSO, Gloria Callinan, TUS
Date:	April 24th, 2023
Partners involved:	PF, BCC, IVE, TUS, IGBC, AEA

This project has received funding from the European Union's h2020 framework programme for research and innovation under grant agreement no 892894.

TABLE OF CONTENTS

CHANGE RECORDS

Version	Date	Author	Changes
Version 0.1	2-11-2021	Jan Cromwijk	Setup of the deliverable structure
Version 0.2	12.01.2022	Marion Jammet	Added information in the section on Ireland
Version 0.3	14.01.2022	Gloria Callinan, TUS	WP 4 lead review
Version 0.4	28.01.2022	Georg Trnka	AT draft input included
Version 0.5	04.02.2022	Carmen Poort, ISSO	Inputs integrated
Final Draft M18	16.02.2022	Jan Cromwijk, ISSO	Proofread & submission of Draft
Final update M30	28.02.2023	Jan Cromwijk, ISSO	Processed input of all partner countries.
Report Review	24.04.23	Gloria Callinan, TUS	Completed
Version 1.0	24.04.23	Dirk de Wit, ISSO	Finalised and uploaded

1 SUMMARY

In this deliverable the BUSLeague consortium documented possibilities for short and challenging e-learning interactions (so called micro-learnings). It also gives an overview of the applied form of e-learning and micro-learnings during the energy efficiency (EE) upskilling interventions in the BUSLeague implementations at national level. BUSLeague has explored how these interactions can be connected with the BUSLeague developed task-based EE-skills qualification, this is seen as an enabler for micro-recognition and learning of micro-credentials.

This report contains an overview of the applied e-learning interactions and experiences with their use in practice. To allow for a proper interpretation and documentation of the experiences, this deliverable includes a chapter on the evaluation of the timeliness and effectiveness of applied e-learning interactions.

BUSLeague works with existing implementations of e-learning systems such as the BUILD UP Skills advisor-app (BUS-app), learning from building mistakes and small sets of learning questions, used in a competitive way and several others.

2 Definitions of micro-credentials & micro-learning

The diversity of e-learning applications is growing rapidly. Especially in the field of shorter (5-30 minutes), ultra short e-learnings (30 seconds – 5 minutes) and user generated content e-learning applications; the diversity of applications and learning interactions is growing rapidly. In order to credit / recognise learners for learning efforts and results the thinking of and about micro-credentials is also developing fast. This results in a rich variety of definitions and expectations. In order to create clarity in this introductory chapter, an overview of several definitions is provided.

2.1 EU Definitions of micro-credentials

On EU level a sound set of definitions are given in 'A European approach to Micro-credentials'. In this paragraph a summary of the key take-aways is shared.

"Increasingly rapid advances in technology and the labour market require graduates and professionals in the workforce to be familiar with state-of-the-art knowledge, and to possess the skills and competences needed to make full use of technological and non-technological know-how. Content-laden degrees are not always effective for adult learners in today's fast paced environment and employees also need 'just-in-time' skills development that is immediately applicable."

"A European approach to micro-credentials will increase personalised learning opportunities for all. It will help widen learning opportunities and strengthen the role of higher education and vocational education and training (VET) institutions in promoting lifelong learning by providing more flexible and modular learning opportunities."

"The need for more flexible and inclusive learning paths will increase as the student population is becoming more diverse and the learning needs more dynamic."

"The European approach to micro-credentials will have a wider scope than higher education, addressing micro-credentials in all fields of education and training as well as the labour market."

"However, the growing number of diverse alternative credentials has led to increasing concerns about their value, reinforced by an absence of shared understanding of what a micro-credential is – despite different attempts at coining a definition. The lack of a commonly agreed definition and the diversity of formats raise questions on the quality, recognition, transparency and portability of micro-credentials between and within countries, education and training sectors, and on the labour market. These constraints limit the value and impact of micro-credentials, leading to limited trust that prevents their wider acceptance and uptake that would support the objectives of reskilling and upskilling, flexible lifelong learning and mobility."

A micro-credential is a proof of the learning outcomes that a learner has acquired following a short learning experience. These learning outcomes have been assessed against transparent standards.

The proof is contained in a certified document that lists the name of the holder, the achieved learning outcomes, the assessment method, the awarding body and, where applicable, the qualifications framework level and the credits gained. Micro-credentials are owned by the learner, can be shared, are portable and may be combined into larger credentials or qualifications. They are underpinned by quality assurance following agreed standards.

2.2 Some definitions on micro-learning

"Microlearning is a process that focuses and offers just the right amount of necessary information aiming at helping the learner achieve a specific objective. Basically, it focuses on one specific thing and only provides useful information that will make it achievable."[1]

"Microlearning – time for some bite-sized digital knowledge"[2]

"Deploying microlearning successfully means creating learning nuggets that are short and practical. This way, an immediate benefit for learners is achieved. Thus, the short time while commuting to and from the office can already be used as an opportunity to learning."[3]

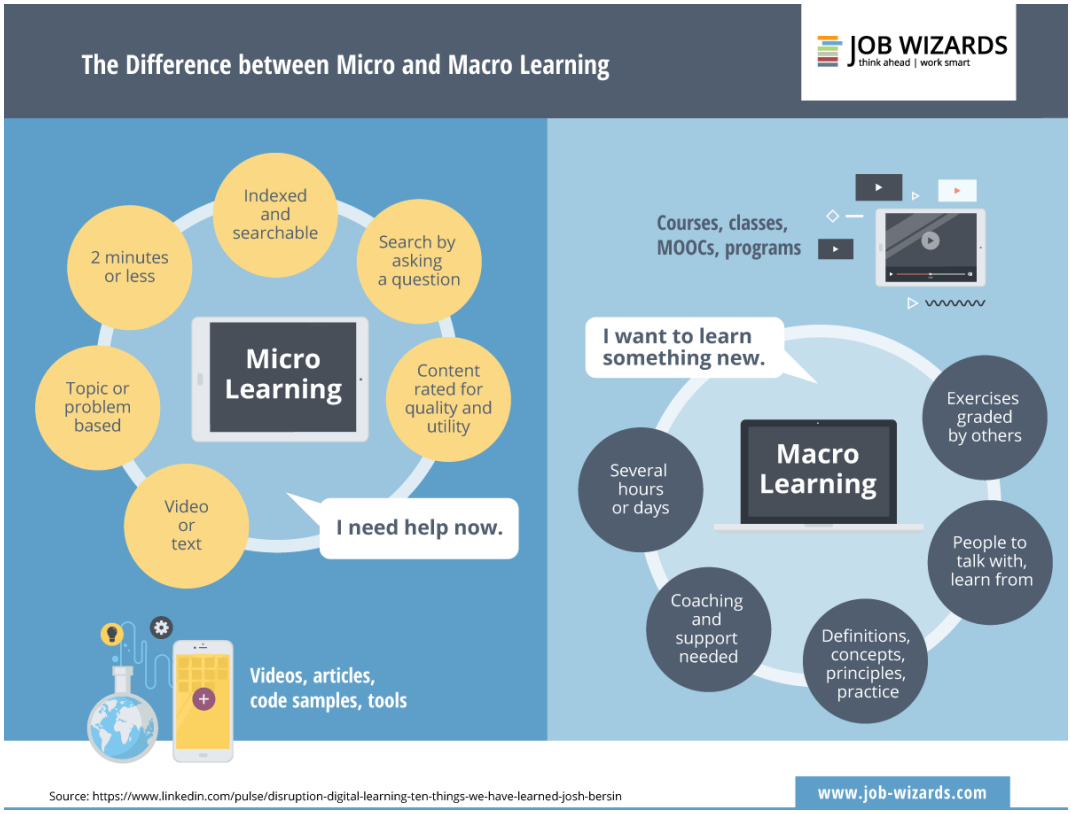


Fig 1: The difference between micro and macro learning

[1] https://ied.eu/project-updates/what-is-microlearning/

[2] https://www.konicaminolta.eu/

[3] https://www.coursepath.com/microlearning-clever-training-on-the-go

A gamified microlearning training might be designed to set learning activities that can incrementally introduce concepts and guide users towards an end goal. The motivational psychology behind game-based learning is that it allows learners to engage with educational materials in a playful and dynamic way.

Game-based learning (GBL) is an active learning technique that uses games to improve student learning. The learning comes from playing the game, which promotes critical thinking and problem-solving skills. Research confirms the power of GBL in developing complex cognitive skills, such as self-assessment and higher-order thinking, as well as metacognitive skills for deep learning.

Simulations, for example, are immersive games that place the learner in a risk-free environment that allows them to engage in an authentic experience contextually demonstrating consequences and benefits. Simulations help students connect theoretical issues with real-world situations and develop analytical skills through comparing different points of view, developing arguments, reflecting and evaluating situations. Below some examples from a Dutch pilot that was organised in parallel of the BUSLeague project.

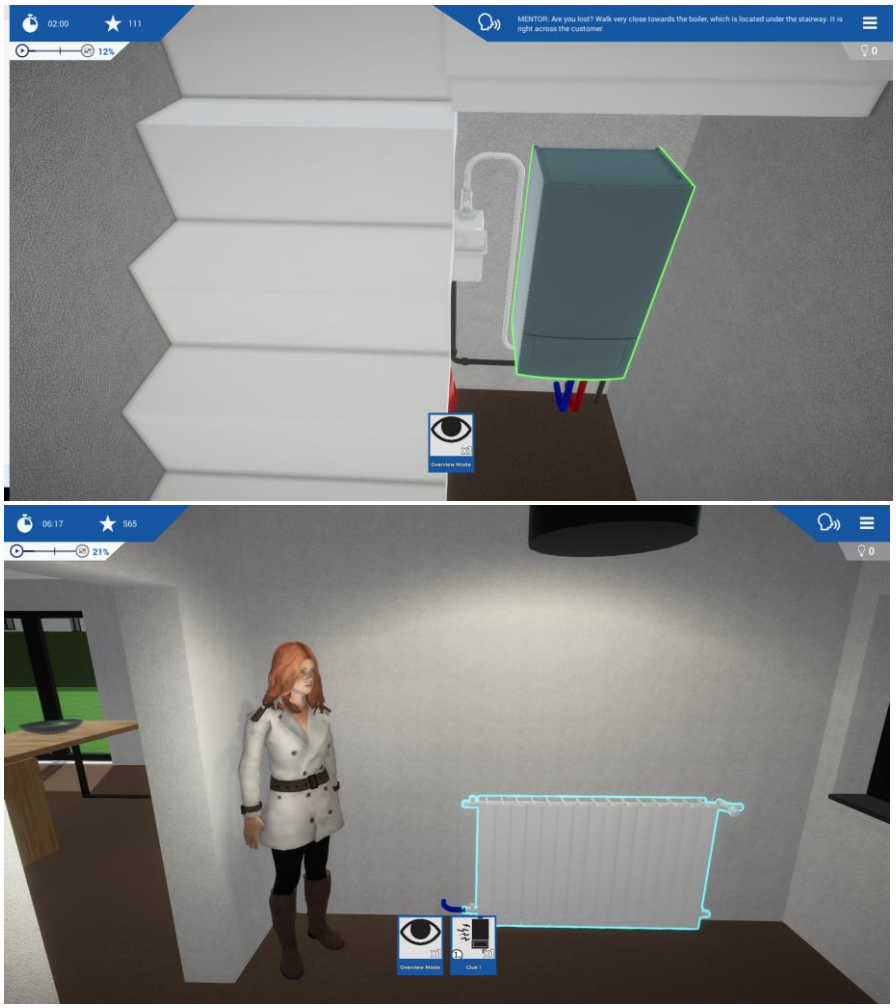


Fig 2: Simulation of various scenarios in which the learner can practise their technical and soft skills in a safe environment.

3 Overview and experiences with e-learning interactions in Austria

The following chapter provides an overview of e-learning interactions linked to the upskilling of building professionals actually available in Austria. Moreover, background and actual implementation status of the ongoing e-learning interventions in Austria within the BUSLeague project are described.

3.1 ConClip – Free Online Educational Video clip Platform for Passive House Construction

The European project "ConClip" brought together the expertise of ten European (three Austrian) building organisations with the focus to offer a format that can be internationally implemented by vocational training and further education institutions throughout Europe and accessed in nine different languages without additional costs.

ConClip pinpoints the key construction issues in Passive House construction and delivers on-the-spot solutions by specifying the execution details of relevant Passive House construction elements. Minor construction defects lead to insufficient thermal insulation and air tightness and consequently to lower energy efficiency.

The main outcome of the project are eight short videos explaining in a quick and simple way important work steps at building sites to enable the construction of highly energy efficient buildings. The videos have a duration of three to four minutes and show step by step what to do to prevent mistakes in the building process. These short videos can be applied in "classical" teaching situations by showing them on a video projector or used on portable devices (smartphones, tablets or notebooks) to make it easy to apply directly at the building site. Experts and managers can use the videos as an aid for explanation – in courses as well as directly on site.

In addition to the videos, the project website offers supplementary information for users and teaching material for instructors. For more information and to access the specific video offer, visit the following website: http://conclip.eu/

3.2 E-Learning offer of the building academy upper Austria

The building academy of upper Austria is an education facility of the federal construction association of the Austrian federal province upper Austria. The everyday business of the institution is the education of apprentices for the bricklayer trade and the education of supervisors and master builders.

As a new service, the building academy upper Austria offers a digital knowledge platform for further education of building professionals. The platform provides the following service offers.

3.2.1 BAU.Live

The service "BAU.Live" is free of charge and includes online presentations of top experts from the building industry to actual topics for the optimal construction of buildings. The presentations have a duration of around 60 minutes and include a timeframe for interactive discussion and specific questions. Every two weeks new topics are presented online.

3.2.2 BAU-Webinar

The format "BAU-Webinar" imparts knowledge to specific topics according to building construction in a virtual lecture room. A "BAU-Webinar" takes up to five hours and requires a training fee.

3.2.3 LIVE. Stream lectures

Lectures, which are marked with the format "LIVE.Stream", are implemented simultaneously online and in person. The trainees can choose how to attend and have to pay a training fee for participation.

3.2.4 BAU-knowledge check

The service "BAU-knowledge check" is an e-leaning service to check and engross gained knowledge. The service is based on learning by question and answer and is offered to various topics according to building construction. The service goes together with training fees.

For more information on the e-learning offer of the building academy upper Austria, visit the following website: E-Learning | BAUAkademie Oberösterreich

3.3 klimaaktiv webinar on building standards

The national climate protection network (klima**aktiv**) offers webinars under the topic klima**aktiv** building standard, which are free of charge. The klima**aktiv** building standard is the most common evaluation standard for sustainable building construction in Austria. The webinar focuses on necessary steps to be implemented to declare a building according to the klima**aktiv** building standard. During the webinar, lecturers show how the trainees declare a building themselves and which additive resources they need, to do so. For more information on the offer, visit the following website: Webinare zum klimaaktiv Gebäudestandard, klimaaktiv.

3.4 klimaaktiv app to support sustainable living

This app is offered by the Austrian climate protection network (klima**aktiv**) and is free of charge. The app includes interactive courses on the topics of sustainable construction, renovation, heating, energy saving and mobility. The courses have been developed by a network of experts all over Austria for diverse target groups. The training is based on interactive learning by question and answer. Specific courses on the topics comfort ventilation, frequently made mistakes within construction and renovation, the klima**aktiv** building standard and climate protection on site are offered. The app is available for smartphones and as desktop version. To install the app use the following links: mobile devices - https://itunes.apple.com/de/app/klimaaktiv/id1250002292; desktop version - https://klimaaktiv.knowledgefox.net

3.5 NEWCOM competence database

To support the enhanced quality of sustainable constructions, the European project "NEWCOM" developed specific training schemes to support the optimal construction and renovation of nearly zero emission buildings (nZEBs). To ensure maximum flexibility, the trainings have been designed in modules so that they can be used both as stand-alone units and

as a complement to already established courses. Based on the needs of building professionals specific training modules in the fields of flat roof and structural waterproofing, comfort ventilation and quality assurance of near zero-energy buildings have been prepared. With the aim of a Europe-wide comparability of acquired skills, a competence database has been created within the NEWCOM project. This database was created with the aim of making acquired skills comparable across Europe. It is based on the methodology for describing learning outcomes developed in cooperation with the H2020 BIMplement project (https://www.bimplement-project.eu/).

The NEWCOM competence database links the description of the competences gained by attending a relevant course with the expert. The NEWCOM competence database can be expanded to almost any field of work and used throughout Europe.

The core element of the database is the harmonised description of competences of training schemes it contains. This is done through the units of learning outcome database, which is a very relevant part of the NEWCOM competence database. Only by implementing this feature is it possible to compare the content and acquired competences of training schemes. Professionals can be tested and recognised based on developed and agreed ULOs (units of learning outcomes) in correlation with these new training schemes. After a successful verification of their competences, professionals have the possibility to register in the NEWCOM competence database implemented through the BUILD UP Skills advisor app to show their competences in a validated format (professional card) and to be found by customers or companies.

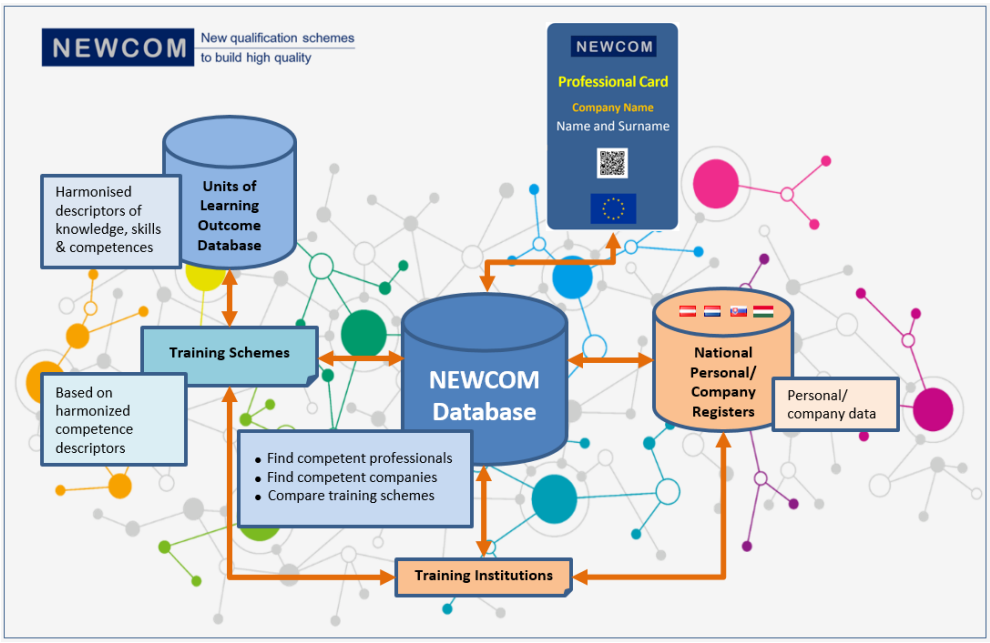


Fig 3: The environment of the NEWCOM database (source: © AEA)

For more information on the project and the developed NEWCOM competence database, visit the following website: https://www.newcomtraining.com/

3.6 Ongoing e-learning interaction within BUSLeague

To identify energy skills that are actually needed and possibilities to support the recognition of correspondent trainings in Austria, the national climate protection network (klima**aktiv**) is actively used. Moreover, a specific national focus has been laid on cooperation with national supplier networks to determine presently successful supplier trainings. In this context, several

meetings were held with product manufacturers and their unions during the implementation of the BUSLeague project.

Based on the findings as well as the project orientation (defined scope of the BUSLeague EE-skills qualification), it was decided to determine national energy advisors as target group for the trainings primarily because it is known from the past that this target group is willing to take part on further education according to the holistic focus of the BUSLeague topics (e.g., cross trade issues).

In cooperation with the further education institute Energy Agency Styria, short online trainings are under development to the following topics:

- Construction site procedures in connection with the implementation of a renovation roadmap
- Interpretation of available quality checks (blower door test, thermography etc)
- Management of ecological construction material on the building site.

To enable the possibility for mutual recognition detailed competence descriptions of these trainings will be developed. Accordingly, the use and implementation of digital means for the recognition of the trained skills is planned to be done by the further exploration of the BUILD UP Skills advisor app (further development of the integrated NEWCOM competence database).

4 Overview of and experiences with applied e-learning interactions in Bulgaria

The micro-learnings used/planned to be used in Bulgaria are based on actual qualification or upskilling schemes for different qualification levels, developed throughout the course of implementation of several EU projects - Fit-to-nZEB, Train-to-nZEB, BUS Enerpro and CraftEdu. Most of these training modules are linked with different e-learning interactions and training materials, which could be used separately or in combination. The e-learning content, however, is not sufficient to obtain a full certification online, as it is expected to be combined with physical trainings, especially practical.

In this chapter, an overview of applied e-learning interactions in Bulgaria and their experiences with them is given.

4.1 E-learning interaction: Build in Green Platform

4.1.1 Description of the e-learning interaction

One of the first e-learning platforms designed by EnEffect in partnership with GEF, UNDP and Gradat Media Group is "Build in Green". The platform provides learning content, useful information and best practices in the field of design and construction of sustainable buildings as well as deep renovation. The information is divided into two main categories: "Build in green" and "Best practices". The content is rather text heavy, and the platform could therefore be considered an e-library. The main themes are divided into sub themes, which could be used together or separately.

4.1.2 Experience with the e-learning interaction

The platform was used to provide theoretical content to trainees in classroom courses on different subjects. The learning content is presented as a specialized professional textbook, split into segments, which correspond to specific learning outcomes for each training course. It is only an auxiliary platform for theoretical content and does not lead to certification on different subjects.

Fig 4: The theoretical training course "Sustainable buildings"-E-learning interaction: Certified Passive House Trainer

4.1.3 Description of the e-learning interaction

As a result of the implementation of the EnerPro project, EnEffect and Passive House Institute designed the Moodle course "Certified Passive House Trainer", accessible here. All courses in English are currently available under a fee as "Passive House Fundamentals". The courses in Bulgarian language as well as the course "Passive House for Decision Makers" are available for free.

4.1.4 Experience with the e-learning interaction

This e-learning platform is designed to provide the following trainings in Bulgaria which lead to certification: Train-the-trainer course and Passive House Fundamentals. The training is broken down into 10 online modules and trainees need to pass all of them in order to obtain certification. This is why it is not so suitable for micro-learnings. The free training Passive House for Decision Makers (non-specialists) has the same modular structure, and the certification follows the same principles.

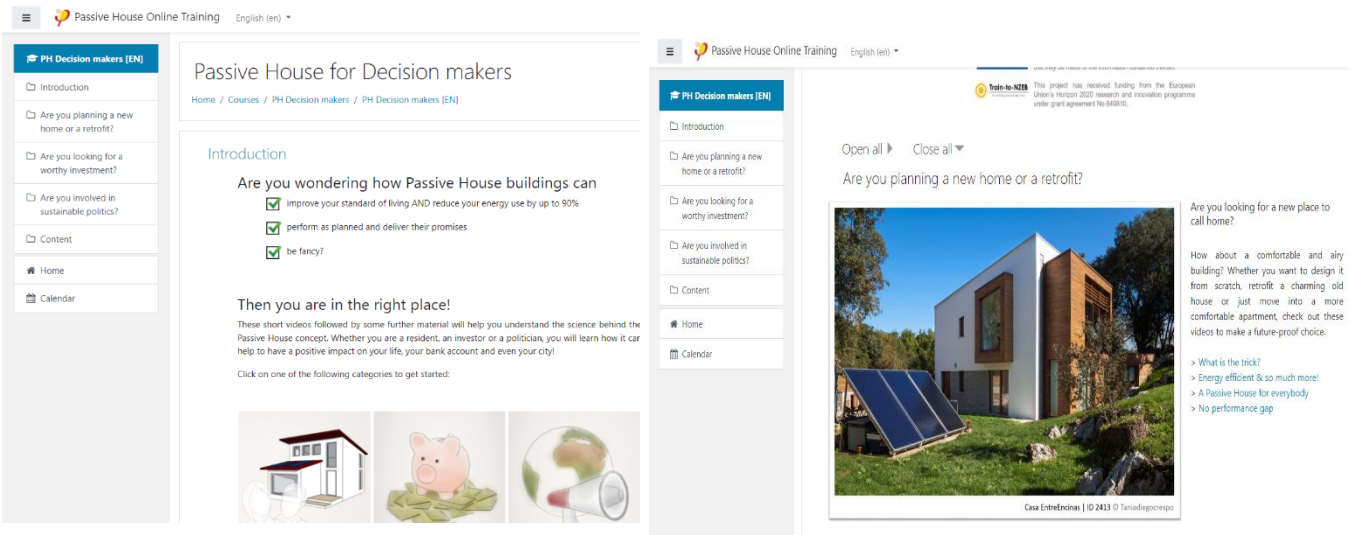


Fig 5: Free learning content – Passive House for Decision Makers

4.2 E-learning interaction: Train-to-nZEB mobile app

4.2.1 Description of the e-learning interaction

Train-to-nZEB mobile app was developed under the Train-to-nZEB project in collaboration with MosArt (IE). The app is accessible here and can be downloaded from google play, however, it needs to undergo some testing as some of the modules are no longer functioning properly. The content is built on the same modular principle with several smaller trainings which cover different learning outcomes and could be combined in different certification schemes.

4.2.2 Experience with the e-learning interaction

The app has been mostly used for reference purposes (e.g., a builder wants to check something on the site), and not for training or education. The learning content is divided into 5 categories:

airtightness, solar, glazing, passive house, timber frame and ventilation in the following languages: English, Bulgarian, Czech, Turkish, Ukrainian and Romanian.

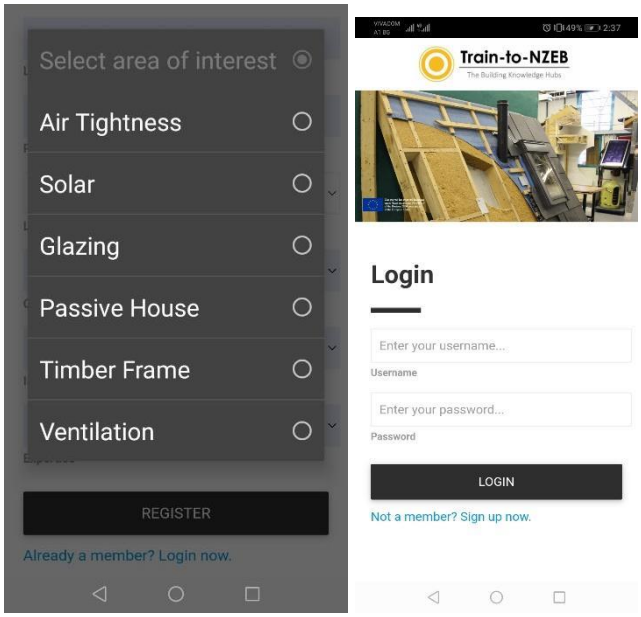


Fig 6: Categories of learning content for Train-to-nZEB

4.3 E-learning interaction: CraftEdu Database

4.3.1 Description of the e-learning interaction

Another e-learning platform used in Bulgaria is CraftEdu database, available in German, Czech, Slovak and Bulgarian languages. The platform is developed by EnEffect and international project partners. It uses the October CMS and offers content structure in modules, which can be united in various (upskilling) courses. The courses could then be united in broader certification schemes.

4.3.2 Experience with the e-learning interaction

The platform is optimised from user perspective, as after the user registers for a course of their choice, the content is delivered in consecutive screens with short content, followed by tests, and using lots of graphic materials and pictures. The user can go through the content at their preferred pace; the tests however must be successfully completed before moving forward. There are 5 courses offered in Bulgarian language: nZEB principles, nZEB tradesperson, glazing installer, hydro insulation installer and drainage system installer and all of them follow the modular structure. This is not a micro-learning, however, the courses and the modules within can be combined based on the trainee preferences. Another advantage is that several courses could be grouped in one bigger certification scheme. Last but not least, this type of training is compatible with the existing conference tools (ZOOM, TEAMS), which could be used for online interaction with the trainer. Combining a virtual learning platform with conference tools for communication with the trainer increases the training efficiency and quality.

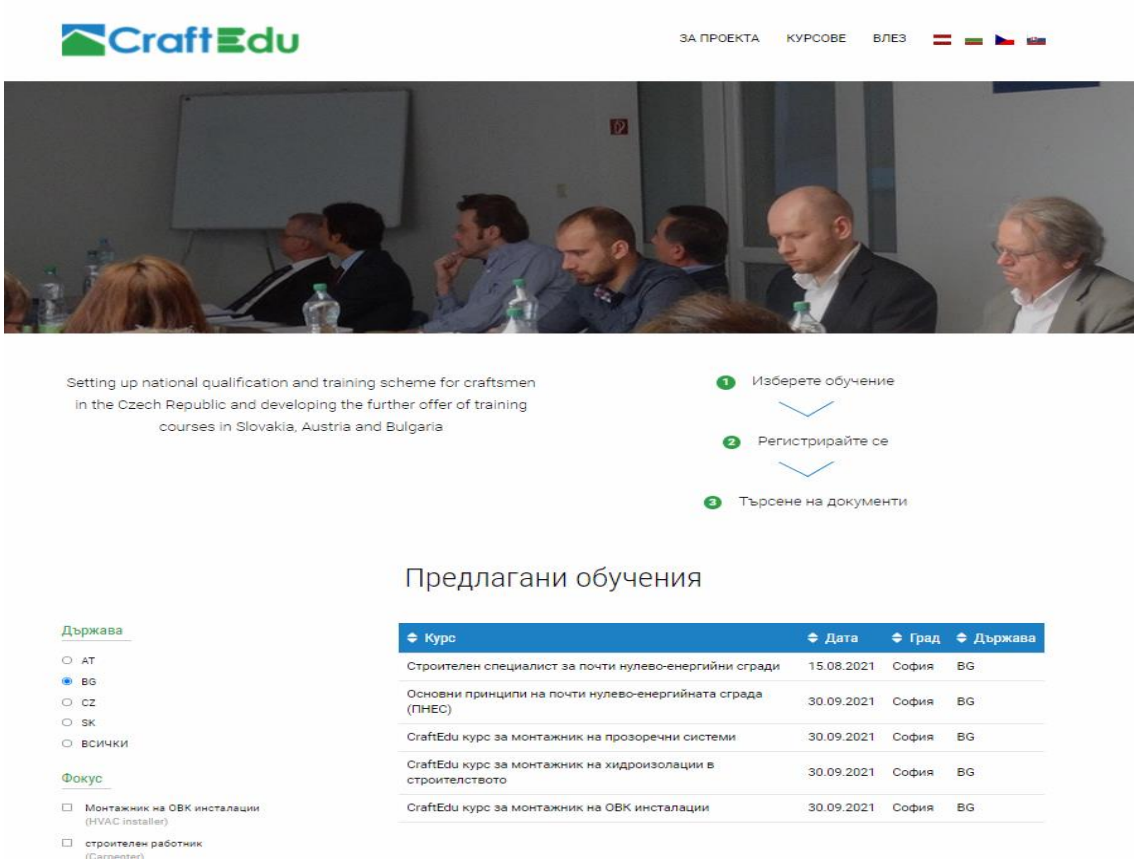


Fig 7: Interface for the CraftEdu Database

4.4 E-learning interaction: Ministry of Education and Science

The implementation of these EU projects in Bulgaria led to change of the State Educational Standards for certain professions. In addition, EnEffect were assigned to develop electronic training aids (PPTs and textbooks) for the new discipline for professional high schools "Ecologic and energy efficient construction". Two sets were developed: "Basic principles of energy efficient buildings" and "Airtightness and ventilation". They are both accessible to all professional high schools in Bulgaria via the online database of the Ministry of Education and Science. Based on feedback from the Ministry the first training package is one of the most downloaded files. However, it is only for high schools that have the right to access this platform.

5 Overview of and experiences with applied e-learning interactions in Spain (ES)

In this chapter an overview of applied e-learning interactions in Spain and their experiences with them is given.

5.1 E-learning interaction: BAUHAUS Moodle platform

Bauhaus has a Moodle platform dedicated to the online training of its employees and partners. Based on its strategic and quality plan, Bauhaus obliges its staff to take courses throughout the year. In general, the courses are quite practical and are mainly based on entertaining videos recorded in the Bauhaus stores where common situations that occur in the shops are analysed. In this way the employees are equipped with sufficient knowledge and skills to deal with such situations successfully.

Fig 8: BAUHAUS Moodle platform

5.2 E-learning interaction: IVE training programme

The Valencia Institute of Building (IVE) has a wide range of trainings adapted to the current challenges of the construction sector. According to their duration, the trainings are classified into the following 4 groups: e-pills, courses, intensifications, master's degree.

5.2.1 Description of the e-learning interaction

Fig 9: Classification of IVE trainings

E-Pills:

Micro-learning with a duration of between 2 and 5 minutes. These are videos that introduce the sector's hot topics. These videos are available on IVE's YouTube channel. They are free and open access. More information: click HERE.

Courses:

They range in duration from 5 to 25 hours. They can be online and/or offline. If they are online, they are taught through IVE's Moodle platform, the so-called "Aula Virtual IVE". If the student passes the exam, he/she receives a certificate issued by IVE. More information: click HERE.

Intensifications:

They have a duration ranging from 20 to 60 hours. They are taken online, through IVE's Moodle platform, the so-called "Aula Virtual IVE". If the student passes the exam, he/she receives a certificate issued by IVE. In addition, if the student gives his/her consent, he/she is registered in a "list of professionals" managed by IVE and hosted on its website. More information: click HERE.

Master's Degree:

It has a duration of between 200 and 800 hours. It is taken online, through IVE's Moodle platform, the so-called "Aula Virtual IVE". The student must submit exercises, pass several exams, and carry out an internship in a company. The student receives a certificate issued by the Polytechnic University of Valencia (UPV). In addition, if the student gives his/her consent, he/she is registered in the corresponding "list of professionals" managed by IVE and hosted on its website. More information: click HERE.

All the above information can be summarised in the following table:

	Duration	Platform	Price	Test	Certificate	List
E-pill	2-5 min.	YouTube	Free	No	No	No
Course	5-25 h	Moodle	€	Yes	Yes	No
Intensification	20-60 h	Moodle	€	Yes	Yes	Yes
Master	780 h	Moodle	€	Yes	Yes (UPV)	Yes

5.2.2 Experience with the e-learning interaction

Over the years, the training offered by IVE has evolved with the aim of being more flexible and adapting to professionals, both in terms of topics covered and in terms of timetables and formats. For this reason, online training has increased considerably in recent years. There has also been an increase in shorter courses.

Progress was also made in the recognition of training. The system evolved from certificates to the publication of lists of professionals and the inclusion of professionals in the so-called "Register CHC":

- IVE CERTIFICATE

The certificates issued by IVE include an "Electronic Verification Code (CVE)". This code confirms the authenticity of the certificate, which is hosted on the IVE website.

IVE
INSTITUT VALENCIÀ de l'EDIFICACIÓ
INSTITUTO VALENCIANO de la EDIFICACIÓN

CERTIFICAT D'APROFITAMENT
CERTIFICADO DE APROVECHAMIENTO

L'Institut Valencià de l'Edificació certifica que

LAURA BALAGUER GARZÓN

ha completat la intensificació **Millora de les condicions d'accessibilitat dels edificis** de 30 hores de duració, celebrada online. Per deixar-ne constància i als efectes oportuns, expedeix aquest certificat.

El Instituto Valenciano de la Edificación certifica que

LAURA BALAGUER GARZÓN

ha completado la intensificación **Mejora de las condiciones de accesibilidad de los edificios** de 30 horas de duración, celebrada online. Para que conste y a los efectos oportunos, se expide el presente certificado.

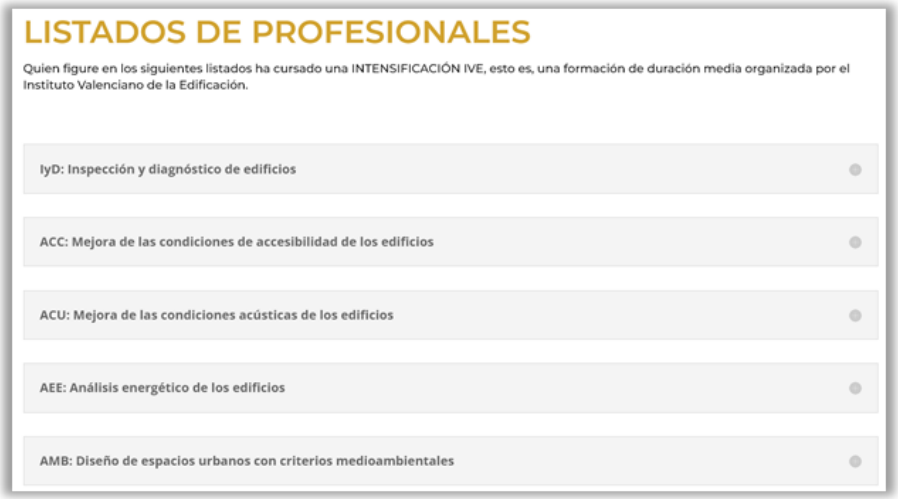
Valencia, 30 de desembre / diciembre de 2021

Código de verificación electrónico (CVE):
E1F4CB55-F6BC-44BF-B822-D91C5549AC79
Puede verificar la validez de este documento con su CVE en http://www.five.es/cve

Fig 10: Example of an IVE certificate

- IVE "LISTS OF PROFESSIONALS"

The IVE "lists of professionals" function as a mutual recognition system, managed by IVE and hosted on the website (click HERE). The aim of these lists is to give visibility to professionals who have completed these trainings and to promote their recruitment. There are currently 14 active lists.



LISTADOS DE PROFESIONALES

Quien figure en los siguientes listados ha cursado una INTENSIFICACIÓN IVE, esto es, una formación de duración media organizada por el Instituto Valenciano de la Edificación.

IyD: Inspección y diagnóstico de edificios

ACC: Mejora de las condiciones de accesibilidad de los edificios

ACU: Mejora de las condiciones acústicas de los edificios

AEE: Análisis energético de los edificios

AMB: Diseño de espacios urbanos con criterios medioambientales

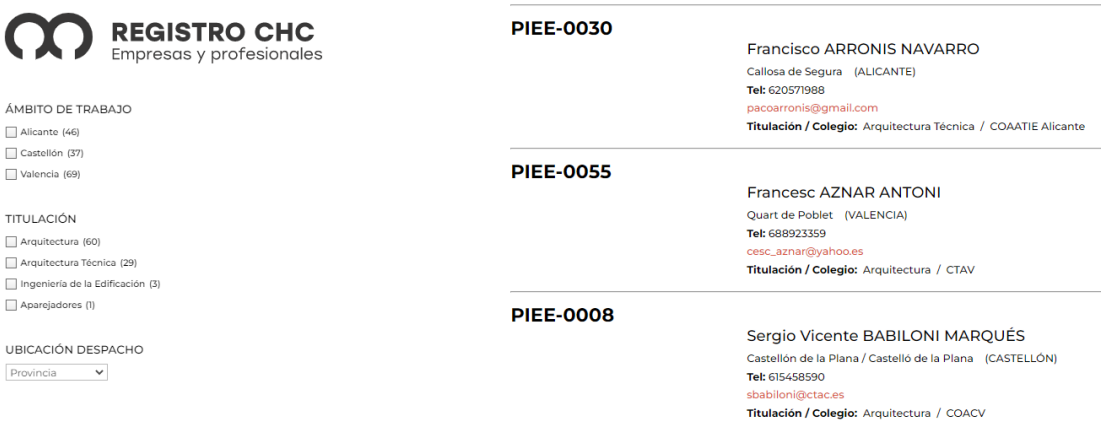
Fig 11: Example of a list of professionals by IVE

- "REGISTER CHC"

The **"Register CHC"** was created by IVE with the support of the Valencia Regional Government (Generalitat Valenciana) in January 2022 during BUSLeague. It is a **recognition scheme** where citizens can find accessible, transparent, and free information through a website managed by IVE and supervised by GVA, which reinforces public confidence and trust. The "Register CHC" contains the following three areas:

1. Buildings
2. Companies & professionals
3. Products

Professionals or companies may register in the "Register CHC" as long as they meet the requirements set out in the area (detailed protocols are in place). In line with the objectives of the BUSLeague project, the **"Companies and professionals" area includes requirements about the skills and experience of professionals**. In general, their registration will be reviewed and renewed every 3 years. Complaints from citizens will be investigated and may result in the removal of the professional or company from the "Register CHC".



6 Overview of and experiences with applied e-learning interactions in Ireland IE

In this chapter an overview of applied e-learning interactions in Ireland and their experiences with them is given.

6.1 Micro-learning in the BUILD UP Skills advisor-app

6.1.1 About the App

An Irish version of the Build Up Skills Advisor App was launched in 2019 as part of the Sustainable Energy Authority of Ireland (SEAI) funded BUNRS (Building Upon Ireland's National Renovation Strategy) project, in which TUS and IGBC were partners. The primary objective of the app is to facilitate building professionals and construction workers to upskill in energy renovation.

The Build Up Skills Advisor App allows building professionals and construction workers to select their profession and the specific area in which they would like to gain new skills in a few clicks. Based on their profile and needs, they can then see a list of all relevant courses currently available in Ireland. During BUSLeague, the app had 237 new users in Ireland of in total (EU) 1.400 new users (17% market share).

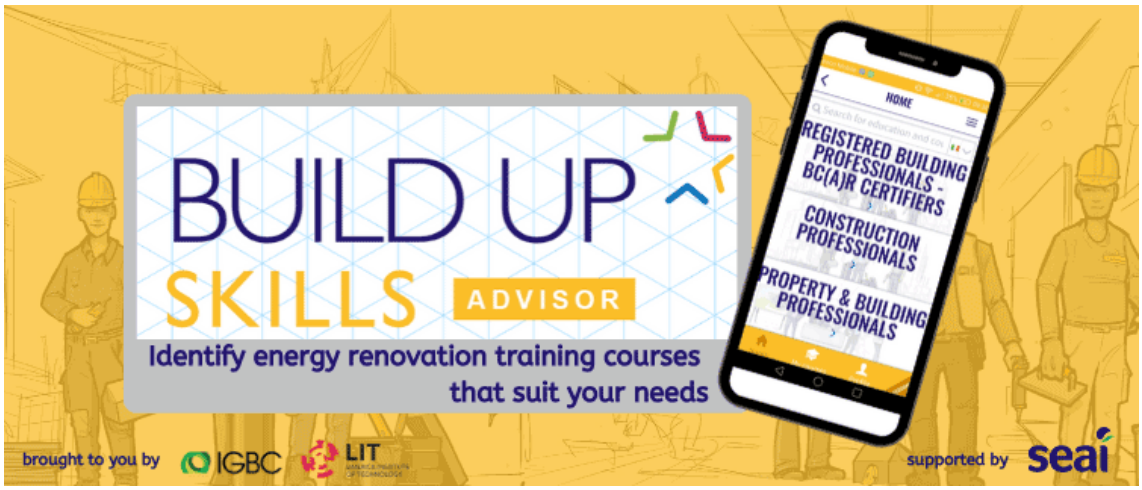


Fig 12: Banner for the BUILD UP Skills Advisor app

6.1.2 Vision

The IGBC and TUS will continue to promote the development of the app through further initiatives such as DASBE, BUSI 2030 and BUSGoCircular and forecast greater use of the app by building professionals and construction workers in Ireland over the coming years. The app supports the newly launched register of Renovation Advisors. More information at WP2-D6-D7Final_Master.pdf (igbc.ie).

Ideally, building professionals and construction workers should be able to register on the platform, develop a personal online profile, identify the training courses that would allow them to move towards being part of the register and signpost to the training courses they have

completed on the platform offering micro-badges. Ideally, this would allow them to demonstrate their skills, competences, knowledge and expertise to potential clients (public and private), thus indirectly incentivising them to upskill.

6.1.3 Next Steps

Although not all these actions can be completed as part of BUSLeague within the project timeframe, the project partners will focus on the following over the next year:

- Updating the Build Up Skills Advisor App, ensuring all relevant training courses are listed. From September 2023 onward, training courses on circularity and construction will be added as part of the BUSGoCircular project.
- Promoting the app to education bodies, professional bodies and the industry, animating the BUSLeague qualification framework
- Test the app assessment functionalities on a small number of courses, their learning outcomes and quiz documents. The objective would be to see if these short introductions to courses and quick assessment could act as an introduction to longer programmes and incentivise users to complete these programmes.
- The project partners will also explore how micro-badges could be added to the Irish app as is done for the BIMzeED project which TUS led on (although not on the app as it is not a self-directed course, but a module will be trialled).

6.2 Micro-learning: Additional Examples and Case Studies

6.2.1 IGBC' Mail Courses

The IGBC in partnership with the UKGBC has developed 4 course mails:

- Sustainability in the Built Environment
- Circular Economy in the Built Environment
- Nature & Biodiversity
- Advancing Net Zero

The Course Mail Series are delivered weekly in easy-to-read emails. Once building professionals receive the emails, they can read the information when and where it suits them. Each Course Mail comes with a short knowledge test. By completing the knowledge tests after each module, building professionals can be awarded Continuous Professional Development (CPD) hours. Certificates are to be issued after successful completion of the tests.

Fig 13: Banner for an IGBC Course Mail

6.2.2 *Experience with the e-learning interaction – E-badges*

In Ireland, a number of organisations are using e-badges to encourage upskilling. For instance, building professionals who have completed the Home Performance Index (HPI) Certification training course can use an HPI assessor badge and are listed on the IGBC website.

Fig 14: Home Performance Index Assessor E-Badge

In Ireland VET centres called Education and Training Boards (ETBs) also issue e-badges to construction workers who complete NZEB training. The digital badge allows learners to recognise and communicate learning achievements and certifications online in a secure way. The badges are issued by City & Guilds on a platform called Credly.

Fig 15: Example of an e-badge issued by WWETB

6.2.3 *Construction Blueprint*

Construction Blueprint is a European project, belonging to the Erasmus+ Programme, (2019-2022) for implementing a new strategic approach to sectoral cooperation on skills. Construction Blueprint is a partnership formed by 24 partners from 12 countries in 2019, led by Fundación Laboral de la Construcción (Spain). TUS from Ireland is a partner in the project and responsible for Work Package 3, Enabling Transnational Sector Wide new Skills and Training. The online

portal as part of Construction Blueprint contains a great detail of information including a significant amount of training content available free of charge, sourced from previously funded programmes and can be accessed by registering on [Online Courses - Construction Blueprint.](#) In addition, once the project is finished in May 2023, 45 new modules for VET which were developed by TUS and piloted in all partner countries to almost 1,000 apprentices will be made publicly available through the website. As can be seen from the screen grab below, courses cover energy efficiency, circular economy and digitisation. In time a link will be made (subject to agreement by all parties and the signing of an MOU) between Construction Blueprint and the BUS advisor App, for which we foresee great synergies.

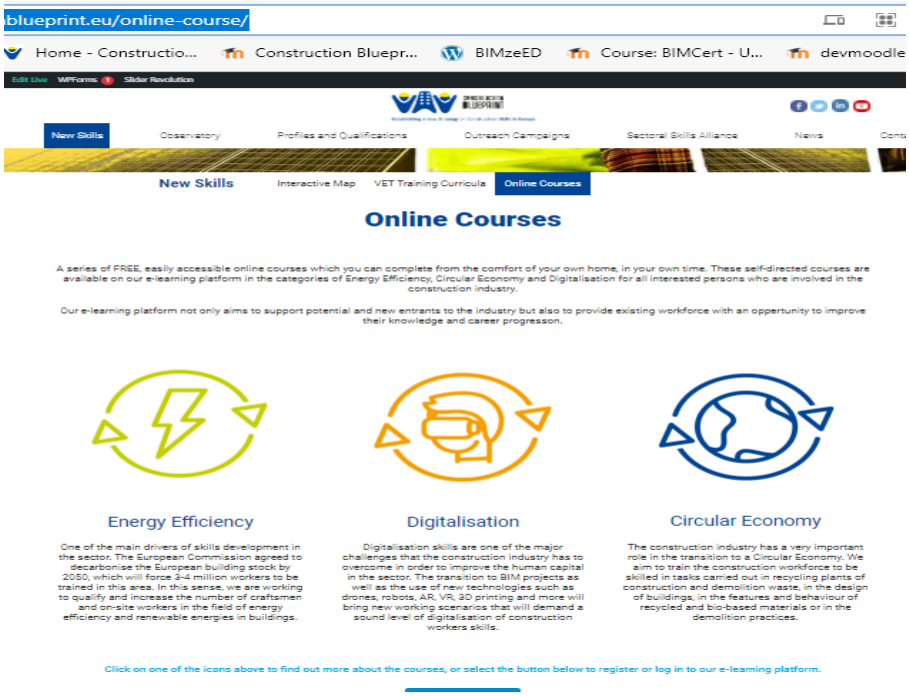


Fig 16: Courses at the Construction Blueprint

7 Overview of and experiences with applied e-learning interactions in France FR

In this chapter an overview of applied e-learning interactions in France and their experiences with them is given.

7.1 E-learning interaction: MOOC- Bâtiment Durable

The MOOC Bâtiment Durable is a training platform dedicated to sustainable building. It is the result of a collaborative project of all professionals in the building sector, the Sustainable Building Plan and ADEME.

The objectives of the platform are:

- to increase the skills of professionals in the building and real estate sector on energy transition and sustainable building in general (construction and renovation),
- the dissemination of knowledge to the general public on issues related to sustainable building, in particular the energy renovation of housing.

Launched by ADEME and the Plan Bâtiment Durable, this initiative took shape with the proposal by GIP FUN MOOC to provide a specific platform. Training projects submitted on the platform come from a variety of structures: training organisations, associations, and universities, design offices, etc. These training courses give voice to professionals and should thus help create a community around the desire to transmit and share knowledge and skills on sustainable building. A set of partners; professional organisations and unions, associations, institutions, training organisations, companies, OPCA ... of the sector are associated with the project. A governance charter has been established and signed by more than 25 partner organisations, to guarantee the platform's editorial line and ensure its sustainability.

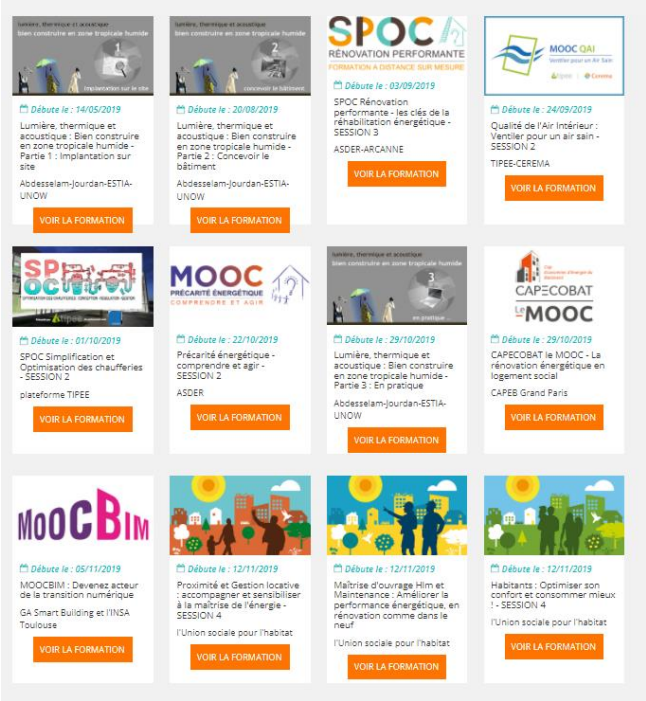


Fig 17: MOOC Bâtiment Durable

7.1.1 Description of the e-learning interaction

To access, candidates must create a personal account, linked to a personal mail address in which they will receive the training's basic information and news. Candidates will have online access to all the academic content, activities, tasks, and notes. However, some pedagogic contents are downloadable.

The account allows candidates to apply for the trainings of interest among the available course disposal (and even the coming ones), following the current inscribed programmes, and review the results of old ones. Each one of them (offered three times) has its own pre-requirements, indicated in the description, and a specific work amount. Some programs demand a final evaluation that often leads to an achievement certificate in case of approval.

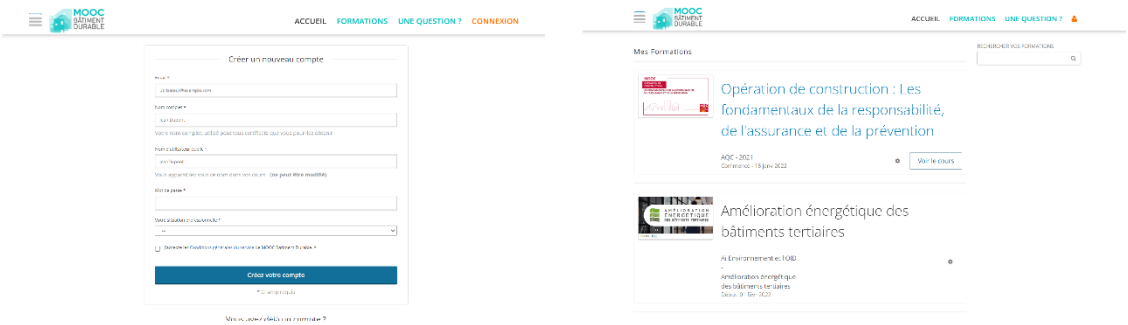


Fig 18: Inscription to the platform and account's course list

The platform is not geographically restrictive, so the courses are available for any French speaker around the world. The candidates of the same course can exchange among them or with the pedagogic team through forums or personalised meetings hosted in this digital space.

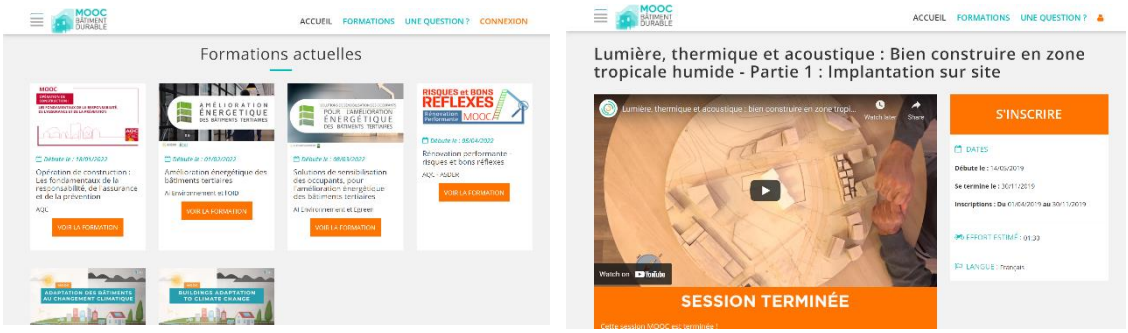


Fig 19: Available Courses and description of one of them

7.1.2 Experience with the e-learning interaction

The constant growth of candidates seems to reflect the increasing relevance of the digital tools in the building sector, especially regarding the upskilling process. Nevertheless, this is also fed by households leading their own renovation process and willing to be trained, according to FUN platform. The first diffusion campaign of the MOOC Bâtiment durable, for example, achieved the enrolment of 8500 users in two main courses. The first MOOC, *Rénovation performante: les clés de la rehabilitation énergétique*, received 7 500 inscriptions (60% of the professionals of the building sector) and an accomplishment rate of 31%, according to FUN.

One year later (in 2017), and two diffusion campaigns after, the platform counted with 17 000 members and a satisfaction rate of 90%. In September 2019, with an accomplishment rate of 23%, the platform got around 41 500 users, 60% of them were professionals of the building sector, including a 25% of engineers and architects and a 15% of craftspeople and project managers, according to FUN.

7.2 E-learning interaction: Leroy Merlin's Campus

The DIY/Hardware store Leroy Merlin launched the Campus to support its clients' bricolage projects, lodging renovations and, more recently, energy efficiency. The campus offers conventional training and coaching services, but also a digital platform with tutorials and videos for those who would like to start renovation projects.

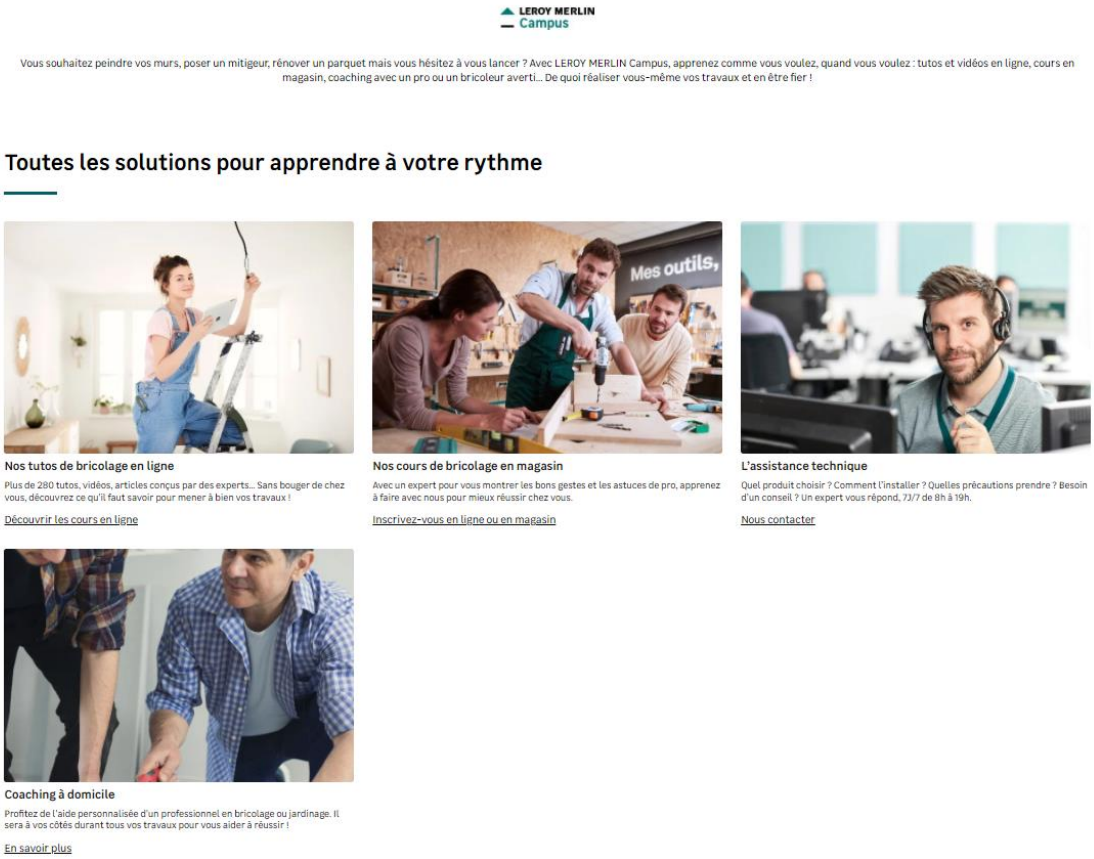


Fig 20: Leroy Merlin's Campus

7.2.1 Description of the e-learning interaction

Among the online trainings, the platform offers around 280 courses classified in 12 project blocks: i.e., "heating and ventilation", "insulation and airtightness" and "doors, windows and carpentry".

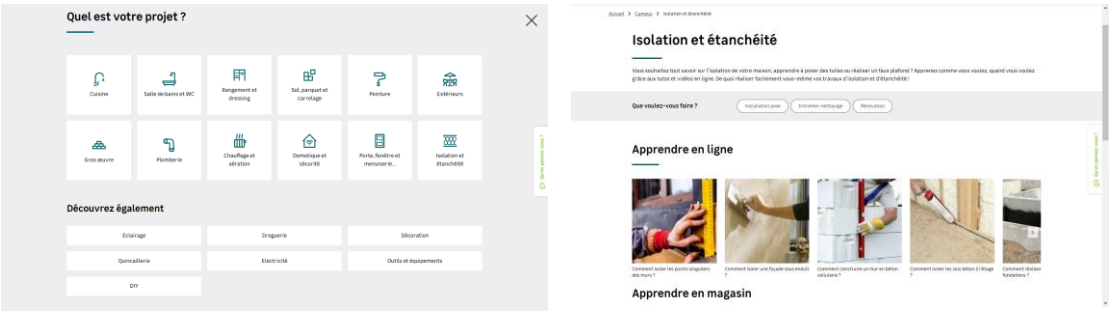


Fig 21: Project blocks and online content for insulation and airtightness.

By selecting a training course, the user has free access to guides containing pictures and written information about how to execute the task, critical points, and other helpful tips.

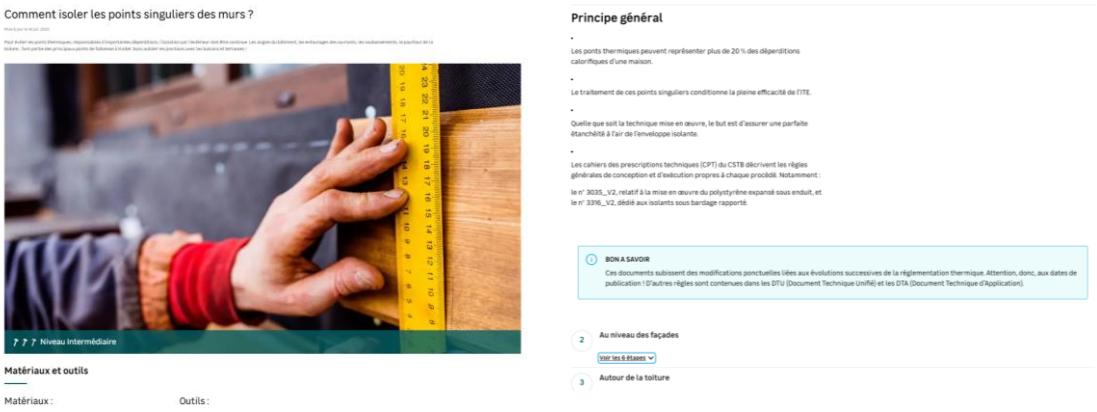


Fig 22: Example of a training guide

7.3 E-learning interaction: LMS Practee formations

In June 2020, the good results of the FIT program encouraged the training centre Practee formation to find a way to ease the time investment required for the training program, by making available online the theoretical content (among 40% and 60% of the training blocks), so candidates may follow autonomously and use the time and space constraints for the onsite training.

The LMS Practee Formations platform is built on a Moodle architecture and holds 7 learning blocks addressed to building professionals: videos, written content, and interactive activities. All the content presented is orientated towards the belief that the game is a powerful tool for knowledge acquirement.

Fig 23: Initial page of the LSM Practee Formations

7.3.1 Description of the e-learning interaction

To enrol in training, a username and a password are assigned, and candidates have access to seven knowledge blocks conceived for complementing bent learning processes. The platform invites the candidates to follow the proposed activities for the concerned block among lighting, carpentry, ventilation, insulation, heating, energy audit for craftspeople and energy audit for project managers.

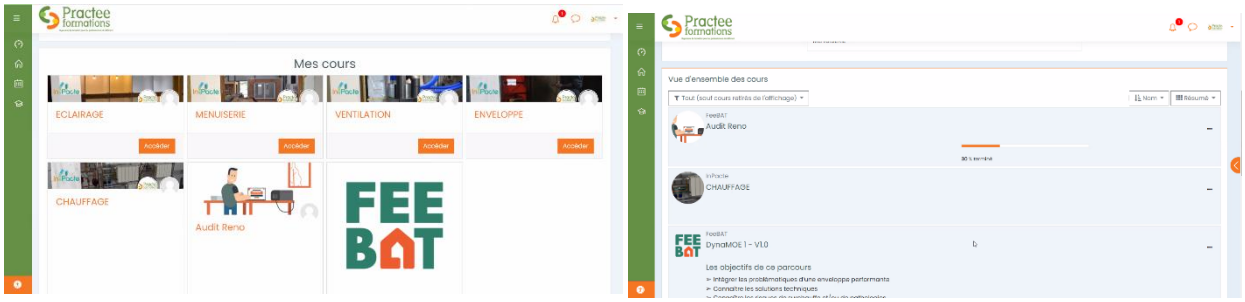


Fig 24: Course disposal and profile view at the LSM Practee Formations

To start, each candidate must approve a classification test, composed of 12 -16 questions selected randomly from a list of 50. The idea is to identify knowledge gaps related to specific topics that are pre-requirements for the training. In case of approval, the candidate is welcomed to the training's modules. Otherwise, the platform suggests MOOC courses or online content to upskill the candidate before he/she could start the training.

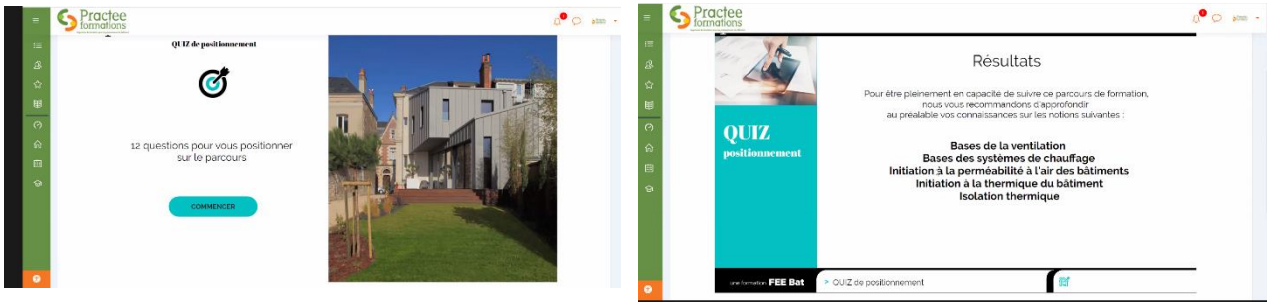


Fig 25: Classification exam at the LSM Practee Formations

Once the test is approved, the candidate has access to the different modules with guides and interactive contents. While the length of each module is different, they are conceived as consecutive sections of 15 minutes. In addition to that, the platform offers interaction spaces with the trainer, who can monitor the progress of each candidate (in quantity and time), enabling a personalised support. Candidates can also make questions to the instructors or platform coordinators.

The platform is also linked to a mail address; candidates will receive notifications on the latest news or about virtual meetings.

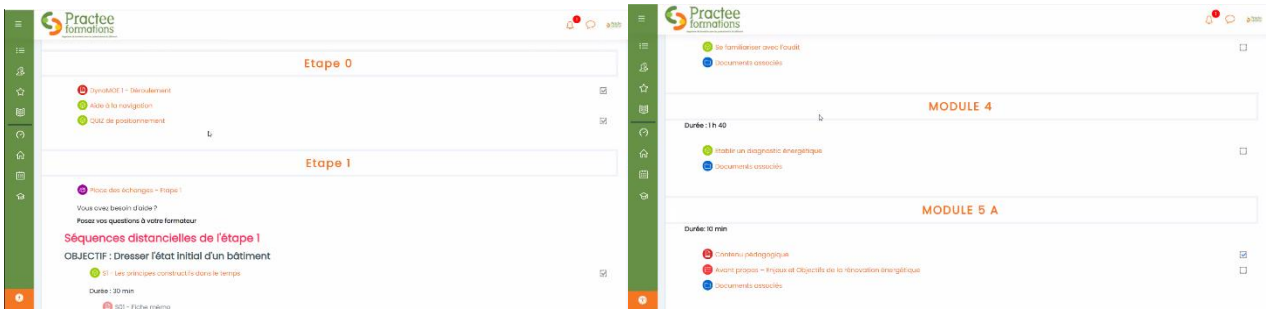


Fig 26: Learning modules at the LSM Practee Formations

Once they approve the modules, the candidate will have access to a synthesis with all the answers and detailed explanations. The content can be downloaded and read later (before the practical session, for example).

Fig 27: Synthesis tests of the Learning modules at the LSM Practee Formations

Fig 28: Synthesis written content of the Learning modules at the LSM Practee Formations

7.3.2 *Experience with the e-learning interaction*

Since its launching, the platform went from hosting 2 courses in 2019 to 7 courses of 15 candidates on average by January 2021, totalling 75 trained professionals with a success rate of 82%, close to the satisfaction rate seen for the complete training (including the virtual and face-to-face modules). This success rate depends largely on the introduction of the "assessment test". On the one hand, this requirement allows only "eligible" students to follow the proposed contents, increasing their probability of success. On the other hand, this selection process reduces the notion of risk for third parties, such as the competency operator Constructys, who receive statistics on this exam and on the candidate's overall performance,

7.4 E-learning interaction: Castorama's Ideas and advice

As other DIY stores, Castorama launched within its website a series of tutorials and guides available for the public. The guides are classified into 24 axes around which the project owners may get the minimum information required for leading a renovation project successfully, build, or just improve their lodgings.

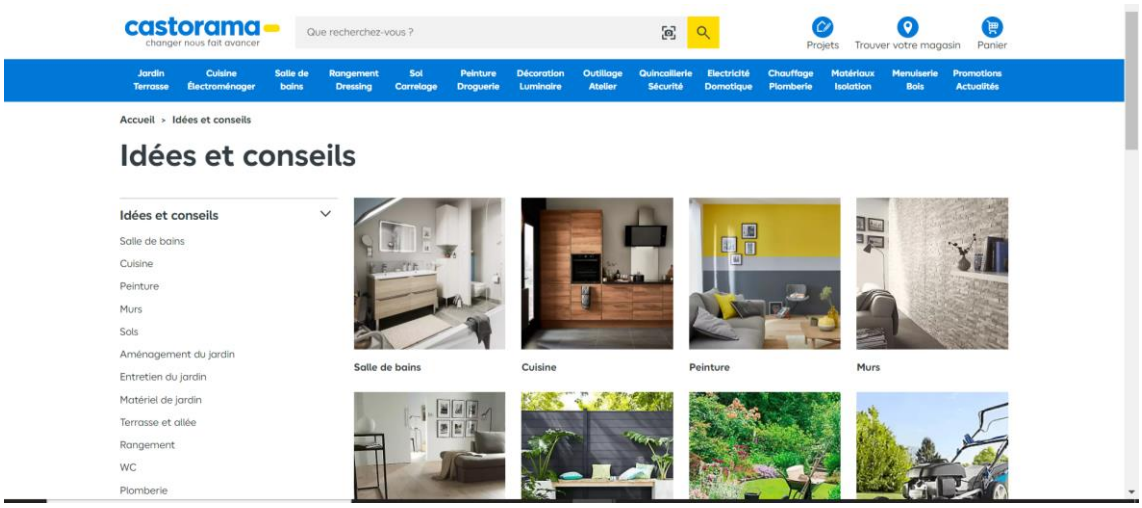


Fig 29: Castorama´s Ideas and advice

7.4.1 Description of the e-learning interaction

The website design expects the client to select one of the axes and based on this decision, it proposes different guides that include written contents, diagrams, videos to inform or provide instructions, advantages and disadvantages and critical points or eventual issues, step-by-step tasks and other helpful information about materials or installation techniques, funding and administrative procedures for energy renovation projects.

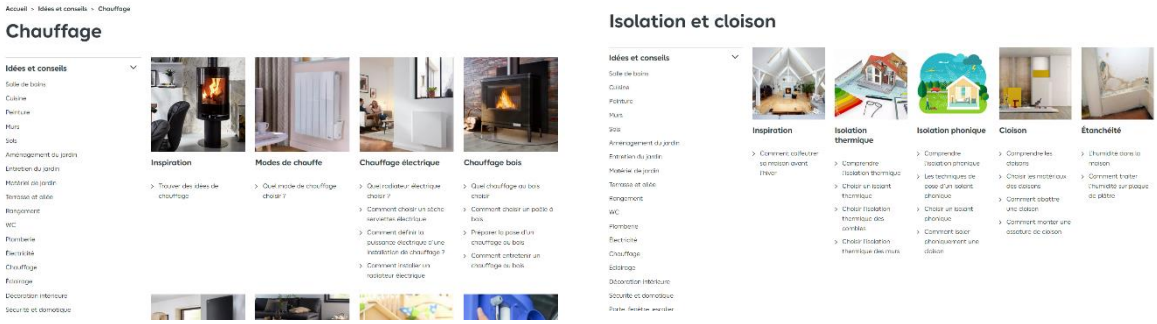


Fig 30: Topics and topics structure

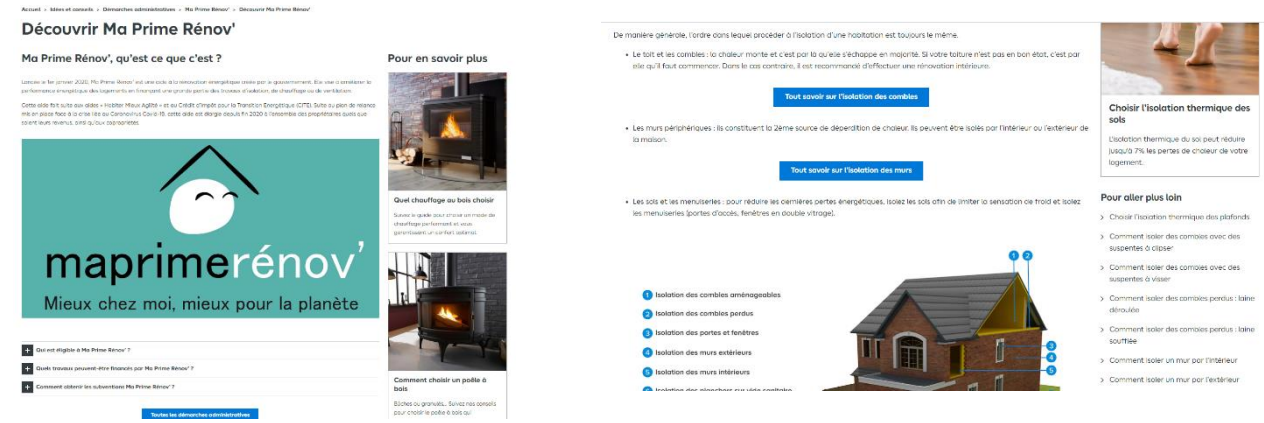


Fig 31: Examples of guide content

8 Overview of and experiences with applied e-learning interactions in Netherlands NL

In this chapter an overview of applied e-learning interactions in the Netherlands and their experiences with them is given. All the different e-learning interactions have been designed with a focus on brain-based learning. Brain based learning is a principle used by many trainers to increase the efficiency of training. Brain learning on the principle that strong neural connections must be made in the brain to retain the material permanently or to change behaviour permanently. What is important here is that all senses must be employed to make the neural connections in the brain. Although digital micro-learnings can never serve all the senses, we have tried to incorporate as many of the principles as possible into the e-learnings.

The 6 principles:

1. Focus (Mirror Neurons).

We all have mirror neurons. If someone yawns, you will yawn too. By always setting a good example and letting professionals do the talking, we set the bar high, and participants can copy the example.

Example 1: RockPit: Play against a good colleague. This will encourage you to behave like him.

Example 2: BIM module BuildUpSkills. The best in the business explains what BIM is.

Example 3: Wisbits. An experienced colleague makes a short instruction. The mirror neurons do the rest.

2. Emotion (dopamine and adrenaline).

People learn best when they are challenged.

Example 1: RockPit. Challenging each other and earning points releases dopamine and adrenaline in the brain. This makes the material stick better.

3. Repeat.

Example 1: Rockpit. Challenges can be repeated as many times as necessary. Also repeats are sent for 6 at least weeks. Research shows that this is the period during which lasting neural connections can be made.

4. Creation.

The brain prefers to create rather than consume. Often, microlearning is a first step before real-world training (Neighbourhood handyman). In micro learning, only the necessary knowledge is given and a taste of what you can do once you have completed the training. In a practical classroom, the participants will eventually get down to creating, making mistakes and learning from each other.

5. Build upon.

It is important to activate pre-knowledge so new knowledge can be linked to it. Our brain always builds on existing experiences, associations, and meaning, therefore making them explicit, is essential to make new insight stick.

Example:

The BUILD UP Skills advisor App uses occupations in the navigation screen. In the e learnings belonging to those professions, we appeal to the participant's previous knowledge. In the module, we build on that knowledge.

6. Use all senses.

Brains use different locations to process information. Offering information by the means of different senses activates several neural networks at the same time. Thereby you create more 'entrances' to the information, more possibilities 'to weave in' the information and more associations to process and bring back the information later.

Digital learning can never touch all the senses. That is why it is crucial to engage in hands-on activities where people can also smell and feel materials.

Example: Neighbourhood handyman training.

8.1 Micro-learning in the BUILD UP Skills advisor-app

8.1.1 BUILD UP Skills app Learning from 'images from practice'-interaction.

In the BUILD UP Skills advisor-app [Android and Apple] training institutes and product suppliers have the possibility to create and deliver small question sets focussing on component, wrong and bad situations. This by documenting images from on-site and off-site situations. The learner is asked to look at the image and to find the right element OR to indicate if the work is delivered Ok or Not Ok.

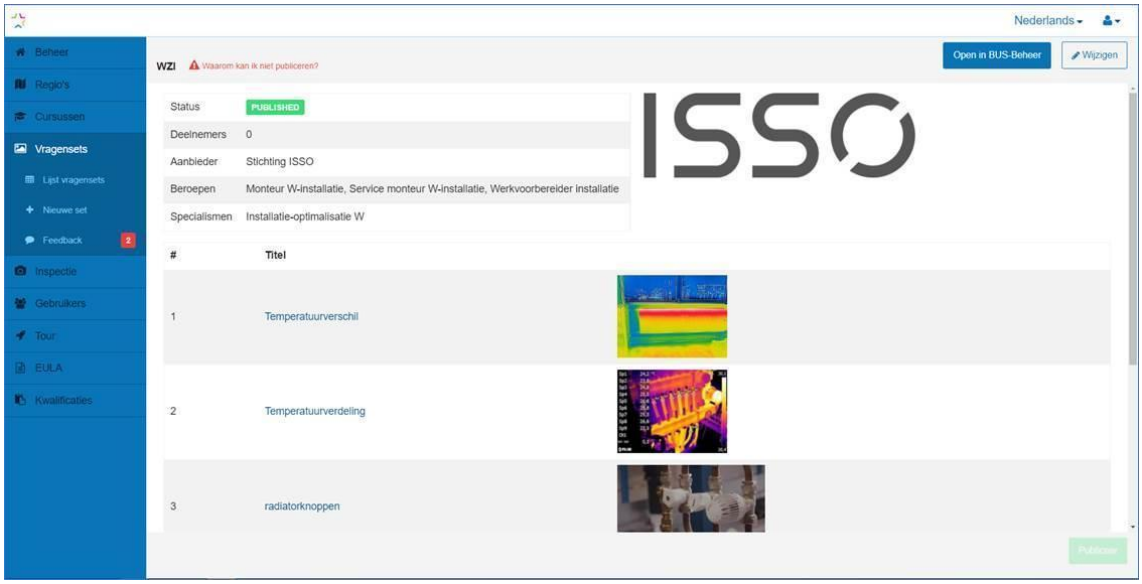


Fig 32: Overview of Question development

While publishing these upskilling interventions the micro-learning interactions can be connected to a topic and one or a few tasks the learner is training on. This will enable the registrations of

micro-credentials. The e-learning can be served out with the use of QR-code advertising and by push-messaging for users following the topic that is linked to the e-learning.

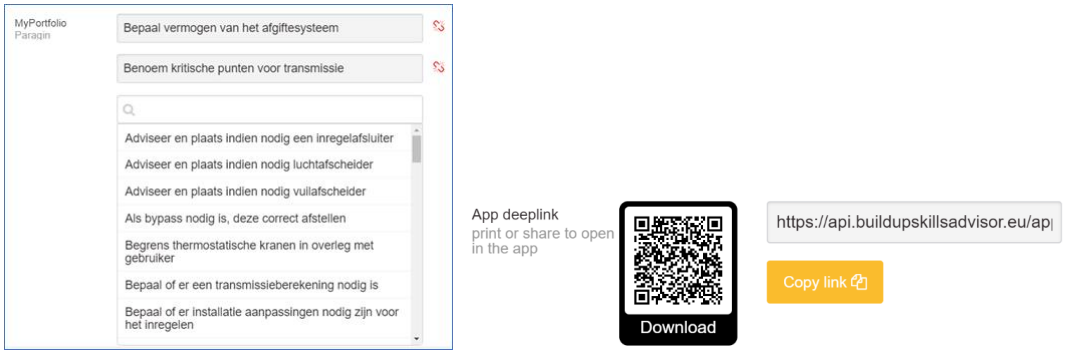


Fig 33: Linking to tasks, and generation of the QR-deeplink

When the interaction is opened the player gets 5-20 questions.

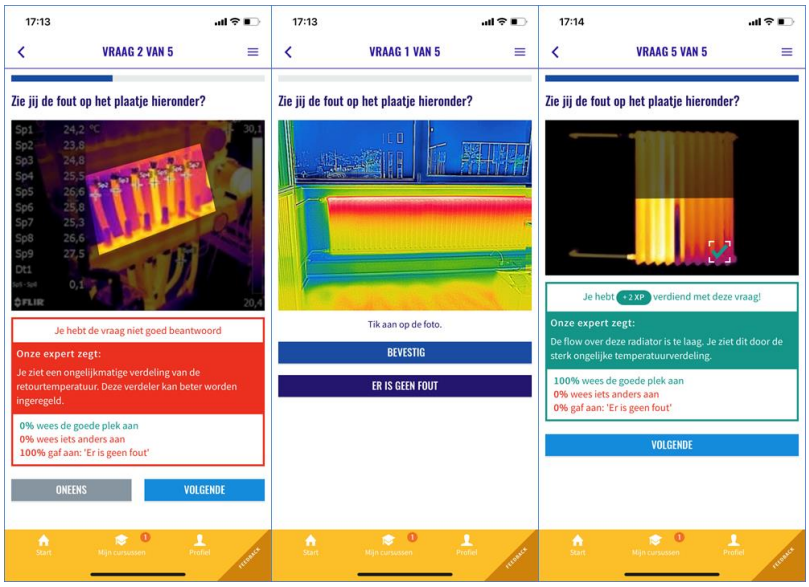
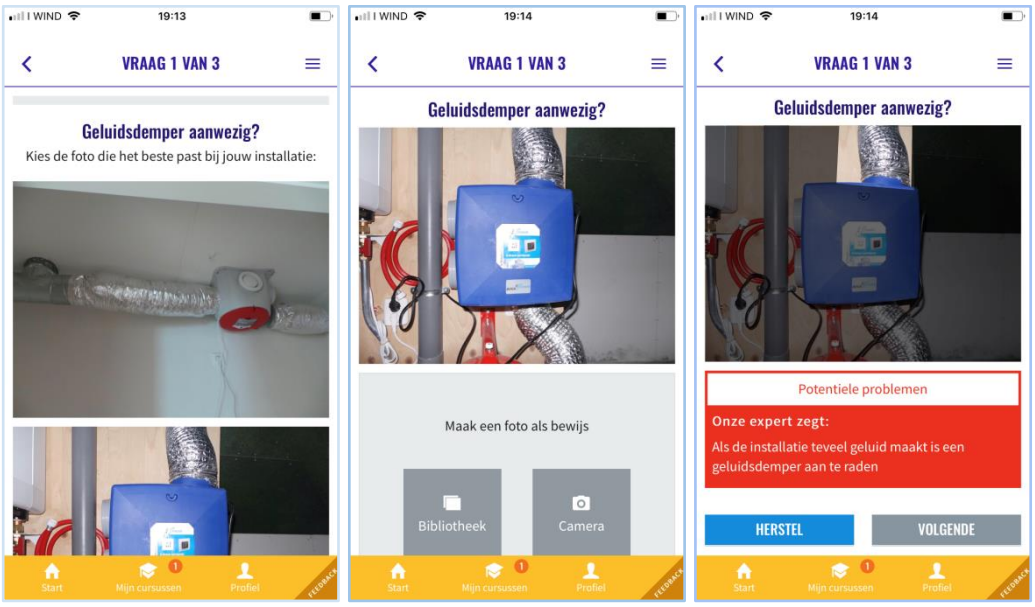


Fig 34: Several questions from the 'building errors interaction'

8.1.2 BUILD UP Skills app Learning from self-instruct and check-interaction.

Building upon the 'Building errors interaction', a visual self-instruct and self-check interaction is also available.



Step 1 Compare Step 2 Deliver proof Step 3 Learn and Improve

Fig 35: Example from the self-instruct and self-check interaction.

Learnings: we planned to use these interactions in the cooperation with DIY-stores. As this cooperation did not work out as planned in BUSLeague, no further testing of this way of micro-learning has been done.

8.1.3 BUILD UP Skills app directly connected mobile e-learning.

Another way of e-learning that can be served directly from the BUILD UP Skills advisor-app is the mobile e-learning served with Ozone. By using Learning Tools Interoperability, a BUS-app user can seamlessly consume mobile e-learning served out with Ozone. The results are retrieved from Ozone by using a secure Application Programming Interface connection.

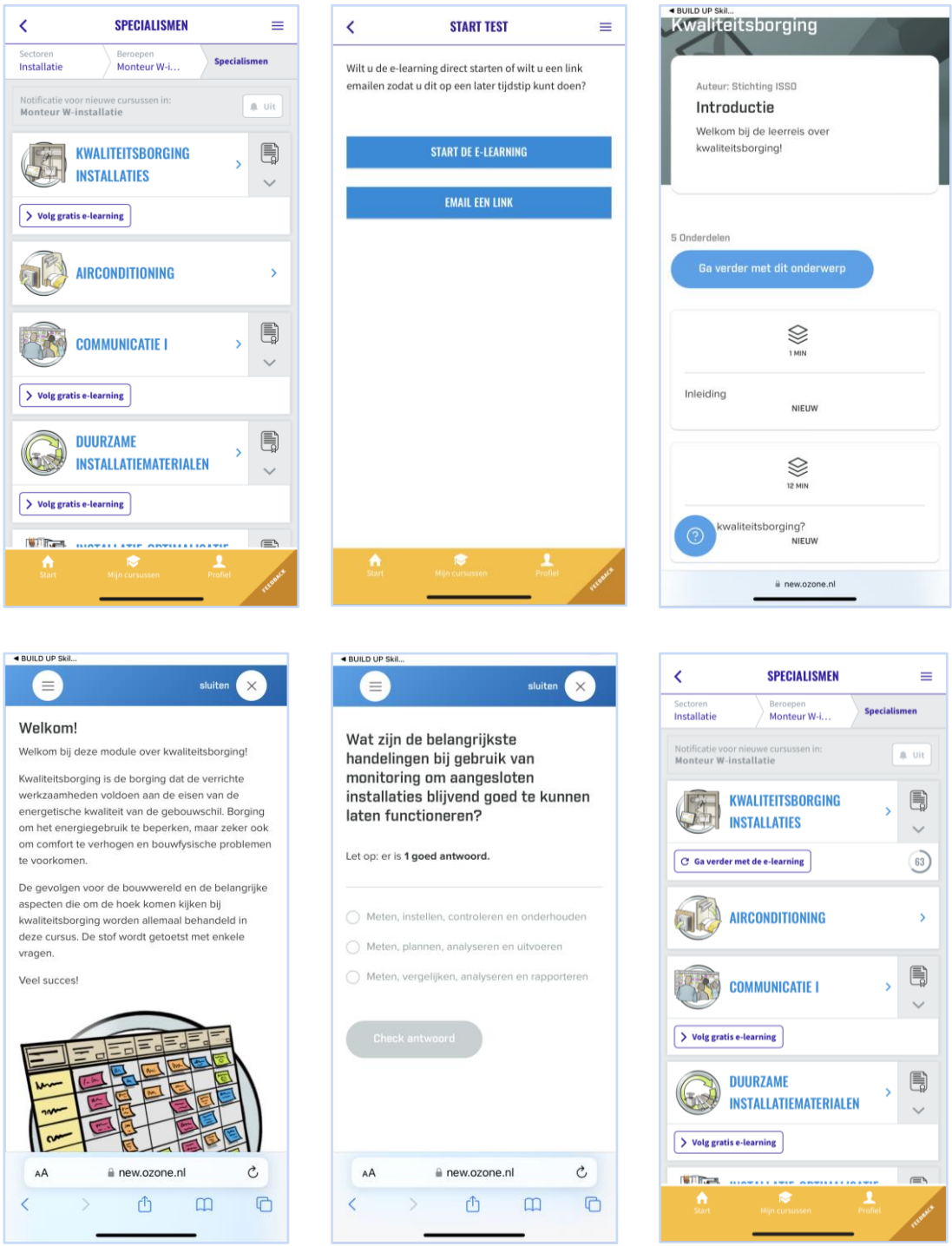


Fig 36: E-learning connected to the BUS-app served out directly with Ozone

8.1.4 Several other examples of e-learning applications worked on in BUSLeague

As the field of new applications is developing rapidly the Dutch team has experimented with several other e-learning tools such as the Attrivity app, Wisbits and the 2B-collective.

Rockpit Attrivity

Rockpit is a commercial provider that offers e-learning challenges of 7-14 questions to educators and companies through the Attrivity app. The use of the Attrivity app can easily be included as part of the course providers' offerings and/or as a company subscription. The advantage of Attrivity is that participants can quickly prepare for the training, that challenges can be played during the training and that companies can also organize team challenges internally.

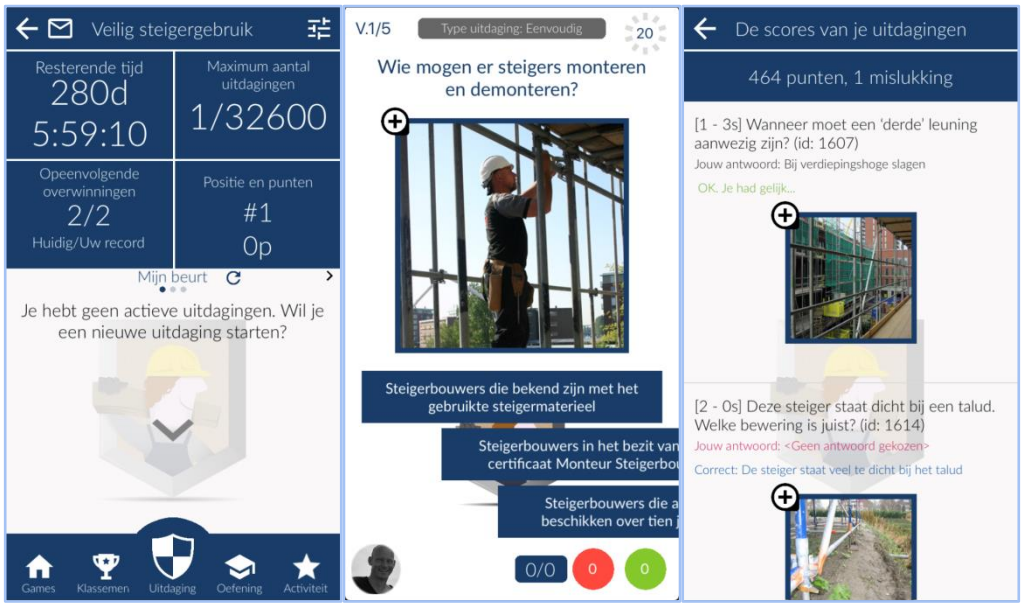
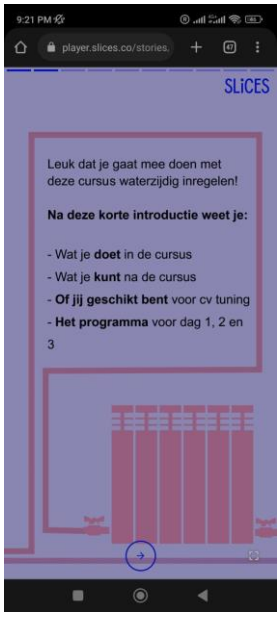


Fig 37: Example of challenging in the Attrivity app.

For Rockpit different micro-learnings have been developed. The aim of these micro-learnings was to introduce blue collar workers to the topic of central heating tuning, before a course about this topic would start. This micro-learning should give the learners an image of what to expect in the course, and potentially have questions to address during the course. Because it is a micro-learning, and the target groups use a minimal number of computers, it is chosen to make micro-learnings which are solely suitable for mobile phones. Below, the different micro-learnings are shown, and learnings are discussed.

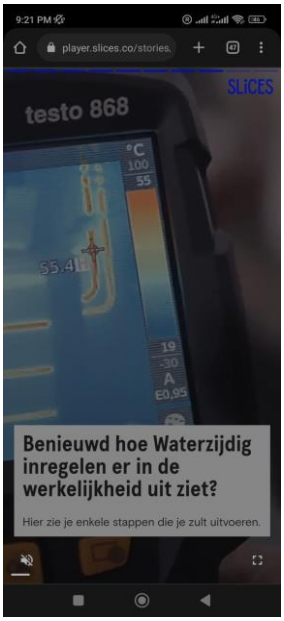
Micro-learning concept 1

In the micro-learning focus is placed on short texts, to increase learning.



Throughout the course simple visuals are created that are related to the topic. Moreover, illustrated workers are displayed to create recognition.

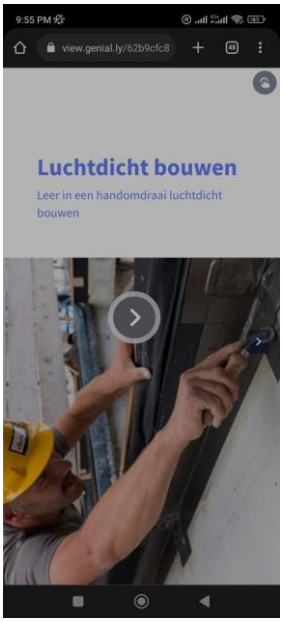
Polls are integrated into the course to either activate prior knowledge or to create a sense of community.



Short videos are placed in the micro-learning to demonstrate how the topic is applied in reality.

Learnings: For this concept, the software of https://slices.co/ is used. This software is easy to use and creates appealing micro-learnings. Especially the live poll function makes this software unique. The downside of this software is that when opening the micro-learning, a pop-up message appears to consent to the regulations of the software. This negatively influences the user flow (it is confusing where to click). Therefore, it is chosen to not test this concept in Rockpit.

Micro-learning concept 2



Moving icons are integrated to place attention on a certain aspect (in this case the 'next' button)

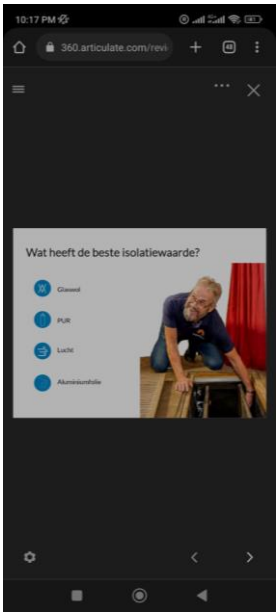
Genial.ly has limited options to ask the learner questions. Solely check-box questions can be asked.

External software is integrated to create more variety in learning forms. The display is not ideal (too small).

Learnings: For this concept, the free software of https://genial.ly/ is used. This software gives the designer complete freedom in how the course template should look like. The downside of this software is that it is mainly usable to 'send' information instead of creating an interaction between the micro-learning and the learner. In addition, when opening the micro-learning, a pop-up message appears to consent to the regulations of the software. This negatively influences the user flow (it is confusing where to click). Therefore, it is chosen to not test this concept in Rockpit.

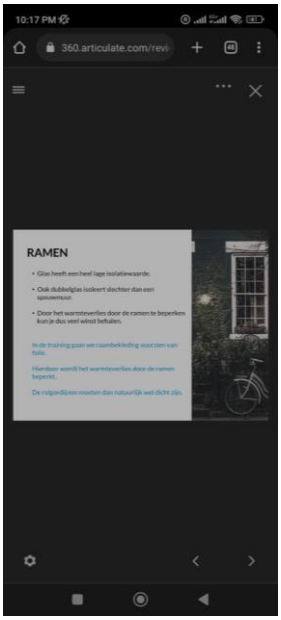
Micro-learning concept 3

The start screen of the micro-learning.

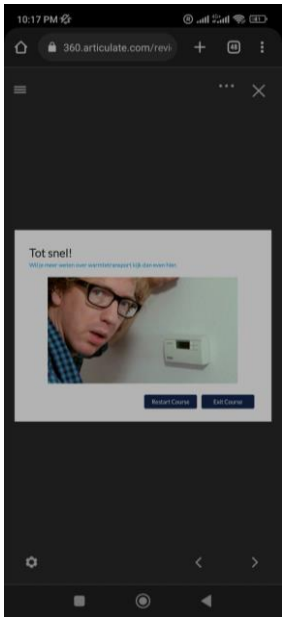


Different questions are asked to the learners to activate their prior knowledge.

The different options have corresponding icons.



Information is kept short. In addition, different colours are used to stress importance.

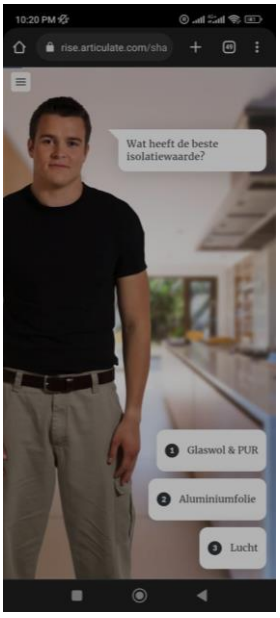


Videos are integrated.

Learnings: For this concept, Articulate is used. Every element can be designed by the course designer. However, this also implies that if the screens are not designed for a mobile screen, that the screens will look small on a mobile phone. This software is very useful if you want to create custom templates/interactions, if this is not needed other software are easier and more suitable.

Micro-learning concept 4

The beginning screen of the micro-learning.



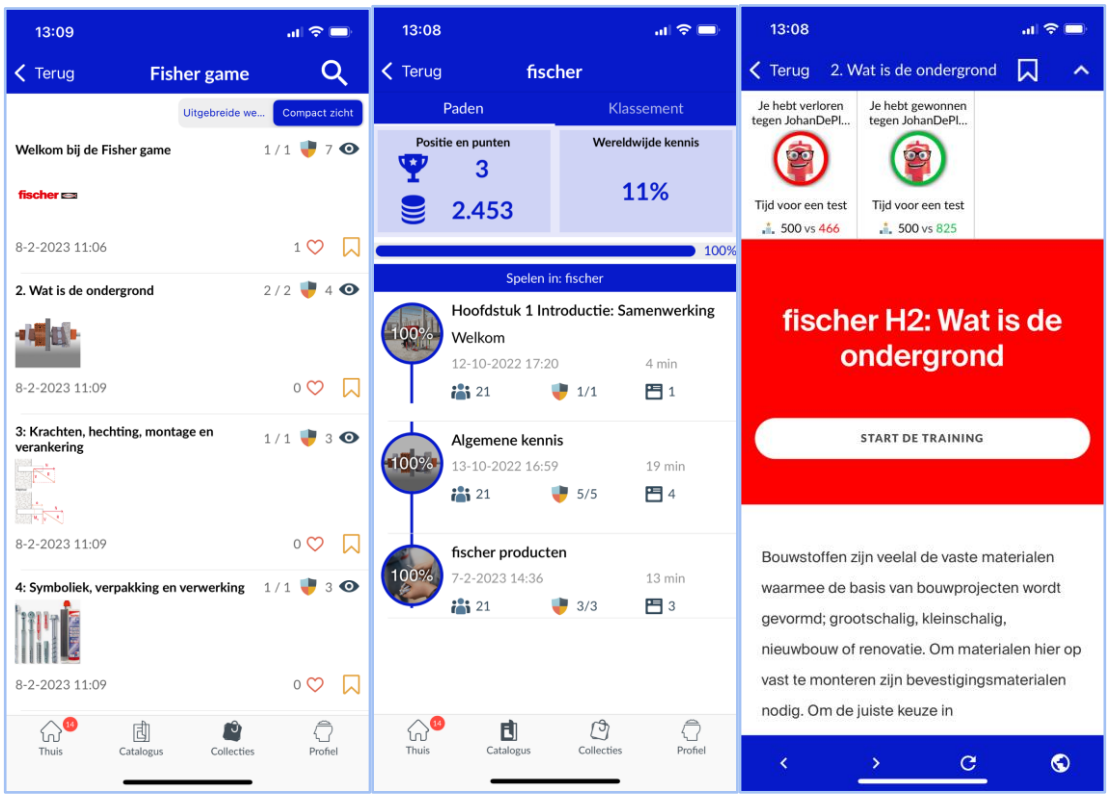
A person whom the target groups can identify is used to add a personal touch to the learning experience. The person will ask different questions to the learner and will answer accordingly.

Different question formats are integrated.

Turning cards are used to create a variety of learning content and give it a playful touch.

Learnings: For this concept Rise 360 of Articulate is used. This software gives the course designer different learning blocks to put content in. This enables the course designer to create quick micro-learnings which look appealing. Moreover, the design is responsive to different screen sizes because the templates are defined beforehand. In addition, the micro-learning has a scroll setup, which creates a flowing learning experience. This concept is used in Rockpit.

Example of how Rockpit integrated the learnings in their work experience.



A chain of challenges | Chapters | Content and interactions

WISBITS

Wisbits is a brand-new e-learning platform fully focussed on learning from and with user / company generated content.

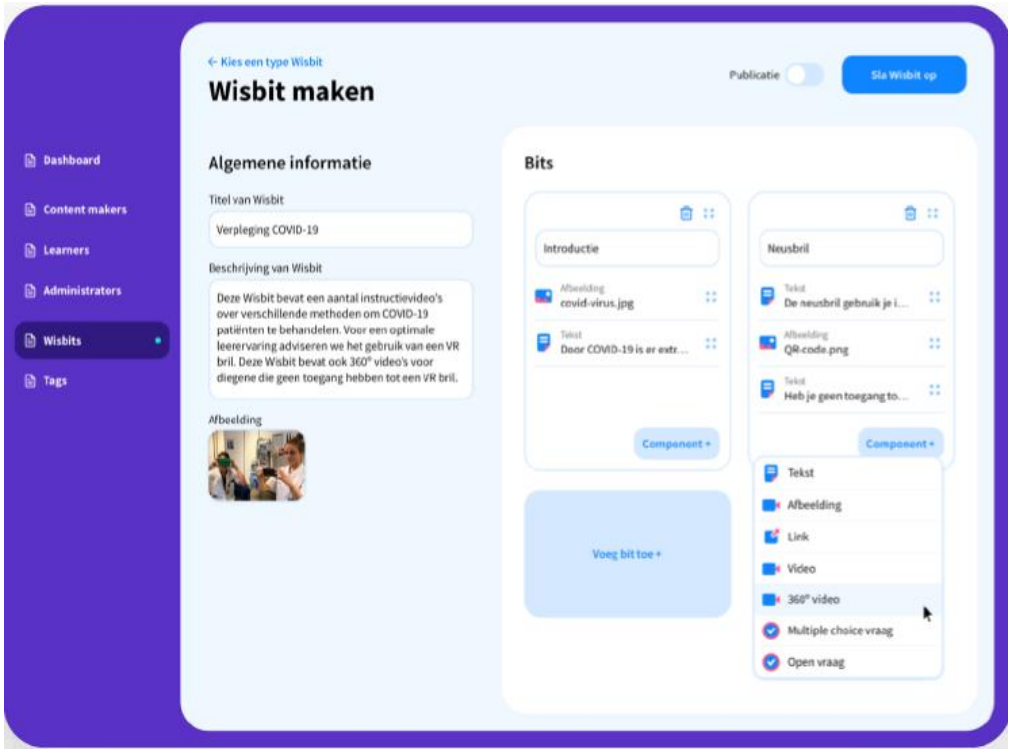


Fig 38: Content creation at company level for WISBITS

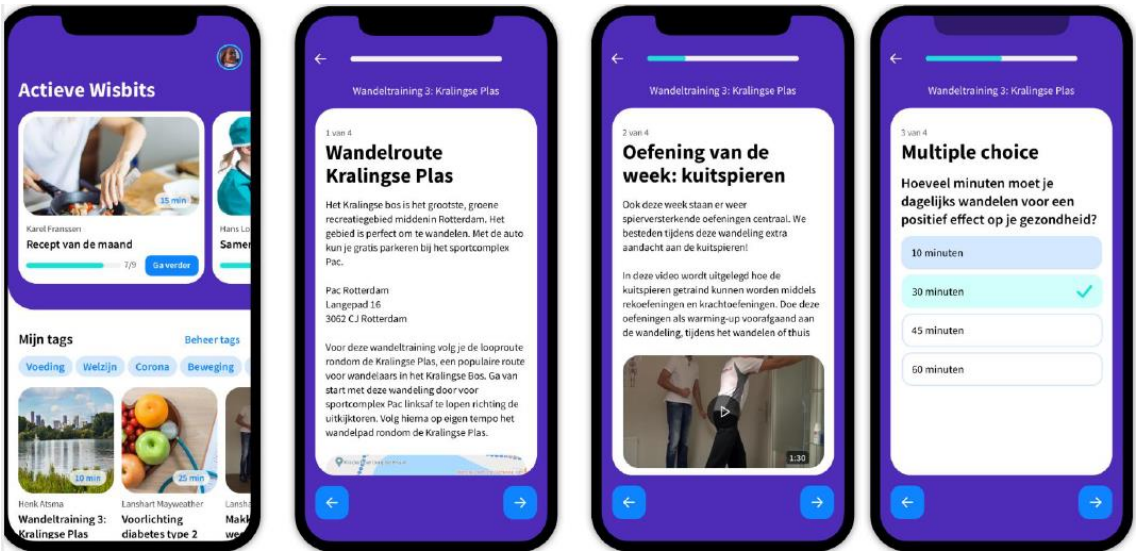


Fig 39: Consuming a WISBIT

Learnings: Due to an unattractive price model (boarding fee of above €7,000 Wisbit is not used in BUSLeague

2BCollective

The 2BCollective is a brand new and fully gamified e-learning platform. It serves a blend of micro-learning (QUIZ), user generated content (ACTION) and social sharing (SHARE).

Fig 40: Learning principles of the 2BCollective.

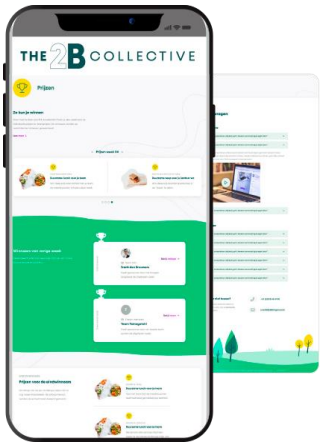
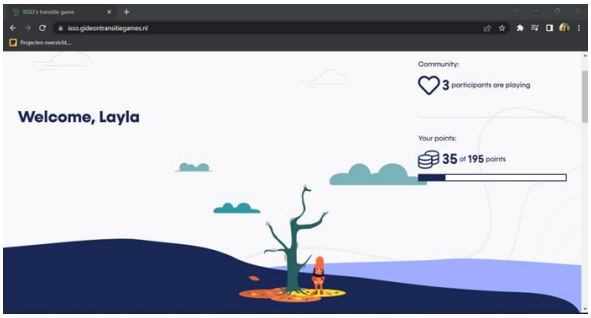
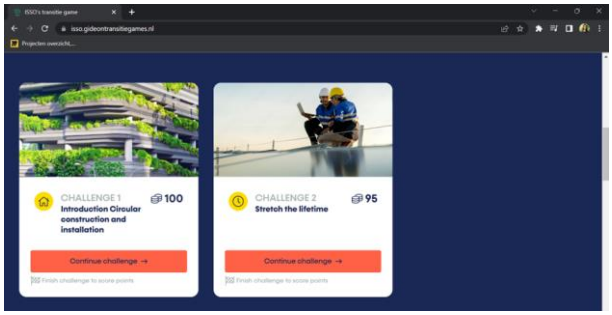


Fig 41: The app of The 2B collective

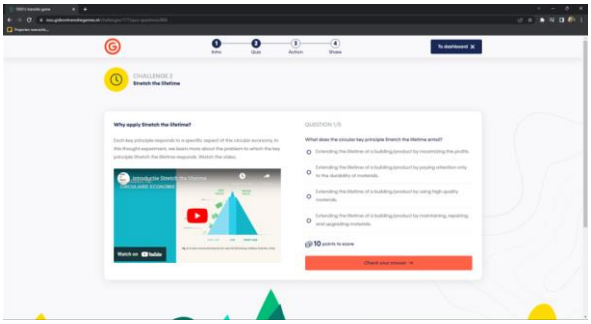
The 2B Collective is used to create e-learning to give white collar workers a basic understanding of what circular construction entails, and how to apply this concrete to work. Below, different screenshots of the course are shown, and learnings are discussed.



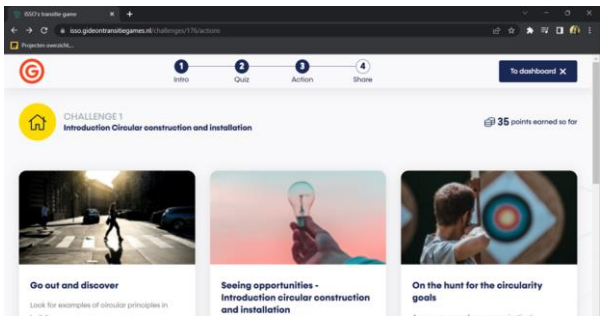
This platform (2BCollective) uses gamification to engage learners. One of the gamification elements is the use of a tree that grows according to the progress made.



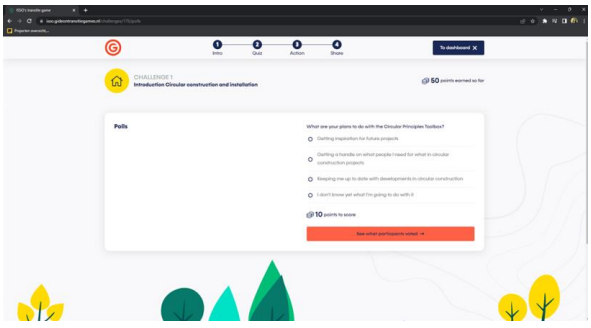
The course consists of 8 modules. In every module a different theme is addressed. For every module points can be earned.



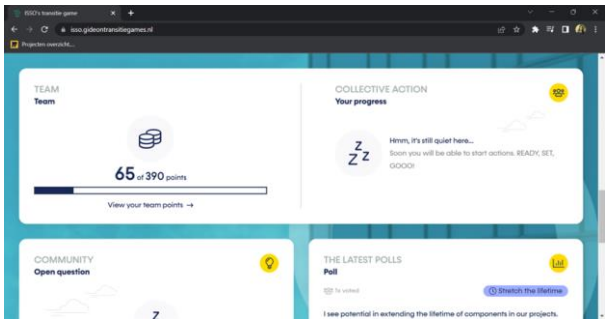
Every module starts with a quiz. In this quiz, the prior knowledge of the learner is activated through the use of a case or video/image. Next more in-depth information is shown about the right answer.



After the quiz, there is room for so-called 'action' exercises. In these exercises, the learner can apply their knowledge in the real world.



Lastly, every course consists of a 'share' section. In this section, the learners can share ideas and opinions.



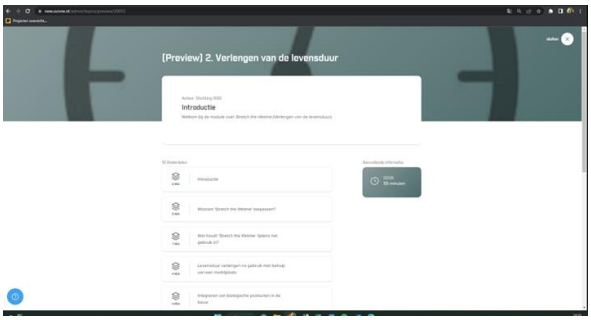
At the bottom of the courses an overview of the group progress is shown.

Learnings: The 2BCollective is a unique platform due to its strong focus on gamification. There is a wide variety of different templates in the 'action' section. However, if the template does not suit the content, it is not possible to make your own interaction.

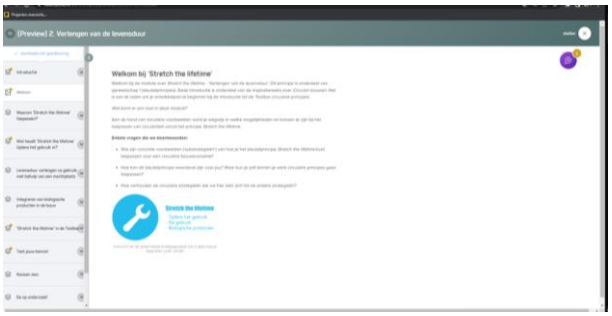
Ozone

Ozone is a learning platform that creates the bridge between upskilling workforces and technical jobs.

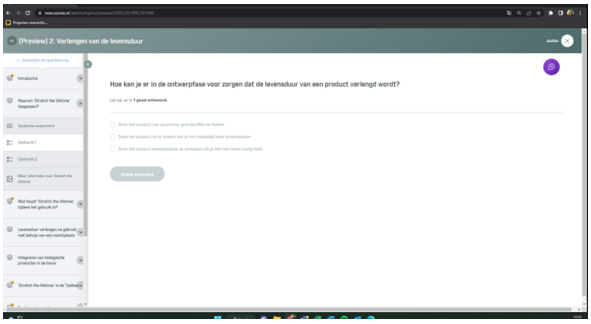
Ozone is used to create an e-learning to give white collar workers a basic understanding of what circular construction entails, and how to apply this concrete to work. Below, different screenshots of the course are shown, and learnings are discussed.



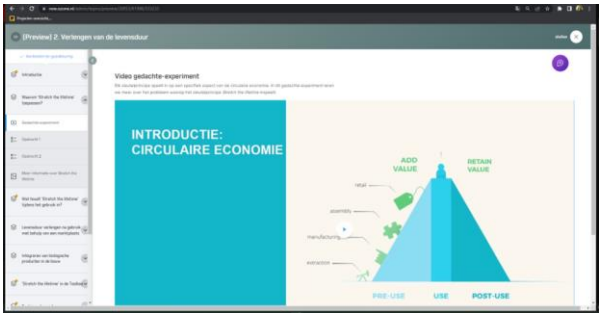
The start screen of the e-learning. Learners can navigate to different sections.



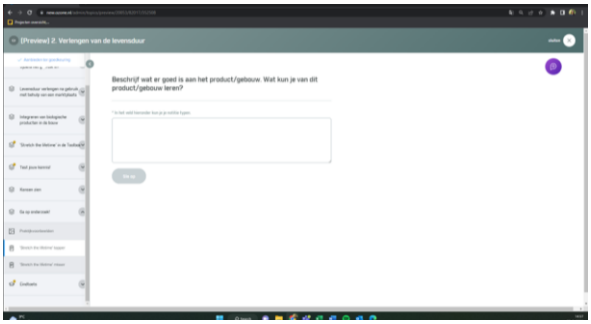
Information is shown by texts, images and videos.



Different learning formats are used such as drag and drop, multi per choice questions and hotspots.



After the quiz there is room for so-called 'action' exercises. In these exercises the learner can apply their knowledge in the real world.



The last exercise centres around 'share'. Here the focus is placed on exchanging ideas. In Ozone learners can formulate their ideas.

Learnings: Ozone is a platform that can be used for conventional e-learnings. Standard learning formats are available such as drag and drop exercises, multi-per choice questions, open

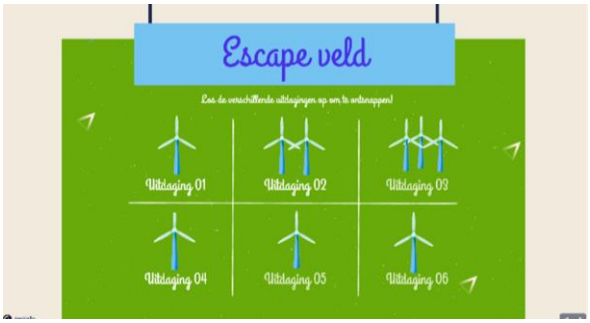
questions, 360 images and hotspots. A con is that the e-learning lay-out does not spark energy. The user experience is therefore minimal.

Genial.ly

An escape room is created as part of a learning programme for youngsters. This learning programme aims to enthuse girls for working in the field of the energy transition and to give them a basic understanding of what it entails.

The begin screen of the escape room. Attention is placed on creating an immersive experience by using visuals and animations.

The escape room begins with a short introduction about the context and why the students should escape.



The 'Escape veld' shows the different challenges that should be finished to escape.

Every challenge consists of different (external embedded) learning formats.

When finishing one challenge the students receive a letter.

Half of the challenges are offline. The role-model supports the students with the experiments. In the online environment the student can find videos/short information about how to execute the experiment

The last exercise is to form a word with the collected letters.

Learnings: For this concept the (free) software of https://genial.ly/ is used. This software gives the designer complete freedom how the course template should look like. For creating an escape room, it is a suitable tool. Moreover, the regulations pop-up does not have a negative impact on the user flow (because the escape room is shown on a laptop, the pop-up takes a less prominent role).

9 Overview of and experiences with applied e-learning interactions on EU-level

In this chapter an overview of applied e-learning interactions on EU-level is given. There are no separate e-learning interactions at EU-level, but some interactions mentioned before in this deliverable are connected to the European scope.

9.1 BUS Advisor App & Construction Blueprint

The BUILD UP Skills Advisor app (mentioned in IE and NL courses) as well as the online courses of the Construction Blueprint project (mentioned in IE courses) are strongly connected to the EU-level since their development is connected to European funding (H2020 and Erasmus+ respectively). The BUS app is currently being expanded with more materials on energy efficiency skills and circular construction skills. It has great potential for European countries.

9.2 Interactions with use outside country of origin

The following interactions are available in English or other multiple languages, which brings them potential use and value added in the EU realm.

- ConClip: Input for ConClip was expertise from ten European building organisations. The material can be accessed in nine different languages and can be used by institutions throughout Europe.
- NEWCOM competence database: This database aims for a Europe-wide comparability of acquired skills.
- Certified Passive House Trainer: For this interaction, one free course is available in English: the 'Passive House for Decision Makers'.
- Train-to-nZEB mobile app: This app is available in English, Bulgarian, Czech, Turkish, Ukrainian and Romanian.
- CraftEdu database: This database is available in German, Czech, Slovak and Bulgarian.
- In principle, each Irish initiative could also be used Europe-wide.

E-learning interactions at EU-level can further contribute to the European approach to micro-credentials. They will allow the scope of learning to widen from just vocational and higher education to meet the learning needs of the market with a modular approach. In this way, lifelong learning will eventually be made accessible to all.

10 Evaluation of timeliness and effectiveness of interactions

For measuring the effectiveness and timeliness of evaluations in the realm of the EE, in T5.3., we implemented desk research about recording of outcomes in learning interventions. This understanding resulted in a rubric to instruct the evaluation of learning interventions based on the well-established training evaluation model of Kirkpatrick (Kirckpatrick & Kirkpatrick, 2016; Smidt et al., 2009). The choice of the rubric was also driven by the need to establish a shared understanding with the NIPs about the requirements of an evaluation ranging from the evaluation of knowledge over skills to abilities (Pusateri et al., 2009; Rolheiser & Ross, 2001). The learning goals or learning outcomes, therefore, drive the requirements for evaluation: e.g., knowledge and skills – learning evaluation (Kirkpatrick level 2) and ability – behavior evaluation (Kirkpatrick level 3). Together, the defined learning goals/ outcomes and the rubric aim at instructing the evaluation of the learning interventions of the NIPs in a uniform way.

The learning goals and rubric, furthermore, provide a structure to make the learning interventions in the energy transition, such as applied e-learning interactions, comparable. They allow comparison and exchange not only of the instructional design approaches including costly learning materials, but also the comparison of learning interventions. Besides learning from each other's concrete evaluation designs for learning and/or behaviour evaluation, and potentially adopting them for further comparison, the self-assessment on learning goals provides a feasible and comparable approximation of learning outcomes in the context of the energy transition. It is independent of the kind of learning intervention (e.g., video, WS & experiences through application) and context (e.g., offline and online) and is beneficial to the professionals' self-regulated learning in terms of orientation and communication (Stallings & Tascione, 1996; Rolheiser & Ross, 2001), for example. And even though such a subjective measure cannot be compared with the validity of objective measures, and shall be validated with them ideally, the self-assessment on learning goals provides an indication of learning "effectivity" for more tangible as well as less abstract domains with matured learners, especially when looking on the group level (Özbıçakçı et al., 2012; Schiekirka et al., 2013).

In addition, learning goals offer a valuable means to structure experiential learning of professionals during and after a training in terms of learning analytics, and allow a (technology-supported) exchange of stakeholders involved in the energy transition. When thinking about the time after an e-learning interaction, the transfer of the knowledge and skills of the participating professionals to the workplace results in experiences: e.g., when facing an insight during the application of the "learnings" or spotting a knowledge gap that can be addressed in the team or community.

Tracing these experiences during and after the interactions in systems like Moodle or the BUS app, therefore, contributes to building an essential knowledge base in extension of the formal training and provides an understanding of the effectiveness and timeliness of the e-learning interaction. While professionals could be motivated by receiving access to the highly relevant practical experiences of comparable professionals (e.g., Q&A and for a), training providers can

analyse the effective transfer of the learnings to the workplace with respect to the learning goal, kinds of intervention, context etc. Such learning analytics could also indicate how relevant and timely these experiences are in the domain of the energy transition for different stakeholders of the energy transition, NIPs and countries, for example. This objective evaluation of effectiveness and timeliness will be extended by a subjective evaluation of relevance of the addressed professionals, together with an exploration of missing elements for an effective learning transfer.

11 REFERENCES

Kirkpatrick, J. D., & Kirkpatrick, W. K. (2016). Kirkpatrick's Four Levels of Training Evaluation. In *Google Books*. Association for Talent Development.

Pusateri, T., Halonen, J. S., Hill, B., & McCarthy, M. (2009). The assessment cyberguide for learning goals and outcomes.

Rolheiser, C., & Ross, J. A. (2001). Student self-evaluation: What research says and what practice shows. *Plain talk about kids*, *43*, 57.

Schiekirka, S., Reinhardt, D., Beibarth, T., Anders, S., Pukrop, T., & Raupach, T. (2013). Estimating learning outcomes from pre- and post-test student self-assessments: a longitudinal study. *Academic Medicine*, *88*(3), 369-375.

Smidt, A., Balandin, S., Sigafoos, J., & Reed, V. A. (2009). The Kirkpatrick model: A useful tool for evaluating training outcomes. *Journal of Intellectual and Developmental Disability*, *34*(3), 266-274.

Stallings, V., & Tascione, C. (1996). Student self-assessment and self-evaluation. *The Mathematics Teacher*, *89*(7), 548-554.

Özbıçakçı, Ş., Bilik, Ö., & İntepeler, Ş. S. (2012). Assessment of goals in problem-based learning. *Nurse education today*, *32*(8), e79-e82.

BUS LEAGUE

This project has received funding from the European Union's h2020 framework programme for research and innovation under grant agreement no 892894. The information in this publication does not necessarily represent the view of the European Commission.