01.3 Study of pedagogical methods transfer opportunities

Study on Building

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1. Introduction

This short document reflects the research undertaken by the Taph Taph Association in order to set a brief State of the art related to Building discipline, but also linked to the scope of the BREATH Project 2022-2024 for Ecological transition inspired by Nature, specifically to Bio-architecture and Bio-construction fields of work and study.

On the other hand, it is also shown a small overview about European Union initiatives linked to green skills for education and employment and ecological transition. This is specially important in a kind of Erasmus Plus project like BREATH: Cooperation partnerships in Vocational Education and Training, but whose transversal project development has included Higher Education and Non formal training.

Besides, this article tries to set recommendations for future users on how national training offers and pedagogical methods used in the Spanish education programs available at present, and linked to the BREATH project, could be transferred to the target audience: elected representatives, institutions, managers, advising professionals, trainers, etc.

A repository of the training offer in Spain is pointed out at the end of the document, as a database to understand the context in Spain, and as a source of information: from Vocational Education and Training, to Higher Education and Non formal training

2. Aims

There are some saims:

- Do a survey of specific literature produced in the past decade and a brief synthesis of the current thinking in the field of Building, specially linked to Bio-architecture and Bio-construction: history, educational methods, knowledge, skills, professional competencies, etc
- Compile the national training offer linked to Bio-architecture and Bio-construction in order to analyze the pedagogical methods used, duration, trainees access requirements and then use the data to implement them in the BREATH Project.
- Study and synthesis on the possibilities of transferring these educational methods from a school environment to a professional environment.
- Create recommendations for the transfer of Breath pedagogical methods about Building and for elected representatives, institutions, managers, advising professionals, trainers.

3. Methodology

First, a compilation of the main topics linked to Bio-construction and Bio-architecture disciplines as part of Building field of work and study has been done. After, a background of the European initiatives for green skills is set and serves as a reference to compare with the existing training offer for building, VET and Higher Education, in Spain.

4. Results

Some social claims about a natural way of life appeared during the beginning of Industrial times of the XIX century in Europe. Since the 60s decade of the XX century, in Europe, urban living collapsed and environmental and social crises appeared. During the last decades, awareness has been raised about global climate change and loss of biodiversity and fertility.

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At present, Construction sector in Europe and the use of buildings is responsible for 40% of the use of fossil resources. 40% of CO2 emissions and energy expenses, 40% of solid waste and 20% of drinking water use.

Bio-construction field of study appeared around the sixties of the last century in Germany, as an answer to the problems caused by chemicals in synthetic construction materials in buildings. The increasing number of illnesses and deaths linked to these materials and technologies caused a social movement, appearing in 1976 the *Institut für Baubiologie und Okologie* (Biology and ecology construction institute), in Baviera, Germany (32).

4.1.1. Bio-architecture, Bio-construction and Habitat biology vs Conventional building

The *Asociación de Estudios Geobiológicos de España* (26), created in 1991, was the first institution in Spain which gathered professionals and proposed discussion about the different topics involved, mainly technical awareness about bio-based construction material and the presence of electrical and electromagnetic pollution in buildings and environment. It was in 1991 as well, when the first congress and fair about Bio-construction happened in Barcelona, Spain. Later, in 2004, the magazine *Ecohabitar (33)* was launched in Spain, and specialized in Bio-construction, Permaculture and healthy life. It was in 2005 when were born the *Asociación Española de Bioconstrucción* aiming to establish the basis for professionals on Bio-construction, but not active at present. In 2009, is created the *Instituto Español de Baubiologie* (34), focused on habitat biology.

Some authors, like Gina Lazenby with the book *La casa sana* (2001), David Pearson with the book *El libro de la casa sana natural* (1991) and Mariano Bueno as author of the book *El gran libro de la casa sana* (1992), present Bio-construction through the concepts of holistic healthy buildings, linking human beings and environment health.

Mainly, Bio-construction means the proper feasibility of buildings into the surrounding landscape and habitats, with an affordable location, ground, design, construction material and its life cycle, and good indoor conditions, by means of health and environment criteria, and taking into consideration natural and artificial radiations. On the other hand bio-construction claims for the responsibility of the population to maintain life in future scenarios and respect all living beings.

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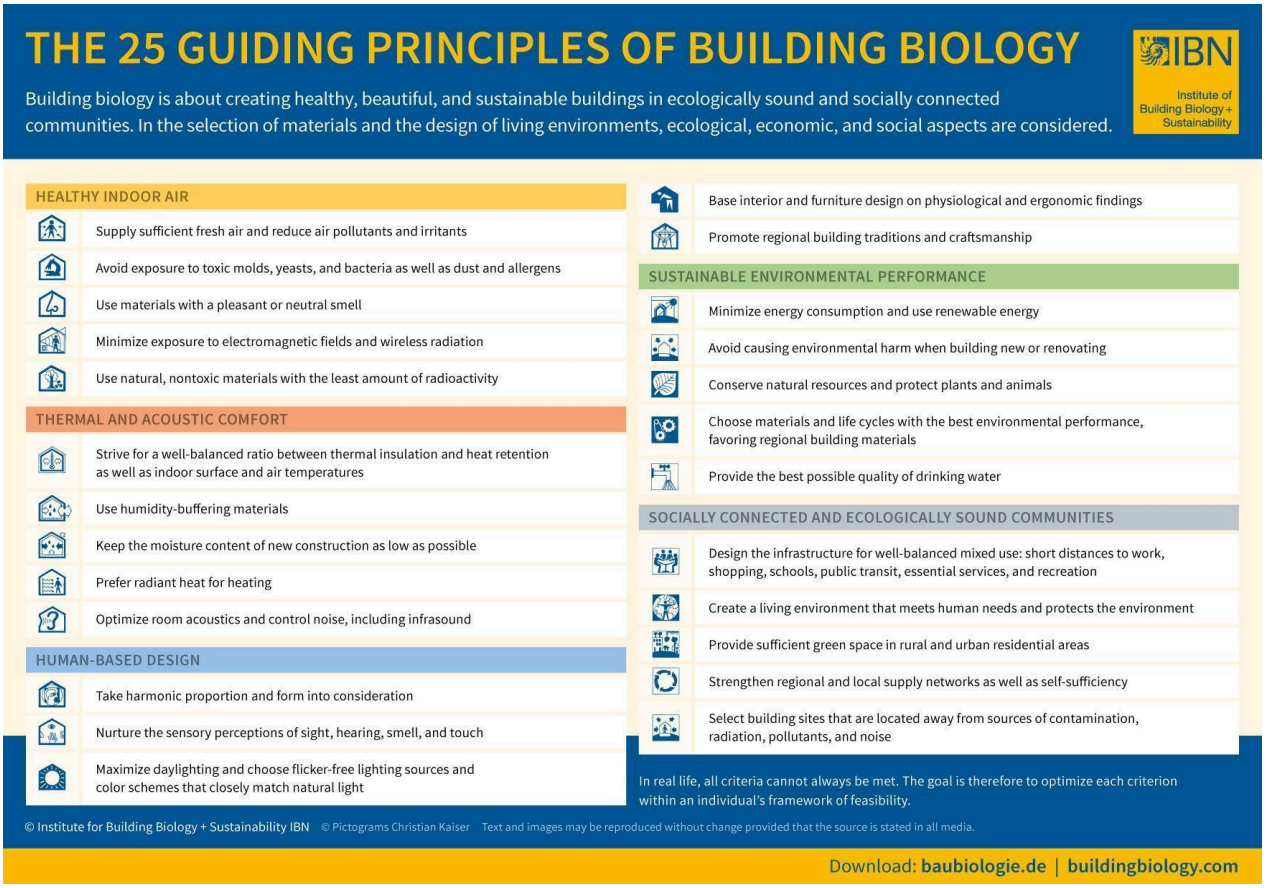

Fig. 1. The 25 guiding principles of building biology. Author : *Institute of building biology* (37)

4.1.2. The sick building syndrome

In 2006, Murphy (2) described this syndrome, also called SBS, as a condition in which people develop symptoms of illness or become infected with chronic disease from the building in which they work or reside. The main identifying observation is an increased incidence of complaints of symptoms such as headache, eye, nose, and throat irritation, fatigue, dizziness, and nausea. In fact the 1989 Oxford English Dictionary defines SBS in that way.The World Health Organization created a 484-page tome on indoor air quality back in 1984 when SBS was attributed only to non-organic causes, and suggested that the book might form a basis for legislation or litigation. Attempts have been made to connect sick building syndrome to various causes, such as contaminants produced by outgassing of some types of building materials, volatile organic compounds (VOC), improper exhaust ventilation of ozone (byproduct of some office machinery), light industrial chemicals used within, or lack of adequate fresh-air intake/air filtration. Sick building syndrome has also been attributed to heating, ventilation, and air conditioning (HVAC) systems.

In the late 1970s, it was noted that nonspecific symptoms were reported by tenants in newly constructed homes, offices, and nurseries. In the media it was called "office illness". The term "sick building syndrome" was coined by the WHO in 1986, when they also estimated that 10–30% of newly built office buildings in the West had indoor air problems. Early Danish and British studies reported symptoms.

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Poor indoor environments attracted attention. The Swedish allergy study (SOU 1989:76) designated "sick building" as a cause of the allergy epidemic as was feared. In the 1990s, therefore, extensive research into "sick building" was carried out. Various physical and chemical factors in the buildings were examined on a broad front. The problem was highlighted increasingly in the media and was described as a "ticking time bomb". Many studies were performed in individual buildings.

In the 1990s "sick buildings" were contrasted against "healthy buildings". The chemical contents of building materials were highlighted. Many building material manufacturers were actively working to gain control of the chemical content and to replace criticized additives. The ventilation industry advocated above all more well-functioning ventilation. Others perceived ecological construction, natural materials, and simple techniques as a solution.

At the end of the 1990s came an increased distrust of the concept of "sick building". A dissertation at the Karolinska Institutet in Stockholm 1999 questioned the methodology of previous research, and a Danish study from 2005 showed these flaws experimentally. It was suggested that sick building syndrome was not really a coherent syndrome and was not a disease to be individually diagnosed, but a collection of as many as a dozen semi related diseases. In 2006 the Swedish National Board of Health and Welfare recommended in the medical journal Läkartidningen that "sick building syndrome" should not be used as a clinical diagnosis. Thereafter, it has become increasingly less common to use terms such as "sick buildings" and "sick building syndrome" in research. However, the concept remains alive in popular culture and is used to designate the set of symptoms related to poor home or work environment engineering. "Sick building" is therefore an expression used especially in the context of workplace health.

Sick building syndrome made a rapid journey from media to courtroom where professional engineers and architects became named defendants and were represented by their respective professional practice insurers. Proceedings invariably relied on expert witnesses, medical and technical experts along with building managers, contractors and manufacturers of finishes and furnishings, testifying as to cause and effect. Most of these actions resulted in sealed settlement agreements, none of these being dramatic. The insurers needed a defense based upon Standards of Professional Practice to meet a court decision that declared that in a modern, essentially sealed building, the HVAC systems must produce breathing air for suitable human consumption. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, currently with over 50,000 international members) undertook the task of codifying its indoor air quality (IAQ) standard.

4.1.3. Preindustrial traditional monumental and vernacular built heritage awareness vs dominant contemporary international and industrial style in architecture and construction.

There have been some movements in the last century and decades, showing that traditional and modern styles in architecture and construction are not only a question of style, but also of environmental and health aspects.

One of the most well known was the *Arts and Crafts movement*, which was an international trend in the decorative and fine arts that developed earliest and most fully in the British Isles and subsequently spread across the British Empire and to the rest of Europe and America. Initiated in reaction against the perceived impoverishment of the decorative arts and the conditions in which they were produced. It advocated economic

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and social reform and was anti-industrial in its orientation. William Morris (1834–1896) was the towering figure in late 19th-century design and the main influence on the Arts and Crafts movement.

Later, *Architecture Without Architects: A Short Introduction to Non-Pedigreed Architecture* (**38**) was a book based on the NYC MoMA exhibition of the same name by Bernard Rudofsky and originally published in 1964. It provides a demonstration of the artistic, functional, and cultural richness of vernacular architecture. Rudofsky had long been interested in vernacular architecture. In 1931 he completed his dissertation on vernacular concrete architecture on the Greek Cyclades islands. He was convinced that modernism, but especially modern architecture, got out of touch with the needs, and sensuality of mankind. This book produced a big impact and awareness between architects and building artisans in Europe.

On the other hand, International style architecture is defined by the Getty Research Institute as "the style of architecture that emerged in Holland, France, and Germany after World War I and spread throughout the world, becoming the dominant architectural style until the 1970s, but widespread all over the world nowadays (3). The style is characterized by an emphasis on volume over mass, the use of lightweight, mass-produced, industrial materials, rejection of all supposed ornament, repetitive modular forms, and the use of flat surfaces, typically alternating with areas of glass. And also producing a big environmental impact with the use of industrial metals, reinforced concrete, plastics and other pollutant material.

4.1.4. Eco-technology and appropriate technology for construction

In scientific literature, some points of view about eco-friendly technology can be found. In their review article about ecotechnology approaches, Haddaway et al, 2018 (4), points that "Eco-technologies are human interventions in social ecological systems in the form of practices and/or biological, physical, and chemical processes designed to minimize harm to the environment and provide services of value to society"

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Figure 2. Clusters of emergent definitions of the term ecotechnology. Haddaway et al, 2018

Appropriate technology (2023) is a movement encompassing technological choice and application that is small-scale, affordable by locals, decentralized, labor-intensive, energy-efficient, environmentally sustainable, and locally autonomous. It was originally articulated as intermediate technology by the economist Ernst Friedrich "Fritz" Schumacher in his work Small Is Beautiful (5). Both Schumacher and many modern-day proponents of appropriate technology also emphasize the technology as people-centered.

Appropriate technology has been used to address issues in a wide range of fields. Well-known examples of appropriate technology applications include: bike- and hand-powered water pumps (and other self-powered equipment), the bicycle, the universal nut sheller, self-contained solar lamps and streetlights, and passive solar building design. Today appropriate technology is often developed using open source principles, which have led to open-source appropriate technology (OSAT) and thus many of the plans of the technology can be freely found on the Internet. OSAT has been proposed as a new model of enabling innovation for sustainable development.

Appropriate technology is most commonly discussed in its relationship to economic development and as an alternative to technology transfer of more capital-intensive technology from industrialized nations to developing countries. However, appropriate

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technology movements can be found in both developing and developed countries. In developed countries, the appropriate technology movement grew out of the energy crisis of the 1970s and focuses mainly on environmental and sustainability issues. Today the idea is multifaceted; in some contexts, appropriate technology can be described as the simplest level of technology that can achieve the intended purpose, whereas in others, it can refer to engineering that takes adequate consideration of social and environmental ramifications. The facets are connected through robustness and sustainable living.

Indian ideological leader Mahatma Gandhi is often cited as the "father" of the appropriate technology movement. Though the concept had not been given a name, Gandhi advocated for small, local and predominantly village-based technology to help India's villages become self-reliant. He disagreed with the idea of technology that benefited a minority of people at the expense of the majority or that put people out of work to increase profit. Despite these early examples, Dr. Ernst Friedrich "Fritz" Schumacher is credited as the founder of the appropriate technology movement. A well-known economist, Schumacher worked for the British National Coal Board for more than 20 years, where he blamed the size of the industry's operations for its uncaring response to the harm black-lung disease inflicted on the miners. However it was his work with developing countries, such as India and Burma, which helped Schumacher form the underlying principles of appropriate technology

4.1.5. Bioclimatism

As adapted to a particular regional climate and culture, fundamentals of vernacular architecture have been used in bioclimatic architecture, which has gradually become the inspiration of various movements in contemporary architecture. Bioclimatism is a design concept in architecture that takes into account the relationship between a building and its systems, its natural environment mainly through its (micro-) climate and its occupants (especially in connection with human thermal comfort conditions). Following bioclimatism in architecture, building designs help achieve optimal comfort using preferably architectural elements and avoiding complete dependence on mechanical systems. The origin of the bioclimatic approach in architecture can be traced back to the design principles applied in most vernacular and traditional buildings all around the world. Vernacular traditional architecture evolved over time, reflecting environmental, cultural, technological, and historical context of a specific location on which it was built (7).

Bioclimatism design and behavior can be applied to any building and outdoor space. In the era of computer-aided design, the bioclimatic design method has moved into a new period, with advanced design techniques and accurate control of building performances through simulation-based design of buildings and smart technologies. The bioclimatic approach, as defined by Olgyay (6), takes into account three disciplines complementary to architectural design. The first step is to define the measure and aim of requirements for human comfort. For this, the answer lies in the field of biology. The next is to review the existing climatic conditions, and this depends on the science of climatology. Finally, for the attainment of a rational architectural solution, the engineering sciences must be drawn upon.

4.1.6. Geobiology and bio-habitability

Radiation was discovered in the late 19th century. However, people were not initially aware of the damage radiation exposure and radioactive rays could cause. The acute effects of radiation exposure were first seen in 1896 when Nikola Tesla purposefully subjected his fingers to X-rays and reported that this caused burns to develop, although

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at the time he attributed the burns to ozone. The mutagenic effects of radiation were not realized until decades later. The genetic effects and increased cancer risk associated with radiation exposure were first recognized by Hermann Joseph Meller in 1927. Muller went on to receive the Nobel prize in 1946 for his research.

Radiation affects the nervous and immune systems. New technologies have completely changed our ecosystem. We have experienced unprecedented advances in our lives, and not only have they affected our lives, but they have also affected our habitat, incorporating many comforts and advantages, and on the other hand, they have introduced complications and disadvantages.

We are living and working in very closed and artificial spaces. The electrical installations with lines run through the ceilings of our offices, the walls and the floor. Multiple plugs without an adequate ground connection. Telecommunications facilities such as internet via wifi, cordless telephones. Installations that generate High and Low Frequency Electromagnetic Fields, artificial radiations and electromagnetic pollution. Offices with very tight enclosures, mechanical air conditioning and ventilation, ventilation ducts and poor maintenance mean that ventilation is deficient and that indoor air is not renewed.

Natural Radiation can be of 3 types:

- Geophysical alterations: groundwater and geological faults
- Geomagnetic networks: Hartmann lines, Curry lines
- Environmental radioactivity

4.1.7. Other subjects and fields of study and work linked to Bio-architecture and Bio-construction.

- Regenerative cultures, Sociocracy, Mutual economy linked to architecture and construction
- History and theory of architecture and construction. Archaeology of architecture
- Technical design and conservation and restoration of buildings: structures, soil mechanics, physics, mathematics, infrastructure.
- Sustainable spatial (territory, rural and urban) planning, development and management
- Bio-architecture and Bio-construction certification systems for buildings
- Others: computer aided design and calculation, geometry, art, etc.

5. Current European context about building and green education and employment

The European and Spanish context, and the reference sources of information analysis in this article, about green skills, professional competences and education or training, show a great awareness about new green jobs which need new green skills and competences to be recognized by official European and national education and employment systems.

Slowly but increasingly, European and Spanish societies demand at present a new vision of building services and products in line with preserving the environment and nature: self-sufficient healthy new and refurbished buildings, use of healthy natural and local construction material, architecture and construction professionals specialized in bio-architecture and bio-construction, alternative and accessible economy to fund building projects and construction works, friendly professional relationships, etc.

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As the BREATH Project propose, Ecological transition inspired by nature in the field of building (architecture and construction) can produce a transformation of the current complex situation: society values and cosmovision, construction production sector, pedagogical education methods, professional competences for employment, new green trades, etc. But first a small review of the recent European innitiaves, is needed.

5.1. **Green Education** (8,9)

The move to a climate-neutral EU will have significant social, economic and employment impacts. A socially just transformation needs people to have the knowledge, skills and attitudes to shape and cope with profound change. Education and training systems and institutions can act as catalysts and support a shift to a more sustainable society.

What is the EU doing?

- The Education for Climate Coalition is a growing community of pupils, students, teachers and organizations active on climate change and sustainability
- A Council Recommendation on learning for the green transition and sustainable development supports Member States in embedding sustainability in education and training
- The European sustainability competence framework sets out the knowledge, skills and attitudes learners of all ages need to acquire for the green transition
- A dedicated working group on sustainability in school education regularly produces input papers and key messages. The working groups on Vocational Education and Training, Adult Learning and Higher Education also deal with the green transition and sustainability
- Erasmus+ and European Solidarity Corps support a variety of initiatives related to sustainability in education and training, including student and staff exchanges, research, volunteering
- The Horizon Europe programme has a dedicated call on climate change and sustainability education
- The InvestEU programme enables Member States to access funding for sustainable education infrastructure and the development of skills
- The Researchers at Schools initiative connects young researchers with teachers and pupils on climate change and sustainable development
- The Erasmus+ DiscoverEU Green route inspires young people to plan and discover Europe in a sustainable way
- The 2022 European Innovative Teaching Award selected 50 outstanding projects focused on sustainability
- The EU Learning Corner includes teaching and learning materials on sustainability and the climate and environmental crisis for primary and secondary schools

5.2. **Skills and jobs for the green transition (**10)

Here are summarized and highlighted some European documents about green skills for transition, and produced by the European Centre for the Development of Vocation Training (CEDEFOP).

A set of 16 documents are shown in its website as publications:

- Growing green; How vocational education and training can drive the green transition in agri-food (March, 2023)

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- Too good to waste: Tapping the potential of vocational education and training in the waste management sector (November, 2022)
- Work-based learning and the green transition (October, 2022)
- Cities in transition (July, 2022)
- Briefing note - An ally in the green transition (March, 2022)
- EU-ANSA mapping report: socio economics aspects of sustainable development (January, 2022)
- The green employment and skills transformation (December, 2021)
- Digital, greener and more resilient (April, 2021)
- Skills for green jobs: 2018 update (April, 2019)
- Green skills and innovation for inclusive growth (July, 2015)
- Briefing note: skills for a low-carbon Europe (May, 2013)
- Green skills and environmental awareness in vocational education and training (June, 2012)
- Briefing note: a strategy for green skills? (February, 2012)
- Skills for green jobs (August, 2010)
- Skillsnet newsletter 1/2010 (November, 2010)
- Briefing note: skills for green jobs (July, 2010)

Going through the document *"The green employment and skills transformation*", which subtitle is "*Insights from a European Green Deal (EGD) skills forecast scenario*", some points could be highlighted and linked to the BREATH Project:

Implementing the EGD is expected to shift the sectoral composition of employment in the EU from polluting to 'cleaner' sectors and boost employment in some supporting services, albeit to a limited extent.

When used in a national or regional economic context, the scenario findings make it possible to identify opportunities and challenges for labour market and training policies. The EGD relies on the implementation of a broad range of policies and targeted investments. The impact of the transition to a green economy will transcend the sectors more directly linked to sustainability and climate change. Not only sectors such as energy (especially renewables), transport, manufacturing (especially automotive, steel and iron), construction, agriculture, and waste management, but also others will be impacted, albeit at various intensities.

In the construction sector, which plays a pivotal role in achieving the green transition, employment is expected to increase initially by about 1.2% (possibly to cover staff needs when major new construction and renovation projects begin). The trend accelerates in 2027 and employment growth reaches a level in 2030 that is 3.6% higher than in the baseline.

This trend may be attributed to the wider diffusion of EGD policies (in particular the renovation wave) affecting the sector. Constructing energy-efficient buildings will require workers to be more aware of eco-friendly materials and technologies. An estimated 3 to 4 million construction workers in various occupations such as heat pump boiler installers, carpenters and joiners, bricklayers, and technicians will require training on energy efficiency and renewable energy sources.

Construction workers are often found to lack knowledge on how to reuse and recycle industrial/construction waste (ECSO, 2020). This reflects increased demand for professionals supporting the implementation of EGD policies, such as architects for the renovation wave, engineers for designing circular economy processes and

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environmental lawyers. To make and shape the green transition, workers in manufacturing will need 'green'-ignited up- or re-skilling. Like construction firms, manufacturing companies must significantly reduce their carbon footprint, pollution and waste and increase recycling.

Then, the construction skills changes are needed for high skilled non-manual occupations, skilled non-manual occupations, skilled manual occupations and elementary occupations.

5.3. GreenComp, the European sustainability competence framework (11)

The development of a European sustainability competence framework is one of the policy actions set out in the European Green Deal as a catalyst to promote learning on environmental sustainability in the European Union.

GreenComp identifies a set of sustainability competences to feed into education programmes to help learners develop knowledge, skills and attitudes that promote ways to think, plan and act with empathy, responsibility, and care for our planet and for public health.

This work began with a literature review and drew on several consultations with experts and stakeholders working in the field of sustainability education and lifelong learning. The results presented in this report form a framework for learning for environmental sustainability that can be applied in any learning context. The report shares working definitions of sustainability and learning for environmental sustainability that forms the basis for the framework to build consensus and bridge the gap between experts and other stakeholders.

GreenComp comprises four interrelated competence areas: 'embodying sustainability values', 'embracing complexity in sustainability', 'envisioning sustainable futures' and 'acting for sustainability'. Each area comprises three competences that are interlinked and equally important. GreenComp is designed to be a non-prescriptive reference for learning schemes fostering sustainability as a competence.

The Member States of the European Union have already begun incorporating sustainability concepts into academic and vocational curricula. Building on this work, GreenComp can support all educators and learners in embedding environmental sustainability topics into all educational systems and curricula in Member States.

GreenComp consists of 12 competences, organized into the four areas below:

- Embodying sustainability values, including the competences
  - valuing sustainability: To reflect on personal values; identify and explain how values vary among people and over time, while critically evaluating how they align with sustainability values.
  - supporting fairness: To support equity and justice for current and future generations and learn from previous generations for sustainability.
  - promoting nature: To acknowledge that humans are part of nature; and to respect the needs and rights of other species and of nature itself in order to restore and regenerate healthy and resilient ecosystems.
- Embracing complexity in sustainability, including the competences
  - systems thinking: To approach a sustainability problem from all sides; to consider time, space and context in order to understand how elements interact within and between systems.

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    - critical thinking: To assess information and arguments, identify assumptions, challenge the status quo, and reflect on how personal, social and cultural backgrounds influence thinking and conclusions.
    - problem framing: To formulate current or potential challenges as a sustainability problem in terms of difficulty, people involved, time and geographical scope, in order to identify suitable approaches to anticipating and preventing problems, and to mitigating and adapting to already existing problems.
- Envisioning sustainable futures, including the competences
    - futures literacy: To envision alternative sustainable futures by imagining and developing alternative scenarios and identifying the steps needed to achieve a preferred sustainable future.
    - adaptability: To manage transitions and challenges in complex sustainability situations and make decisions related to the future in the face of uncertainty, ambiguity and risk.
    - exploratory thinking: To adopt a relational way of thinking by exploring and linking different disciplines, using creativity and experimentation with novel ideas or methods.
- Acting for sustainability, including the competence
    - political agency: To navigate the political system, identify political responsibility and accountability for unsustainable behavior, and demand effective policies for sustainability.
    - collective action: To act for change in collaboration with others.
    - individual initiative: To identify own potential for sustainability and to actively contribute to improving prospects for the community and the planet.

The European Green Deal (2019), the European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience (2020), and Achieving the European Education Area by 2025 (2020) have underscored the need to develop a European competence framework on sustainability. The EU biodiversity strategy for 2030: 'Bringing Nature Back into our Lives' (2020) also highlights the important role education and training have for Europe to become a climate-neutral continent by 2050. The Erasmus+ Teacher Academy consists of three academies to provide resources about teaching sustainability.

Aims of GreenComp:

- A model of sustainability competence areas and competences
- A common reference that everyone working in education and training for environmental sustainability can use, share and refer to
- An initial list of competence components, namely knowledge, skills and attitudes, as examples of how to put the competences into practice
- A common reference basis for dialogue, exchange of practices and peer learning among educators involved in lifelong learning across the EU
- A contribution to help make the competences portable and promote mobility in the EU for a full participation in European society.

5.4. Two examples of Non formal Vocational Education and Training in Europe for Building and ecology

5.4.1. **ECVET Earth building** (12)

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Earth as a historical construction material present all over the world, is of a demonstrated very low environmental impact. In the last decades, a whole new business sector using earth or soil in low impact building is emerging. Across Europe there is a growing demand for earth materials and earth building, repair and decoration. But there is a shortage of trained craftspeople to exploit these opportunities, because to date there has been little professional training (in higher education and vocational education and training levels) and accreditation.

Despite the spread and density of traditional earthen buildings in many European regions, this heritage is very little known by populations, professionals and even by conservation specialists. As a result, construction companies and technicians of local community and urban planning departments intervene on earthen walls every day with little or no knowledge about the material and its properties.

So it's a real necessity to train skilled workers in this vocational area and to guarantee the quality of training and professional development in earth building.

ECVET Earth building is a matrix of units of learning outcomes that are conceived for construction, renovation and decoration with unfired clay materials. Each unit relates to a set of tasks that together form an activity specific to earth construction sites. Each activity, thus each Unit, may be considered either as a work place for a person on a building site, as a job position of a person in a company, or as an activity a whole company is specialized in. Each unit has been described on several levels of the EQF, representing understanding, depth of knowledge and skill. For each level a unit is described by:

- a list of knowledge, skills and competence
- a list of criteria and indicators for assessment
- The content of each unit is illustrated by videos and pictures.
- For each unit there is a worksheet for assessors and an evaluation sheet to record a person's results after assessment.

The units can be used:

- to set up exams
- as a basis for developing teaching programs
- to create new qualifications or introduce earth into existing ones
- as a kit to map out an individual learning pathway, with or without mobility between learning contexts

The units can be individually assessed within either formal or occupational training environment.

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Unit	Subunit	EQF Level					
		L1	L2	L3	L4	L5	
M							From raw material to earth mix
P							Production of prefabricated elements
B	B1 earth masonry						Building with earth
	B2 cob						
	B3 rammed earth						
C							Application of clay plaster
F							Formwork for earth building
R	R1 building						Repair and conservation in earth building
	R2 clay plaster						
D							Interior design
O							Decorative techniques
E							Earth building market

Figure 3. Unit by levels in ECVET Earth scheme

In addition to the units, ECVET Earth building gives training providers a toolkit for training and assessment, in several European languages, and an outline on how to use these within mobility exchange programmes.

Achievement of the learning outcomes will be recognised by a Learn-Earth Certificate, creating flexibility in training provision as part of a mobility exchange programme agreed in a Memorandum of Understanding between the European partners. Strategies have been set in place to progressively recognise and integrate the units in national qualifications.

The units cover the full spectrum of earth construction activities: sourcing and processing materials, mix production, prefabricated elements, building, formwork, repair and conservation, decoration, business management, site supervision. Not all of the earth building techniques and EQF levels have been covered by the units but the system is designed to be upgraded and like all standards reviewed.

The aim of ECVET Earth building is to promote individual professional development and mobility by allowing individual learning outcomes in earth building to be recorded, presented transparently and in a comparable way, tested and validated independently of the learning environment. In the future the Learn-Earth vision is that Earth building learning outcomes can be accredited irrespective of the place of learning to improve the training and career opportunities of the various target groups interested in earth building and promote mobility. The existing, lively earth building culture of learning is to be retained in all its variety.

The opportunity to record acquired learning outcomes and add them to existing qualifications also enhances the training opportunities of disadvantaged young people.

Potentially ECVET Earth building opens up equal vocational involvement, and therefore career opportunities in the growing European earth building sector.

5.4.2. **STEP Strawbale building for European Professionals** (13)

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Since the appearing of straw bales made by machinery at the crop lands, straw bale has become a more and more used building material, and as an alternative to build low impact and energy efficient buildings.

Within the projects STEP Leonardo and BuildStrawPro, the basis for mutual recognition of assessments in straw bale building in various European countries was worked out. The "intellectual outcome" is a "memorandum of understanding" between the partners involved, and – in the context of dissemination – other European organizations, which are active in the qualification area.

Primary beneficiaries of the project are (training) organizations, which are engaged in the qualification for sustainable building practices. Underlying qualification modules have been developed in European projects and are offered in parts or as a coherent "Professional Straw Bale Builder" as vocational education and training. The new profession "Straw Bale Builder" offers a possibility for various craftsmen of different trades as an additional qualification, for career-changers the possibility to form start-ups or offer their skills in a sustainable area. Furthermore, the project aims to strengthen formal professional recognition of straw bale builders in Europe.

STEP – Straw Bale Training for European Professionals is now also offered in other countries, starting from Austria (from 2017). The programme and above all the learning outcomes of this ECVET training remain the same in all countries. In addition to the theory in 8 modules, there is also a straw and clay building practice of at least 20 days. After completing all modules, trainees can take the written and oral examination to become a "certified straw bale builder". The units are not divided in levels because they are defined only for "Professional straw bale builder". But they are divided in training sessions. Every session is organized by: knowledge, skills, competences; objectives; pedagogical method, theory and practise/tasks; materials/documents.

The 8 units (and their training sessions) are:

- 1 Introduction
- 2 Infill and prefabrication
- 3 Load bearing
- 4 Wrapping
- 5 Finishes
- 6 Building physics / Sustainability
- 7 Concept for the house
- 8 Market and Communication
- 9 Building practice

6. The Vocational Education and Training offer in Spain for the professional family of Building and civil works

There are a total of 756 professional qualifications, arranged in 26 professional families which reflect the present and coming national productive sector. The professional family of "Building and civil works" contains different professional certificates or professional titles (14), which are related to the training offer (15).

- Professional certificates: 585
- Training cycles: 174
- Specialization courses: 21

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They are:

- Masonry and finishes: construction of residential and no residential buildings, roads, railways and subways, bridges, tunnels, fluid networks, electricity networks, telecommunication networks, building refurbishment, etc.
- Mounting and installation: coating systems, vertical and horizontal coating, waterproof membranes, paving and tiling, roof construction, etc.
- Structures: infrastructure maintenance, building measurement, setting-out of construction work, concrete operations, formworks, steel frames for reinforced concrete, ec.
- Construction machinery. excavations, demolitions, soil works, hand equipment, elevation machinery, etc.
- Project and building site control: building plots and graphics, execution control, etc.

But, showing the complexity of the social situation of Construction Sector, there are some possible professional families linked to the professional family of "Building and civil work", obtained from the spanish National Institute for professional qualifications (11 out of 26): Agriculture; Arts and crafts; Electricity and Electronics; Energy and water; Mechanical production; Extractive industries; Installation and maintenance; Wood, furniture and cork; Chemistry; Health; Security and environment.

Annex I describes the official vocational education and training professional qualifications, by level, indicating for each qualification the core competence, the units of competence, the possible updating of BREATH and the duration of the training. Some specialization courses are listed in Annex II, but more could be included from this catalogue.

In both Annexes, it is pointed out in every input the possible BREATH updates in order to imagine how the existing building training offer and professional qualifications could be change for a better Ecological transition in the building sector.

7. Higher Education training offer in Spain

Only some higher education titles are mentioned but, talking about higher education for the employment sector of building and construction, there are a lot of possible titles or professions involved:

- Architect. Grade level (27)

Knowledge. Building structure design and calculation; Soil works and foundations design and calculation; Urban and building installations and infrastructures: electricity, illumination, water, waste, heating and cooling, ventilation, telecommunication, fire protection; Urbanism, landscape, architecture, construction, interior design and heritage regulations; Building site management: regulations, financial analysis, labour, materials, technology, quality control; Intangible and built heritage and culture; HIstory and theory of architecture, Arts and crafts, science, computer aided design and analysis for territory, urbanism and buildings; Mathematics and Physic applied to architectural works; Hygrothermal performance of buildings and outdoor places; Social and habitat management, inclusion and participation in territory, urban and building works;

Breath upgrade of knowledge: Bio-based, Healthy, eco friendly and low environmental impact of Building structures design and calculation; io-based, Healthy, eco friendly and low environmental impact soil works and foundations design and calculation; Bio-based, Healthy, eco friendly and low environmental urban and building installations and

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infrastructures: electricity, illumination, water, waste, heating and cooling, ventilation, telecommunication, fire protection; Urbanism, landscape, architecture, construction, interior design and heritage regulations based in ecoregional contexts with sociocracy and mutual economy methods, using the principles of agroecology, permaculture, biomimicry, Nature´s unifying patterns, ecovillages and bio-construction; Building site management: regulations, financial analysis, labour, materials, technology, quality control, based in the principles of sociocracy, regenerative cultures and appropriate technology; Sociocracy applied to social and habitat management, inclusion and participation in territory, urban and building works; HIstory and theory of architecture, Arts and crafts, science, computer aided design and analysis for territory, urbanism and building; Mathematics and Physic applied to architectural works; Hygrothermal performance of buildings and outdoor places; Social and habitat management, inclusion and participation in territory, urban and building works;

Competences: Apply graphical procedures to spaces and objects. Theory of forms, geometry, drawing techniques, computer aided design; Apply statics and mechanics principles; Apply thermodynamics, acoustics and optics principles; Apply mechanics of fluids, hydraulics, electricity and electromagnetism principle; Apply topography, hypsometry, mapping; Aptitude to design, calculate and integrate buildings and urban fabric; Aptitude to apply technical and construction standards. Preservate buildings, foundations and civil works. Assess building works; Ability to design, calculate, integrate and preservate: urban and building structures, partition wall systems, carpentry, stairs, infill, roof and building supplies; Appropriate knowledge about: fluid mechanics, continuum means and soil; plastic, elastic and resistance behavior of construction materials; Usual construction systems and pathology states; Physical and chemical features of construction material and their production procedures; Knowledge about deontology, architects professional organizations, civil responsibility, administrative procedures, construction jobs, professional reports, safety and security at construction works, real state management; Aptitude to avoid architectural barriers, solve environmental passive conditioning for thermal insulation, acoustics, climate, energy and illumination. Aptitude to built heritage compilation and protection. Aptitude to the development of architectural, urban, landscape, garden and environmental impact projects applications and building site supervision; Ability to design architectural and urban functional programs. Ability to conservate, refurbish and rehabilitate the built heritage. Ability to do safety and security building plans; Knowledge in theory of the form and architectural composition, architecture history, symbols, ergonomics, society, habitat, housing, ecology, sustainability, preservation of natural resources, traditional architecture, western cultures, ideology, aesthetics, arts and crafts, social responsibility, vernacular architecture, sociology. Knowledge in official rules and codes with professional purposes; Making and presentation to an academic and university committee of and individual final career study

Breath upgrade of competences: Apply graphical procedures to spaces and objects. Theory of forms, geometry, drawing techniques, computer aided design with a focus in the Nature´s unifying patterns; Apply statics and mechanics principles within the scope of low-impact and eco friendly building structures; Aptitude to design, calculate and integrate buildings and urban fabrics based on the principles of bio-construction, using methods to measure the social and environmental impact of buildings and infrastructure and certifying through eco-label systems, assessing the kind of possible construction pollution of radiations, volatile organic compounds, air, water, soil, sound, light; Aptitude to apply technical and construction standards. Preservate buildings, foundations and civil works. Assess building works based on the principles of bio-construction; Ability to design, calculate, integrate and preservate: urban and building structures, partition wall systems, carpentry, stairs, infill, roof and building supplies based on the principles of bio-construction; Appropriate aptitude to

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develop competencies: fluid mechanics, continuum means and soil; plastic, elastic and resistance behavior of construction materials; Usual construction systems and pathology states; Physical and chemical features of construction material and their production procedures based on the principles of bio-construction; Knowledge about deontology, architects professional organizations, civil responsibility, administrative procedures, construction jobs, professional reports, safety and security at construction works, real estate management based on the principles of bio-construction, sociocracy and permaculture; Aptitude to avoid architectural barriers, solve environmental passive conditioning for thermal insulation, acoustics, climate, energy and illumination. Aptitude to built heritage compilation and protection. Aptitude to the development of architectural, urban, landscape, garden and environmental impact projects applications and building site supervision based on the principles of bio-construction, sociocracy and permaculture; Ability to design architectural and urban functional programs. Ability to conserve, refurbish and rehabilitate the built heritage based on the principles of bio-construction, sociocracy and permaculture. Ability to do safety and security building plans; Knowledge about deontology, architects professional organizations, civil responsibility, administrative procedures, construction jobs, professional reports, safety and security at construction works, real state management; Knowledge in theory of the form and architectural composition, architecture history, symbols, ergonomics, society, habitat, housing, ecology, sustainability, preservation of natural resources, traditional architecture, western cultures, ideology, aesthetics, arts and crafts, social responsibility, vernacular architecture, sociology. Knowledge in official rules and codes with professional purposes based in the principles of bio-construction, sociocracy and permaculture; Making and presentation to an academic and university committee of an individual final career study.

Skills: Are not pointed in the official document (35) and not compiled in this article.

Education duration: 300 + 60 ECTS = 9000 hours. (Degree + Master to sign civil responsibility as architect)

- Technical Architect / Construction Engineer. Grade level
  Knowledge and competences not described. Similar to Architect but focused on execution construction works.
  - Education duration: 300 + 60 ECTS

- Other titles of Grade level linked to the Building and civil works field of employment and education: Civil engineer, Agriculture engineer, Material engineer, etc.

About Master level:

- Master in Bio-construction project manager (28)
  - Approach: Bio-construction principles, soil diagnosis for construction, urban laws, environmental pollution, bioclimatism, vernacular architecture, sustainable urban planning, architecture project management, quality and execution control planning, natural construction material, bio-infrastructure supplies, energy efficiency, bio-construction indoor design,
  - Competences: construction material advising; ground diagnosis; administrative and technical management of bio-construction projects; architecture design based on bio-construction principles; construction details; building site director; bio-construction contractor management.
  - Training mode: On line (virtual campus for contents, forum and tutor questions) plus Hans on training at a real building site or training center.
  - Education duration: 60 ECTS = 1500 hours

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- Provider: Okambuva Cooperative Society (private body) & University Antonio de Nebrija (private agreed body)
- Target public: Any kind, no access requirement

- Master in Expert in habitat biology and bio-construction (29)
  - Approach: Habitat biology, indoor environment conditions, Life cycle assessment, construction physics, geobiology, pollution, construction design, habitat psychology, bio-construction standards, furniture
  - Competences: construction material advising; ground diagnosis,
  - Educational programme: Habitat biology and bio-construction; the human being and the environment; indoor conditions; bio-affordable construction systems; life cycle assessment and eco-labels; wood protection and domestic plagues; construction material and physics; heating and ventilation; water infrastructure and saving systems; energy efficiency in construction and refurbishment; radiations; electrical systems; air and pollution; noise, thermal insulation and acoustic conditioning; construction design; space, form and proportion; habitat psychology; urban landscapes; non built spaces; physiology, habitat accessibility and security; furniture; light; paint and coatings; regulations, standards and laboratory tests; practicing bio-construction and habitat biology.
  - Training mode: On line (virtual campus for contents, forum and tutor questions) with 2 face to face students meeting and seminar
  - Provider: Spanish Institute of Baubilogie (private body) & University of Lleida (public body)
  - Education duration: 60 ECTS = 1500 hours
  - Target public: Any kind, no access requirement

- Máster en bioconstrucción aplicada y Ecoarquitectura. Universidad de Girona (30)
  - Approach: Provide tools and resources to architecture, engineering and construction professionals about bio-construction and eco architecture.
  - Competences: traditional architecture; properties, costs and ways to use ecological construction material; identify and implement construction details; analyze and assess the surrounding habitat; architecture and bioclimatisim.
  - Educational programme: introduction; eco urbanism and bioclimatism; bio-habitability; bio-construction technologies; biomimetism and nature; optional apprenticeship in a company.
  - Training mode: On line / On site / Optional Apprenticeship with enterprise
  - Provider: University of Girona
  - Education duration: 60 ECTS = 1500 hours
  - Target public: University degree requirement

- Máster en Formación Permanente en Arquitectura Sostenible, Bioconstrucción y Desarrollo Medioambiental online (31)
  - Approach: Bio-architecture and Bio-construction criteria for architecture and construction
  - Competences: life cycle assessment and low environmental impact construction techniques and material (production, transport, durability, maintenance, reutilization, recycling, recovery); certified energy efficiency professional through different systems; confort passive strategies for building design;
  - Educational programme: environmental urbanism, landscaping and permaculture; full architectural sustainable project management; circular bio-economy in sustainable architecture design; renewable energy systems and efficiency; bio-construction systems: envelope and structures; environment pollution; water system management; sustainable building certification: LEED, BREAM, Passive house; environment assessment: use of software and equipment;

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- Training mode: On line
- Provider: Universidad europea on line
- Education duration: 60 ECTS = 1500 hours
- Target public: Any kind, no access requirement

8. Non formal short training offer about building and ecological transition in Spain

Here are other kinds of short hands-on training about bio-construction, traditional architecture techniques and material, provided by private or private bodies or entities:

- Asociación Taph Taph Bioconstrucción, Arquitectura y Paisaje Holístico (16)
  - Main aim: Introduction to the use of natural, healthy and local construction material and techniques; construction prevention risks;
  - Educational programme: Stone masonry; earth architecture and construction (wall, coating, roof, pavement, etc); lime coatings; strawbale construction; basketry; permaculture introduction; structural wooden carpentry; earth building and archaeology;
  - Learning mode: On site. Theoretical plus hands on activities. At training center or in real and legal building site.
  - Training duration: 20-30 hours per training
  - Target public: Professional, amateurs, self-builders, students.

- Instituto Español de baubilogie (17)
  - Main aim: Introduction to bio-construction criteria
  - Educational programme: habitat biology; indoor conditions; bio-construction material and systems; environmental impact of buildings and; strategies to save water and energy; physical and chemical risks for health in the habitat; Habitat design and physiology; territory and social management .
  - Learning mode: On line
  - Training duration: 3 months
  - Target public: Professional, amateurs, self-builders, students

- Homo Faber (18)
  - Main aim: Traditional construction trades, material and techniques
  - Educational programme: use of lime, earth, wood, vegetal fibers, ceramics; pavements; coatings; thatched roofs; ceramic vaults; pottery; wood structural carpentry; gypsum oven; marquetry; earth coatings through the educational program of ECVET Earth.
  - Learning mode: On site
  - Training duration: 20-30 hours per training
  - Target public: Professional, amateurs, self-builders, students

- Asociación Museo de la cal de Morón (19)
  - Main aim: Traditional construction trades, material and techniques
  - Educational programme: use of lime, earth, wood, vegetal fibers; pavements; coatings; thatched roofs; ceramic vaults;
  - Learning mode: On site
  - Training duration: 20-30 hours per training
  - Target public: Professional, amateurs, self-builders, students

- Asociación Escuela de bioconstrucción Los Guindales (20)
  - Main aim: Traditional structural carpentry and strawbale building through the educational programme STEP.

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- Educational programme: Traditional carpentry, tools, wood, details.
- Learning mode: On site
- Training duration: 20-30 hours per training
- Target public: Professional, amateurs, self-builders, students

- Okambuva sociedad cooperativa (21)
  - Main aim: Bio-construction techniques
  - Educational programme: introduction to bio-construction; earth coatings; lime coatings; energy, water and waste systems management in buildings; continuous pavements; wooden reciprocal frame roof; reed construction
  - Learning mode: On line (introduction to bioconstruction, earth coatings), On site (coatings, systems management, continuous pavements)
  - Training duration: 20-30 hours
  - Target public: Professional, amateurs, self-builders, students

- Instituto Rural Iscles (22) Through Okambuva sociedad cooperativa and University Antonio de Nebrija
  - Main aim: Bio-construction expert course; Bio-construction and sustainable construction techniques at building sites
  - Educational programme: Theory: introduction to bio-construction principles; bioclimatic design; construction systems; standardized construction material; constructive elements; indoor space; energy, water and waste building management; energy efficiency; legal rules and administrative management. Hands on: stone, earth and strawbale construction; wooden structural carpentry; coatings; roofs; energy, water and waste systems.
  - Learning mode: On site / On line
  - Training duration: 400 + 100 hours / 16 + 4 ECTS credits (On line + On site)
  - Target public: Professional, amateurs, self-builders, students

- Agotzenea (23)
  - Main aim: Professional training about bio-construction techniques and other, in collaboration with Navarra employment service, National Reference Center about renewable energies and energy efficiency for high levels of vocational education and training for employment (CENIFER), Spanish national employment service (SEPE) and the Integrated center for vocational education and training Donibane.
  - Educational programme: bio-construction; wooden structures carpentry; strawbale building; natural coatings; dry stone building; ceramic vault; sustainable landscape and gardening; agroecological management of pieces of ground.
  - Learning mode: On site
  - Training duration: 20-400 hours
  - Target public: Professional, amateurs, self-builders, students

- Arquitectura Verata (24)
  - Main aim: Traditional architecture of the region of La Vera
  - Educational programme: traditional architecture; traditional coatings; wooden structural carpentry; thatched roofs; refurbishment;
  - Learning mode: On site / Conferences / Visits
  - Training duration: 20 hours
  - Target public: Professional, amateurs, self-builders, students

- Instituto Ecohabitar (25)

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- Main aim: A website which offers a list of trainings and trainers where the users ask and the training is provided by demand.
- Educational programme: systemic sustainability introduction; place analysis; bio-construction, material and construction systems; architecture bioclimatic passive design; renewable energies and efficient active systems; water integral system management; geoenvironmental health; assessment and certification systems; ecourbanism, permaculture and society; transition; construction techniques.
- Learning mode: not pointed
- Training duration: Not pointed out
- Target public: Not pointed out

- Asociación de estudios geobiológicos (26)
- Main aim: Geobiology and Bio-habitability
- Educational programme: Natural and artificial radiations, geophysical alterations detection, indoor air toxicity, use of electronic equipment for the measurement of electrical and magnetical fields in low and high frequency, risk factors detection, introduction to bio-construction and bio-architecture, professional collaboration.
- Learning mode: On site plus free magistral conferences
- Training duration: 171 hours
- Target public: Professional, amateurs, self-builders, students

- Other individual artisan professionals or trainers, through public or private entities, teaching in a one-off training activity
- Main aim: Introduce bio-construction, vernacular architecture and traditional techniques, sustainability and ecological transition principles,
- Educational programme: bio-construction techniques; vernacular and monumental heritage.
- Learning mode: On site / On line
- Training duration: 4-60 hours
- Target public: Professional, amateurs, self-builders, students

9. Discussion and Conclusion

After analyzing the educational programs providers about these building, ecology, education and employment topics in Spain, and their courses or training for VET, Higher Education and Non formal training, different aspects may be highlighted. On the other hand, It may be taken into consideration that these courses or training usually are complementary to other kind of education and experiences of students and professionals (architecture, engineering, construction, etc):

- Certification level of the educational program offered
  Mainly the official training offer for VET and Higher Education in Spain, is focused on conventional or non ecological building. However, some recent Master degree organized by private entities linked to public universities by an agreement, offer bio-construction and bio-architecture specialization, using different pedagogical methods. On the other hand, there is a higher offer of short practical (20-30 hours) hands-on training provided by non formal education entities.
  This means that slowly the society change is coming but a big push to set training at public official education entities is needed.

- Trainees access requirements

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We can highlight that in the specialization Master degrees about green building or bio-construction, mainly no education certificate is needed despite the private education provider or organizer being linked to a public University. However, for public Higher Education and higher levels of VET it is always mandatory to have an education certificate. Perhaps this means that the education demand of specialized training in green building for master degree is not so high in Spain and then promoters and organizers have to be more flexible with the access requirements.

- Pedagogical methods
  There are some mainly used in the specialized Master degree about green building or bio-construction:
  - Transmissive by conference and digital presentation
  - Interactive MOOC platform and multimedia learning tools and contents
  - Written final project done by the student by theme/unit and in the end of the training
  - Experiential. Hands on practicing at building site or at the office of an enterprise
  - On-site pedagogical visits to buildings, enterprise, institutions, industries, etc

- Training duration
  - Grade degree: 4800 hours
  - Master degree: 1500 hours
  - VET technicians: 600-1500 hours
  - Specialization courses for vocational education and training: 20-400 hours
  - Non formal training: 20-40 hours

- Training mode
  - Transmissive face to face and online with MOOC platform
  - Dual = At education center + At Enterprise
  - Experiential. Hands on practicing at building site + Pedagogical visits

- Training center location
  - Urban
  - Rural
  - At building site in urban and rural contexts

The link among education, employment and professional competences, in European contexts, is demonstrated in this article by the author. European green skills documents, some divided by education levels, reflect the old awareness about this and about the world environmental crisis. Master degrees and expert courses by microcredentials for higher education and specialization courses for vocational education and training are part of the primary changes in the educational programme, slowly introducing some issues of ecological transition inspired by nature.

The different sources for teaching Bio-architecture and Bio-construction show that there is a wide range of different education/training/courses for different levels of education and employment (higher education and vocational education and training) and for no certified students. But even for a master degree organized by a private institution (institute/cooperative/association) and agreed with a public institution (university of any Spanish city), in some cases there are no student requirements to access the education.

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Meanwhile there are not any long term (400 to 2000 hours) public vocational education and training courses about Bio-construction agreed with the public Spanish education ministry (only two specialization courses of 40 to 60 hours), there are some Master degrees (1500 hours) about Bio-architecture and Bio-construction for higher education level but organized by private bodies related to public universities.

Recommendations for developing Educational programs about Bio-architecture and Bio-construction through Ecological transition inspired by nature with the BREATH method:

- Education at Higher education levels should include an enough percentage of the pedagogical methods as Experiential, letting students apply the transmissive education contents in labs, workshops, enterprises and real building sites.
- Despite the mix of students accepted in any kind of educational program, with different levels of knowledge, competences and expertise, and where no access requirements are asked to students, it can be interesting to promote social and professional mix, but it also could be an obstacle to have a good development of the learning outcomes for trainers and students.
- Surveys about the social and professional agents of the building sector and visits to natural spaces and to existing pre-industrial buildings and bio-architecture buildings, as well as to raw material extraction places, construction material and construction technologies facilities, should be taken into consideration to bring students awareness about the different processes the construction sector involves.
- Education centers should be integrated into nature and be designed and built by Bio-architecture and Bio-construction criteria, in order that students could obtain their profits and they could experience the results of applying the educational contents they learn. On the other hand the link to the bioregion and professional networks where the center is should be reestablished, inhabitants, industries, flora, fauna, etc.
- In order to develop Bio-architecture and Bio-construction into societies, employment, education and construction sector decision makers, they should develop long-term (400-2000 hours) Vocational training and education programs, linked to raw material extraction, construction material and technology production and supplying. For Higher Education some seeds of change are occurring and should be complemented by VET proposals.
- Training mode for Spanish master degree on bio-architecture and bio-construction are mainly on-line and are complementary to face to face university architecture and engineering degrees. Then, face to face master degrees should be developed by regions, probably after doing a big public dissemination campaign and balancing education and employment offers and demands.
- BREATH Project values should be implemented in education programs, meditating about the social values presented and expected in the bioregion where the education is programmed.
- BREATH Project professional competences should be treated with public authorities on employment and education, balancing some aspects like educational level, professional specialization, qualifications, occupations and job positions.

10. Recommendations for the transfer of Breath pedagogical methods for elected representatives, institutions, managers, consulting professionals, trainers, in any kind of field of study and training

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To sum up, the general recommendations are:

- Link ecological transition inspired by Nature education to employment and regional societies and contexts
- Create educational program learning outcomes and access requirements scheduled by levels of knowledge, skills, competences and expertise of the applicants and trainers.
- Inclusion of Breath project professional competences and values in educational programs
- Long term education programs of 400 to 2000 hours
- Pedagogical methods mix providing a good percentage of experiential and active methods and promoting internships by dual modes of learning at education centers and at enterprises.
- Possibly, and to be adapted to the possible time of learning dedicated by adults professionals interested in learning about Building and ecological transition, a mix of education modes should be developed: 50% face to face + 50% on-line (master class, MOOC, other)
- Education centers should be integrated into Nature and be designed and built by Bio-architecture and Bio-construction criteria

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2. Clusters of emergent definitions of the term ecotechnology.
3. Unit by levels in ECVET Earth scheme

Annexes

Annex I

VET Professional Qualifications for Building in Spain

Every professional qualification title is preceded of the vocational education and training level and by the code used in the spanish national catalog:

- Level 1. EOC051_1. Concrete operations
  - Main competence: Workmanship of concrete: foundations, structural elements, slabs and pavements. Participate in actions prior to and after pouring. Support other tasks, following instructions, prescriptions and health and security rules
  - Competency units: Auxiliary works in construction, concrete pouring operations, workmanship of concrete, preparation of admixtures for concrete, mortars, plasters and adhesives.
  - Breath update: Ecological concrete works with the use of natural, local and healthy raw materials and products (earth, lime, natural fibers, recycled aggregates, etc), by means of appropriate technology, for the construction techniques of hempcrete, rammed earth, poured earth, lime concrete, light-straw clay, etc.

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- Training duration: 360 hours

- Level 1. EOC271_1. Masonry and roof operations
  - Main competence: Workmanship of masonry for coating, masonry for sloping roofs, support other tasks, following instructions, prescriptions and health and security rules, and environmental rules.
  - Competency units: Masonry construction, Auxiliary works in construction, masonry roof slopes, preparation of admixtures for concrete, mortars, plasters and adhesives.
  - Breath update: Ecological masonry with the use of natural, local and healthy raw materials and products (earth, lime, gypsum, natural fibers, recycled aggregates, etc), by means of appropriate technology for the construction techniques of adobe, rammed earth, cob, stone, wattle and daub, thatched roofs, domes, vaults, etc.
  - Training duration: 300 hours

- Level 1. EOC272_1. Continuous coatings operations
  - Main competence: Wall or supports preparation for workmanship of mortars, plasters and paints, base and fine coatings. Support other tasks, following instructions, prescriptions and health and security rules
  - Competency units: Auxiliary works in construction, preparation of admixtures for concretes, mortars, plasters and adhesives, preparation of walls or supports, renders and plasters application, paints and primers use
  - Breath update: Ecological renders, plasters, primers and paints with the use of natural, local and healthy raw materials and products (earth, lime, gypsum, natural fibers, recycled aggregates, bio-polymers, etc), by means of appropriate technology.
  - Training duration: 330 hours

- Level 1. EOC409_1. Rigid coatings and urbanization operations
  - Main competence: Collaborate in the execution of concrete and stone pavements, preparing supports and doing surface treatments for rigid pieces tilling and other auxiliary works. Support other tasks, following instructions, prescriptions and health and security rules
  - Competency units: Auxiliary works in construction, preparation of admixtures for concretes, mortars, plasters and adhesives, preparation of supports, level surfaces, prepare pieces and treat surfaces for rigid pieces coating, do concrete and stone pavements
  - Breath update: Ecological mortars and concrete with the use of natural, local and healthy raw materials and products (earth, lime, gypsum, natural fibers, recycled aggregates, bio-polymers, etc), by means of appropriate technology.
  - Training duration: 330 hours

- Level 1. EOC578_1. Light and technical coatings operations
  - Main competence: Installation of light pavements and collaboration in the installation of laminated gypsum boards. Support other tasks, following instructions, prescriptions and health and security rules

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- Competency units: Auxiliary works in construction, preparation of supports, level surfaces, install light pavement on continuous supports, basic operations in the installation of laminated gypsum boards
- Breath update: Ecological boards and primers with the use of natural, local and healthy raw materials and products(earth, lime, gypsum, natural fibers, recycled aggregates, bio-polymers, etc), by means of appropriate technology.
- Training duration: 330 hours

- Level 2. EOC052_2. Masonry works
- Main competence: Organization and making of masonry of bricks, blocks and stone (load-bearing, infill and partition walls), following technical documentation and prescriptions, and health and security rules
- Competency units: Organization of masonry works, build masonry for coating, build faced brick masonry, preparation of admixtures for concrete, mortars, plasters and adhesives.
- Link to Breath competence:
- Breath update: Ecological masonry with the use of natural, local and healthy raw materials and products (earth, lime, gypsum, natural fibers, recycled aggregates, etc), by means of appropriate technology for the construction techniques of adobe, rammed earth, cob, stone, wattle and daub, thatched roofs, domes, vaults, etc.
- Training duration: 510 horas

- Level 2. EOC579_2. Metal bar reinforcement for concrete works
- Main competence: Execute and organize, at industrial facilities or at building site workshops, making of loosely reinforcement for construction elements of reinforced concrete, workmanship, following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Cut and fold loosely reinforcements by semi automatic machinery, workmanship of metal bars for concrete reinforcement, make bar reinforcement by means of semi automatic machinery, control loads by means of crane and hoist, work organization of passive reinforcement, do basic operations about construction prevention risks; manage roof and waterproofing operations.
- Breath update: bio-composite, recycled mineral and vegetal bar reinforcement by means of Appropriate technology
- Training duration: 600 hours

- Level 2. EOC580_2. Sloping roofs works
- Main competence: Execute and organize sloping roofs, combining roof systems and their different elements: slopes, thermal isolation, rain and wastewater pieces, windows, anchorage of collective equipment protection and installations, and roofing materials, following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: build boards and roofs with panels, boards and steel sheets; build light metal structures for roofs; build slooping roofs; preparation of admixtures for concretes, mortars, plasters and adhesives; build roof coating with slate and ceramic tiles; do basic operations about construction prevention risks; manage roof and waterproofing operations.

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- Breath update: Green roofs with plants, thatched roofs, earth roofs, ecological water proof membranes or no use of them; natural material boards; natural adhesives and primers.
- Training duration: 660 hours

- Level 2. EOC581_2. Formworks
- Main competence: Execute and organize construction works by using different kinds of formwork (pre-mounting non modular panels, vertical and horizontal panels, climbing formworks, concrete workmanship following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Workmanship of concrete operations, vertical formworks, horizontal formworks, pre-mounting of non modular formwork panels, pre-mounting and use of climbing formworks, manage concrete and formwork operations, do basic operations about construction prevention risks;
- Breath update: Eco Friendly wooden and bio-composite formwork, by means of appropriate technology
- Training duration: 690 hours

- Level 2. EOC582_2. Waterproofing with membranes
- Main competence: Execute and organize waterproofing works of flat roofs and building facades and other kinds of buildings, using all the different elements of the waterproofing system (bitumen and synthetic liners, sloping layer, thermal isolation, protection layers, etc), following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: preparation of admixtures for concretes, mortars, plasters and adhesives; basic functions of construction prevention risk; organize construction works about roof and waterproofing; waterproofing by use of synthetic membranes; waterproofing by use of bitumen membranes; execute elements and layers of the water proofing system.
- Breath update: ecological bio-composite and recycled water proof membranes or avoid the use of them through construction design and details, by means of appropriate technology
- Training duration: 600 hours

- Level 2. EOC583_2. Installation of gypsum boards and ceiling
- Main competence: Execute and organize installation works of gypsum boards in buildings (partition wall, ceiling systems, backwall), using finishing techniques for board joints, following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Install ceiling systems, organize work operations of gypsum board and ceiling, basic functions for construction prevention risks, execute gypsum boards joints, basic operations of gypsum board construction, install self-supported gypsum board partitions.
- Breath update: natural gypsum and earth boards, natural vegetal and animal fiber boards, natural adhesives and primers, by means of appropriate technology
- Training duration: 600 hours

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- Level 2. EOC584_2. Installation of technical systems of pavements, panels and screens.
  - Main competence: Installation of technical flooring and dismounting screens, technical boards and light floor pieces for continuous floor, following technical instructions of a responsible worker and documents, and health and security rules.
  - Competency units: Clean and level surfaces for coating, installation of light pieces for continuous floors, basic functions for construction prevention risks, install screens and technical board partitions, install technical floors.
  - Breath update: bio-source local and natural pieces for pavements, natural lime, gypsum and earth mortars, by means of appropriate technology
  - Training duration: 330 hours

- Level 2. EOC585_2. Installation of tubular scaffoldings
  - Main competence: Execute construction works about scaffolding mounting and other kinds of structures by tubular scaffolding (access and work towers, temporary protections, formworks and others), including the different steps (download, storage, mounting, maintenance and transformations), complying with the technical instructions and following of inspection and responsible workers, check and coordinate the mounting operations and controlling risks.
  - Competency units: basic operations of scaffolding mounting, check and coordinate scaffolding operations, basic functions for construction prevention risks, mounting and dismounting of tubular scaffoldings.
  - Breath update: wooden and bio-composite scaffolding by means of appropriate technology
  - Training duration: 360 hours

- Level 2. EOC586_2. Urban pavement and masonry
  - Main competence: Execute and organize the workmanship of pavements and other urbanization elements as stone and ceramic discontinuous pavement, concrete slabs and pavements, small walls and urban furniture, infrastructure networks (pipes, wells, drainage, registration pit), as well as work organization and team management, following technical instructions of a responsible worker and documents, and health and security rules.
  - Competency units: preparation of admixtures for concretes, mortars, plasters and adhesives; stone and printed concrete pavement, urbanization pavements, basic functions of construction prevention risks, waste water systems, organize workmanship of urban masonry, and execute complementary elements of urbanization works.
  - Breath update: eco friendly bio-source local and natural pieces for pavements, natural lime, gypsum and earth mortars, by means of appropriate technology
  - Training duration: 510 hours

- Level 2. EOC587_2. Decorative paint in construction
  - Main competence: Execute and organize finishes of decorative painting, wallpaper and vinyl and fiberglass, preparing the surface and following technical instructions by documentation and a responsible worker, and health and security rules.

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- Competency units: coating of walls with paper, fiberglass and vinyl; decorative painting in construction, organize painting works in construction, basic functions about construction prevention risks, clean and level supports for coatings, use of primers and protection painting in construction.
- Breath update: bio-source healthy, local and natural paint by means of appropriate technology
- Training duration: 570 hours

- Level 2. EOC588_2. Industrial paint in construction
- Main competence: Execute and organize finishing works of industrial painting, primers and protection painting in building and civil construction, resine continuous pavements, following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Use primers and protection painting in construction, finishes of industrial painting in construction, resin continuous pavements, basic functions of construction prevention risks, organize painting works in construction, clean and level supports for coatings.
- Breath update: bio-source healthy, local and natural paint by means of appropriate technology
- Training duration: 600 hours

- Level 2. EOC589_2. Renders and plasters for coating in construction
- Main competence: Execute and organize coating works with mortar and plaster in construction (fine gypsum coating on base gypsum coating, flat lime coating, sgraffito, thrown monolayer, imitation of stone (including interim thermal isolation layers) following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Organize construction works of mortars and rigid pieces; coat surfaces with plasters for surface preparation, thermal isolation and waterproofing; coat with monolayer plaster, and base and fine coating; flat layer to receive finishing coating; coatings without the use of master lines; clean and level surfaces for coating; preparation of admixtures for concretes, mortars, plasters and adhesives; basic functions of construction prevention risks.
- Breath update: eco friendly bio-source local and natural coatings, lime, gypsum and earth mortars, by means of appropriate technology
- Training duration: 600 hours

- Level 2. EOC590_2. Adhesive pieces for coatings in construction
- Main competence: Execute and organize coating works in construction by means of rigid pieces (floors and tiles with ceramic, natural or artificial stone, glass and other materials), with adhesive or mechanical anchorage, preparing flat flat and special surfaces, following technical instructions of a responsible worker and documents, and health and security rules.
- Competency units: Prepare surfaces and use rigid pieces for coating; clean and level supports for coating; preparation of admixtures for concretes, mortars, plasters and adhesives; do vertical tiling and floor coating; organize construction works about rigid

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and continuous coating by means of using admixtures; do flat preparation layer for surfaces to coat; basic functions of construction prevention risks.
- Breath update: bio-source local and natural pieces for coating, natural lime, gypsum and earth mortars, wood, by means of appropriate technology
- Training duration: 780 hours

- Level 2. EOC687_2. Tower crane maintenance of loads and operations
- Main competence: Do loads maintenance operations, checking and controlling them, and maintenance of cranes for construction and other operations, complying with standards about health, security, prevention risks, machinery and maintenance.
- Competency units: Do crane operations of lifting and horizontal movement of loads, basic functions of construction prevention risks.
- Breath update: Animal and human traction, by means of appropriate technology.
- Training duration: 300 hours

- Level 2. EOC688_2. A-category of self-powered mobile tower crane maintenance of loads and operations.
- Main competence: Do maintenance of loads, driving, checkin and controlling, as well as of self-powered mobile tower crane at building sites and other sectors, complying with standards about health, security, prevention risks, machinery and maintenance.
- Competency units: Do A-category of self-powered mobile tower crane operations of lifting and horizontal movement of loads, basic functions of construction prevention risks.
- Breath update: Animal and human traction, by means of appropriate technology.
- Training duration: 360 hours

- Level 2. EOC689_2. Dry stone construction
- Main competence: Do and maintain buildings by means of dry stone techniques without mortar, preparing and selecting raw material for its use, complying with standards about construction prevention risks and environmental protection
- Competency units: Organize dry stone construction works, do dry stone masonry without mortar for vertical walls, sloped retention walls; dry stone floor coatings, stone hydraulic installations like channels or other horizontal elements; conservation of dry stone elements; basic functions of construction prevention risks.
- Breath update: by means of appropriate technology.
- Training duration: 600 hours

- Level 2. EOC720_2. B-category of Self-powered mobile tower crane maintenance of loads and operations.
- Main competence: Do maintenance of loads, driving, checkin and controlling, as well as of self-powered mobile tower crane at building sites and other sectors, complying with standards about health, security, prevention risks, machinery and maintenance.
- Competency units: Do B-category of self-powered mobile tower crane operations of lifting and horizontal movement of loads, basic functions of construction prevention risks.
- Breath update: Animal and human traction, by means of appropriate technology.
- Training duration: 510 hours

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- Level 2. EOC732_2. Radon gas and fire protection, thermal and acoustic insulation in construction
  - Main competence: Do operations for allocating and using thermal, acoustic and protection isolation (against fire, radon gas, etc), in new and refurbishment construction works, complying with standards about environment and planning prevention risks operations and quality standards.
  - Competency units: Isolation and protection indoor works of vertical and horizontal envelopes; Isolation and protection indoor works of vertical and horizontal envelopes by means of insufflation, projected and injected grouts, ; outdoor insulation and protection works; protection painting in supports; joint sealing in supports; protection of supports by means of mortar coatings, membranes and liners; do basic functions of construction prevention risks.
  - Breath update: natural isolation coatings and boards
  - Training duration: 540 hours

- Level 2. EOC733_2. Excavating and load operations with machinery in soil works.
  - Main competence: Do excavation and load machinery operations in construction and civil works, as well as in stone, earth and aggregate quarries, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Do excavation and load machinery operations in construction and civil works, basic functions of construction prevention risks.
  - Breath update: Animal and human traction, by means of appropriate technology.
  - Training duration: 360 hours

- Level 2. EOC734_2. Pouring and leveling operations with machinery in soils works.
  - Main competence: Pouring and leveling operations with machinery in soils works in construction and civil works, as well as in stone, earth and aggregate quarries, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Pouring and leveling operations with machinery in soils, basic functions of construction prevention risks.
  - Breath update: Animal and human traction, by means of appropriate technology.
  - Training duration: 420 hours

- Level 2. EOC735_2. Transport operations in soil works
  - Main competence: Soil transport operations with machinery in soils works in construction and civil works, as well as in stone, earth and aggregate quarries, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Soil transport operations with machinery, basic functions of construction prevention risks.
  - Breath update: Animal and human traction, by means of appropriate technology.
  - Training duration: 360 hours

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- Level 2. EOC736_2. Temporary height works for refurbishment and maintenance with ropes
  - Main competence: Temporary height works using access and position of ropes and cables for construction, civil, infrastructure and industrial works, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Store management of access and position systems through ropes and cables for temporary height works, do temporary height works for access and position by the use of ropes and cables, basic functions of construction prevention risks.
  - Breath update: by means of appropriate technology
  - Training duration: 420 hourS

- Level 2. EOC737_2. Well works.
  - Main competence: Do construction, refurbishment and maintenance works for horizontal water waste systems from indoor of building to public waste water supply, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Do construction, refurbishment and maintenance works for horizontal water waste systems, basic functions of construction prevention risks.
  - Breath update: by means of appropriate technology
  - Training duration: 450 hours

- Level 2. EOC782_2. Load off-road machinery
  - Main competence: Do maintenance load operations by off-road machinery in construction and civil works, as well as in stone, earth and aggregate quarries, complying with standards about construction prevention risks and quality and environmental protection
  - Competency units: Load operations by off-road machinery, basic functions of construction prevention risks.
  - Breath update: by means of appropriate technology, animal and human traction,
  - Training duration: 220 hours

- Level 3. EOC201_3. Building project graphical outputs.
  - Main competence: Do graphical outputs: plots for basic and execution projects, models, propose improvements in graphical outputs, supervise files and documents, attend to the building site, following instruction by a responsible worker.
  - Competency units: Graphical outputs in construction, do and supervise building projects, installations graphical outputs.
  - Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
  - Training duration: 600 hours

- Level 3. EOC202_3. Civil construction project graphical outputs.
  - Main competence: Do graphical outputs for civil works, global representations and construction details: propose improvements in graphical outputs of quarries and

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urbanization, supervise files and documents, following instruction by a responsible worker.
- Competency units: Graphical outputs in construction, do and supervise road and urbanization projects, installations graphical outputs.
- Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
- Training duration: 600 hours

- Level 3. EOC273_3. Building project and building site control.
- Main competence: Do, check and follow systems of planning, expenses control and documentation of construction projects, through all the stages of the process.
- Competency units: check and follow planning, expenses control and documentation
- Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
- Training duration: 510

- Level 3. EOC274_3. Measurement and setting-out of buildings
- Main competence: On site and office works for Measurement and setting-out of buildings, using direct and indirect methods, and doing setting-out of projects, following instruction about safety, security and quality.
- Competency units: Do on site and office measurement and setting-out of buildings.
- Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
- Training duration: 600 hours

- Level 3. EOC641_3. Control of execution in civil works
- Main competence: On site direction of civil construction work, organizing and supervising execution, setting-out, short-term planning and workload to reach quality and planning goals, as well as safety and security, following technical requirements and instruction of a responsible worker.
- Competency units: Do setting-out of different construction works, organize topography staff; workmanship control of concrete, reinforcements and formworks; execution control of structures and foundation in civil works; execution control of soil works; execution control of civil infrastructure channels and services; execution control of soil subbase and load layers in civil works; organize and manage the evolution of construction works; basic functions about construction prevention risks.
- Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria , Ecological economy, Sociocracy
- Training duration: 720 horas

- Level 3. EOC642_3. Control of execution in construction
- Main competence: On site direction of the different parts of a building execution (new and refurbished), organizing and supervising, coordinating and transmitting instructions to all the construction staff, doing setting-out, checking short-term planning and workload to reach quality and planning goals, as well as safety and security, following technical requirements and instruction of a responsible worker.

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- Competency units: Do setting-out of different construction works, organize topography staff; workmanship control of concrete, reinforcements and formworks; execution control of structures and foundation; execution control of envelop; execution control of partition walls, installations and finishes; organize and manage the evolution of construction works; control construction techniques about rehabilitation; basic functions about construction prevention risks.
- Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria , Ecological economy, Sociocracy
- Training duration: 870 hours

- Level 3. EOC783_3. Photogrammetry development works
- Main competence: Do photogrammetry works to digital modeling by means of digital devices and linked to construction and engineering providers, following standards about environmental protection, construction prevention risks and quality.
- Competency units: Image shot project for photogrammetry and model the geometry, tridimensional information of models (vector and numerical of identities), coordenate geometry transformation of images and models
- Breath update: Appropriate technology
- Training duration: 600 hours

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Annex II

VET Specialization courses for Building in Spain

Some specialization courses are pointed, but more could be included from this catalog. The main linked to BREATH Project are:

- Level 4. ENAC07. Energy refurbishment of building through passive systems
  - Professional family: Energy and water
  - Main aim: Do energy refurbishment project through passive systems in buildings, diagnosis of the envelope and building site control, following sustainability criteria, for the obtention of nearly zero-energy building certificate complying with standards.
  - Learning mode: On site / On line
  - Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
  - Training duration: 150 hours

- Level 2. ENAC13: Energy work execution of building through passive systems
  - Professional family: Energy and water
  - Main aim: Energy work execution through passive systems and its mounting in refurbishment works of a building, taking into account confort values of users, for the obtention of nearly zero-energy building certificate complying with standards.
  - Learning mode: On site / On line
  - Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
  - Training duration: 200 hours

- Level 2. ENAC14. Energy efficiency Passive systems in Buildings
  - Professional family: Energy and water
  - Main aim: Collaborate in the making of execution proposals for the energy refurbishment of a building through passive systems, taking into account confort values of users, the present construction material in the building, geography and climate factors.
  - Learning mode: On site / On line
  - Breath update: Appropriate technology; bio-architecture and bio-construction design and control criteria
  - Training duration: 280 hours

- Level 2. EOCB01. Bio-construction
  - Professional family: Building and civil works.
  - Main aim: Execute the construction works needed of a building project, construction solutions adapted to climate and geography and using local material. Bio-construction criteria, construction prevention risks, foundations, load bearing walls (ceramic, straw, earth, , carpentry, green roofs, coatings (earth, lime), heating physics (thermal mass stoves), continuous pavements (gypsum, lime, earth).
  - Learning mode: On site
  - Breath update:

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- Training duration: 498 hours

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