

## The CONDAP VOOC an autonomous modular course to improve skills, knowledge and competencies in sustainable construction

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### Abstract

*The CONDAP VOOC is a self-standing modular course for in-company mentors, who need to improve their skills, knowledge and competencies in sustainable construction using digital technologies in energy conservation and green generation. The CONDAP online course, was developed in the context of the third Intellectual Output, aiming to act as the main delivery method for the CONDAP curriculum and educational resources. The CONDAP VOOC, available in all partnership languages, has been grounded on evidence-based learning outcomes (coming out from extended labour market and skill needs analysis), reflects the structure of the developed curriculum as organized around learning units and lessons, and comprises (contextualized) the project's training and assessment materials in an online form. It also integrates additional pedagogical resources such as video units, infographics, working assignments, and collaboration mechanisms to provide an optimal learning experience with increased collaboration opportunities. Overall, the CONDAP VOOC offers a modular, e-learning scheme, always available over the Internet, that supports the attainment of learning outcomes and places the "learner" at the heart of the educational process. The learner is given the flexibility to establish individuals learning goals and a personal learning path based on available content and materials.*

**Keywords:** *Condap Project; Self-learning; Construction site managers; Specific training; Efficient learning.*

## **Introduction**

During the recent years the employers in the construction sector have been noticing a skill shortage in the new apprenticeships of the field (McGuinness, S., & Bennett, J. 2006), which concludes in difficulties at the time of hiring new professionals.

Numerous reasons justify this lack of skills on the part of new apprentices, which must be solved as soon as possible, in order to ensure and guarantee the quality of the work of professionals throughout the sector (Mackenzie, S., Kilpatrick, A. R., & Akintoye, A. 2000). The main reason is that VET (*Vocational Education and Training*) training is not adequate, and is included in a sector that is not very attractive, due to its low versatility and capacity for innovation. Professionals in the sector must update and focus more on the application of new technologies (Gann, D., & Senker, P. 1998) and systems more in line with the sustainability needs that arise today (Lim, Y. S., Xia, B., Skitmore, M., Gray, J., & Bridge, A. 2015).

Specifically, one of the most prominent weaknesses when it comes to training new apprentices is that mentors in the workplace do not have the necessary skills to make the apprenticeship training process as enriching as possible. Professionals in the sectors in charge of mentoring and training apprentices in the workplace may be reluctant to update their skills to the new demands, due to the limited supply of training in the new skills required for the sector, as well as the limited option they have to be able to invest time in additional training concerning their current knowledge. In addition, this situation is compounded by the feeling of threat to be supplanted by new technologies in the workplace, given the new advancement of technologies.

It is for these reasons that, to improve the skills of new members of the construction sector, it should be ensured that the training provided to apprentices is as up-to-date, modernized and effective as possible (Stephens, S., Doherty, O., Bennett, B., & Margey, M. 2014). To do this, the didactic material must be reviewed, ensuring that the training provided by the VET is of the highest teaching quality. It should be ensured that apprentices have the opportunity to learn through systems based on the WBL (Work-Based Learning), where mentors must have the appropriate training skills, ensuring that the work of the apprentices in the workplace is focused on their maximum learning and enrichment. Furthermore, for these WBL systems to be viable, good relationships must be sought between training organizations and companies providing training in the workplace, guaranteeing that communication between both parties is focused on the successful training of apprentice, providing them with the most current and updated skills and knowledge.

In this context, the CONDAP project arises, which, with the aim of improving the skills of apprentices and new professionals in the construction sector, focuses on improving the conditions of VET training systems, together with a review of training conditions in WBL

systems, ensuring that on-the-job trainers and mentors will have the necessary skills to make the learning process of new apprentices as productive as possible.

To this end, the main action of the CONDAP project focuses on the creation of an open training system so that workplace trainers have the knowledge and tools necessary to be able to adequately train apprentices and new professionals in the construction sector. The system used for this training consists of a VOOC (Vocational Open Online Course). This VOOC is collected on a public digital platform, which includes a series of teaching units and complementary materials, focused on strengthening knowledge.

This open training tool is the main action of the CONDAP project, which together with other actions in the relationship between WBL providers and companies, aims to ensure that the experience of apprentices in the construction sector is as enriching as possible.

## **CONDAP Project**

CONDAP is a project funded by the EU aiming to improve the digital skills of mentors in learning construction, from a Strategic Partnership formed by five partners from different European countries, which gives the project a greater diversity and perspective, making it possible to reach a much wider audience. The partnership comprises of 5 organisations, from 5 European countries:

The CONDAP project focuses on ensuring the best learning conditions for new professionals in the sector, and it establishes its objectives based on the following three guidelines:

1. Design a work-based learning system that can be applied to different companies, emphasizing training in modern concepts such as digital tools for construction, as well as notions related to sustainable performance in the construction sector.
2. Introduce modern training methods, which help mentors to provide knowledge to new apprentices in all the necessary concepts in the workplace, with special emphasis on the use of digital tools that can ease the work of the professionals.
3. Ensure that there is active cooperation between VET providers and companies in the construction sector, thus facilitating professionals to have the opportunity to learn in the workplace, under the tutelage of expert professionals in the subject, with adequate skills for training.

In this way, to emphasize the effort to achieve the project's objectives, it is important to list which are the most relevant agents for the development of the project, in order to work together and achieve the best result. The agents involved in the project are the following:

- In-company mentors involved in construction apprenticeships, since they must be able to properly mentor and train new apprentices in the sector.
- VET providers, who are in charge of providing training in the first instance to apprentices interested in the construction sector.

- Employers in the construction sector, since it is up to them that new professionals can put the knowledge obtained in their previous training into practice.
- Apprentices in the construction sector. They are the main target of the project, since the objective is to provide these apprentices with the best learning and conditions.
- Representatives and associations of employers & employees in the construction sector, who guarantee adequate communication of interests and needs between the involved groups in the project.
- Stakeholders & policy makers, aiming to carry out all the procedures correctly.

Taking into account the objectives of the project and the involved groups, a clear methodology must be followed in order to carry out the project. Once all the agents were involved and the objectives clarified, the project developed the training units that would serve as a guide to carry out the training material that will be provided to the mentors, in digital format, so that any interested party can carry out the course, and expand his knowledge.

## **Learning Units**

After extensive research on the gaps and problems that can be found in work-based learning (WBL) systems, a number of concepts were collected that should be clear after the mentor training course.

Once the concepts needed to provide an adequate training system for mentors had been analyzed, the following three didactic units were established, focused on introducing learners to innovative and enriching concepts within the construction sector:

1. Energy efficiency and sustainable construction. The first learning unit focuses on sustainable construction, enhancing the use of energy efficiency strategies and renewable energy system integration for sustainable energy generation. The learning unit encloses the basis of energy legislation and certifications, characteristic of sustainable construction (Passivhaus standards and Nearly Zero Energy Building specifications), bioclimatic strategies measures, and integration of renewable energy systems. It introduces the learner to sustainable construction and provides basic facts and principles for energy conservation and green generation, including energy monitoring indicators and energy certifications.
2. Digitization of construction. Learning Unit 2 deals with Building Information Modelling (BIM) methodology and its application to the professional field. This learning unit introduces practical knowledge, studying different practical cases using BIM method and other digital tools. It introduces the learner into Building Information Modelling methodology and project management using digital tools.
3. Organization, management and communication skills. Learning Unit 3 describes different communication methods for collaborative work, using actual digital technologies for communication and advantaging from collaborative tools and

platforms. It introduces the learner to relevant digital tools for effective communication and collaborative work.

In this way, these three didactic units must undertake the principles and characteristics of sustainable construction, energy efficiency measures and renewable generation, as well as understand the fundamentals and bases of the creation of an information modelling system and project management with digital tools. In the same way, they must also be able to use and introduce digital technologies applied to communication and collaborative work in virtual environments such as electronic platforms.

These didactic units will be taught in an open digital course, and are composed of different lessons within each didactic unit.

Additionally, along with all the didactic units, complementary material has been developed, to ensure that the knowledge obtained through the didactic units can be further consolidated. This supplementary material consists of the following:

- Practical cases: In each didactic unit a minimum of two practical cases are developed, so the mentors can put into practice the knowledge acquired in the previous lessons.
- Practical exercises. To develop the different situations that can be given in the workplace.
- Short answer questions. To strengthen theoretical knowledge from a series of questions.
- Multiple choice questions. In order to finish reviewing all the concepts
- Discussion Forum. In this way, knowledge can be considerably expanded, being in contact with more mentors and learners who can suggest changes and proposals.

### **VOOC training tool**

Once all the academic material included in the CONDAP project had been completed, the online training platform was developed to make it accessible to the general public. This platform, contained in the Openlearning application, hosts a complete training course for mentors in charge of training apprentices in the workplace, structured in a very intuitive way, and in a very gentle format to encourage learning. In figure 1 the format of the initial menu of the online course can be seen.

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Fig. 1. Home page of the CONDAP VOOC.  
Font 1. Condap VOOC

Within the CONDAP training course, the three didactic units are developed in-depth, including lecture notes and presentation videos that determine the format of this course.

- Lessons. In each of the didactic units, the different lessons that make up the unit can be found. In the VOOC learning platform, each of the lessons is developed in-depth, attaching reading notes along with presentations, as can be seen in figure 2. In addition, in each of the lessons a section of useful information is added, to expand knowledge.



Fig. 2. Lessons training VOOC sample  
Font 2 CONDAP VOOC

- Questions and answers. In this section, a set of answered questions can be found, as can be seen in figure 6, in order to ease the process of solving all the questions that the mentors might have at some point of the training process.

- Case studies. The aim of this assessment material is to provide an example of a work-site real life situation, that the mentors should be able to solve, in order to guarantee the best learning outcome for the pupils.
- Short answer questions. In this case, in order to be able to evaluate the progress of the learners, a series of short-format questions have been developed as can be seen in figure 3, which will also help the learners to consolidate the knowledge acquired.

1. Identify some of the current reasons of BIM implementation in the construction sector.

My response ...

Submit

2. What does BEP stand for?

My response ...

Submit

Fig. 3. Short answer questions sample in the VOOC application

Font 3 CONDAP VOOC

- Timed asingment. In this case, the aim is to test the skills of the mentors through development exercises with limited time, in which they must elaborate tasks within a time limit.
- Multiple choice questions. In this way, as seen in figure 10, it is possible to continue progressing and advancing in the acquisition of knowledge from a series of questions, in test format, which will also help to keep track of the progress of the apprentice mentors.

## Conclusions

Given the low quality of the training provided by the mentors of the WBL training systems, it is necessary to take action and suggest new training systems to be as attractive as possible to the new generations of apprentices for the construction sector. In this context arises the CONDAP project, which after having carried out an exhaustive investigation about the outdated aspects of training systems by mentors in the workplace, has carried out a series of learning units focused on mentors for them to be able to update their education and training systems, to ones more adjusted to the current reality of the construction sector.

In these teaching units, the application of digital systems to the construction work has been specially developed, as well as concepts related to sustainability and energy efficiency in the construction sector. This is because these topics are two of the most current topics today, which are less regarded in the construction sector.

Thus, taking into account that the objective of the project is to openly train mentors in the construction workplace, an online learning platform, VOOC, has been developed, open to the general public, aiming to apply the knowledge of professionals in the construction

industry and upgrade to current workplace needs. This platform, developed in the Openlearning application, contains all the training material developed in the CONDAP project, from lecture notes, practical exercises, evaluation questions and video presentations.

With this new tool, the training of professionals will be considered more complete, and a series of knowledge will be guaranteed within the workplace in the construction sector, ensuring in the same way that the apprentices trained by the WBL system have more productive training, and that the knowledge in all the professionals of the sector that take the course, will increase significantly.

### **Acknowledgement**

This work has been conducted within the framework of the CONDAP project "Digital skills for workplace mentors in construction sector apprenticeships" funded by the European Commission within the Key Action 2: Cooperation for innovation and the exchange of good practices, reference number 2018-1-UK01-KA202-048122.

### **References**

Condap Project. <https://www.condap.eu/>

Gann, D., & Senker, P. (1998). Construction skills training for the next millennium. *Construction Management & Economics*, 16(5), 569-580.

Lim, Y. S., Xia, B., Skitmore, M., Gray, J., & Bridge, A. (2015). Education for sustainability in construction management curricula. *International Journal of Construction Management*, 15(4), 321-331.

Mackenzie, S., Kilpatrick, A. R., & Akintoye, A. (2000). UK construction skills shortage response strategies and an analysis of industry perceptions. *Construction management and economics*, 18(7), 853-862.

McGuinness, S., & Bennett, J. (2006). Examining the link between skill shortages, training composition and productivity levels in the construction industry: evidence from Northern Ireland. *The International Journal of Human Resource Management*, 17(2), 265-279.

Stephens, S., Doherty, O., Bennett, B., & Margey, M. (2014). The challenge of work based learning: a role for academic mentors?. *International Journal of Mentoring and Coaching in Education*.