Professional Competence Matrix

Co4 Health

Co-funded by the European Union

Project Coordination

BGZ Berliner Gesellschaft für internationale Zusammenarbeit mbH

https://bgz-berlin.de/en

Project Partners:

Vocational Training Institution of the Construction Industry Berlin-Brandenburg e.V. (BFW-BB)

Vocational Training Centre JEDU Nivala

Construction School Andrea Palladio (SCVAP) Vicenza

Stichting CHAIN5

Construction School Complex No.1 (ZSB1) Poznań

University of Technology (PUT) Poznań

https://co4health.eu/en/partnerschaft

2025

Co-funded by the European Union

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Introduction

The main theme of the project is "Co4Health" - identifying the needs for healthy construction and preparing a proposal to expand the educational offer of vocational training with content developing competences in this topic and equipping future specialists with new skills.
The project partners are six vocational training centers and universities from Germany, Finland, Italy, Poland and the Netherlands - cooperating under the leadership of BGZ Berlin Agency for International Cooperation, and they are substantively supported by various economic associations, chambers of commerce and construction companies.

The project analyzes, among others:

- what professional requirements in the field of healthy construction will qualified construction workers encounter,
- what vocational education institutions and universities should look like in the future so that they can practically transmit competences related to healthy construction in vocational training.

Selected activities within the project (www.co4health.eu):

- analyzing current labor market requirements in the construction industry,
- creation of a competence matrix,
- developing proposals for quality assurance and documentation of learning outcomes,
- developing a strategy for long-term cooperation between vocational education and industry, science and research.

Multi-aspect research was used in the project.
The team from the Poznań University of Technology (PUT) coordinated the activities preparing the matrix.

This classification, which was discussed and developed by the lead partners for the result (PUT& Chain 5) in consultation with the VET partners in Germany, Finland, Italy and Poland, has been accepted by all participating partners and others, including associates.

The working and discussion groups were attended by representatives of:
research and development units e.g. members of PZITB - Polish Association of Construction Engineers and technicians, universities, teachers of vocational subjects from technical secondary schools; small, medium and large companies from the construction industry in each country.

The authors of the study took part in discussion meetings to exchange experiences with industry practitioners and lecturers from other schools.

The result of the activities included in this report is a matrix of competences in the field of knowledge, skills and social competences.

The matrix thus illustrates which thematic aspects need to be considered in terms of competence acquisition at each level in order to enable the adaptation of important thematic content in the field of healthy building.

At the same time, the matrix serves as a basis for the EU-wide adaptation of existing teaching and learning materials for future-oriented education and training.

Competence Systems

European competence systems

The European Qualifications Framework is recommended by the Council of the European Union [1, 2] to compare qualifications systems in European education systems.
Eight levels of education were established, for which three categories of learning outcomes were prepared: **knowledge, skills, responsibility and autonomy.**

The project prepared competence matrices for education levels:
3, 4, 5 and 6.

Level	Knowledge	Skills	Responsibility and autonomy
3	Knowledge of facts, principles, processes and general concepts in a given field of work or study	A set of cognitive and practical skills needed to perform tasks and solve problems by selecting and applying basic methods, tools, materials and information	Accepting responsibility for carrying out tasks at work or learning adapting one's behavior to the circumstances when solving problems
4	Factual and theoretical knowledge in a broader context of a given field of work or study	Range of cognitive and practical skills needed to solve specific problems in a given field of work or study	Self-organization within the guidelines of work-related contexts *or*
5	Extensive specialist factual and theoretical knowledge in a given field of work or study and awareness of the boundaries of this knowledge	A comprehensive range of cognitive and practical skills needed to creatively solve abstract problems	Learning, usually predictable, but subject to change, overseeing the routine work of others, assuming some responsibility for assessing and improving work or study activities
6	Advanced knowledge in a given field of work or study, including critical understanding of theories and principles	Advanced skills, demonstrating proficiency and innovation needed to solve complex and unpredictable problems in a specialized field of work or study	Management and supervision in work or study contexts subject to unpredictable changes analyzing and developing own and other people's achievements

National Competence Systems in Partner Countries

National qualifications systems are based on the European Qualifications Framework. Learners, graduates, education and training providers and employers can thus better understand and compare qualifications awarded in different countries and in different education and training systems [1].

Types of types of analyzed professions related to healthy building

3th level of education

Vocational education at level 3 means learning in a first level of professional school. The following occupations were analysed in the project:

- construction worker (PL),
- fitter of building and finishing works in construction,
- production.

4th level of education

Vocational education at level 4 means learning at a vocational secondary school or technical school.

The project analysed the professions:

- building technician,
- finishing technician,
- bricklayer,
- tiler,
- carpenter,
- drywall builders,
- plasterer,
- painter,
- screed layer,
- building carpenter,
- construction technician,
- water engineering technician,
- hydraulic engineering technician,
- landscape architecture technician,
- facility manager,
- cabinet maker,
- road construction technician,
- technician TGA,
- production.

5th level of education

Level 5 vocational education means upper secondary education. These types of schools do not exist in all EU countries. The project analyzed the profession of a technician specializing in acoustics (Italy).

6th level of education

Vocational education at level 6 means first degree studies at Universities and Higher Vocational Schools. The following occupations were analysed in the project:

- civil engineer,
- master carpenter,
- architects,
- heating engineer,
- investor supervision inspector.

Suggestions for new professions:

It is proposed to create new professions in the following crafts:

- facility manager,
- audit activity,
- energy advisor,
- construction and insulation technician (Italy),
- construction technician in the field of programming and automation (e.g. roof joinery, gates and windows),
- representative for prevention and well-being at work,
- heating engineer and qualified companies (Italy),
- construction technician in the scope of wider adaptation of facilities for the elderly.

Competence matrix for specific stages of education proposed competences for teaching about healthy construction

The competence matrix has been prepared for each level of education. The competences included in it can be chosen in whole or in a selected part - only the relevant decision-making teams in individual schools / universities decides which competences will be selected. The division into educational levels is indicative and competences from another educational level can also be selected.

The competences for levels 3 and 4 and 5 and 6 overlap, so they are presented in the common tables. The project partners selected competences appropriate for the professions offered in their schools (GE - Germany, FI - Finland, IT - Italy, PL - Poland, NL - Netherlands).

3TH AND 4TH LEVEL OF EDUCATION

Symbol	Knowledge		3	4
K1	thermal comfort	Has knowledge of building materials and their proper use in the project in terms of thermal insulation	PL GE	PL GE
K2	thermal comfort	Knows legal regulations and technical solutions related to building thermal insulation		PL GE
K3	thermal comfort	Has knowledge about new thermal insulation materials and their correct use in the project	PL GE	PL GE
K4	thermal comfort	Has knowledge of how to compare techniques and technologies used depending on the case	PL	PL
K5	thermal comfort	Know systems air conditioning		
K6	thermal comfort	Knows the principles of constructing energy-efficient buildings		PL GE
K7	humidity comfort	Has knowledge about the dangers of mold in buildings		PL GE
K8	humidity comfort	Has knowledge of building materials and their proper use in the project in terms of moisture insulation	PL GE	PL GE
K9	humidity comfort	Has basic knowledge about building tightness		PL GE
K10	humidity comfort	Has basic knowledge about thermal bridges in buildings	PL	PL GE
K11	humidity comfort	Has basic knowledge of building physics in the field of protection against moisture in buildings		PL GE
K12	humidity comfort	Knows waterproofing materials	PL GE	PL GE
K13	humidity comfort	Has basic knowledge about the impact of humidity on thermal comfort		PL GE
K14	clean air	Has knowledge about the disposal of construction materials	GE	PL GE
K15	clean air	Has knowledge about the release of harmful substances from building materials		PL GE
K16	clean air	Knows the basics of human chemistry and physiology		PL

Symbol	Knowledge		3	4
K17	acoustics	Has general knowledge about the impact of sounds and infrasound on health		PL GE
K18	environmental protection	Has knowledge about the impact of building materials on the environment	GE	PL GE
K19	environmental protection	He knows what material can be reused	PL	PL GE
K20	environmental protection	Has basic knowledge of the life cycle of materials	GE	PL GE
K21	environmental protection	Has general knowledge about carbon footprint	GE	PL GE
K22	environmental protection	Has general knowledge about material passports (DPP)		PL EG
K23	environmental protection	Has general knowledge of what green construction is		PL GE
K24	environmental protection	Has general knowledge of what sustainable construction is		GE
K25	universal design	Has general knowledge of the principles of universal design		
K26	radiation protection	Knows the types of soil with higher radon content		
K27	radiation protection	Knows the principles of ventilation in the building		
K28	radiation protection	Knows which building materials have the highest content of radioactive elements		

Symbol	Skills		3	4
S1	thermal comfort	Can install materials thermal insulation	PL GE	PL GE
S2	thermal comfort	Is able to calculate heat transfer coefficients		PL GE
S3	thermal comfort	Is able to select materials and technologies that ensure adequate thermal insulation		PL GE
S4	thermal comfort	Is able to apply IT in construction works		GE
S5	thermal comfort	He can pre- size heating installations and verify them		
S6	humidity comfort	Is able to properly connect walls, ceilings and roofs in order to avoid thermal bridges	PL GE	PL GE
S7	humidity comfort	Is able to properly install waterproofing, vapor barrier and vapor permeable foils	PL	PL GE
S8	humidity comfort	He can perform professional sealing of a building partition	PL GE	PL GE
S9	humidity comfort	Is able to select materials and technologies for moisture insulation		PL GE
S10	humidity comfort	He can dry buildings		
S11	clean air	Knows how to clean and maintain air conditioning systems		
S12	clean air	Knows how to properly use tools and handle highly volatile substances during construction		
S13	acoustics	He can install sound-absorbing mats and soundproofing elements in buildings	PL	PL GE
S14	acoustics	Is able to properly install window joinery for acoustic protection	GE	GE
S15	acoustics	Is able to install anti-vibration protection		
S16	environmental protection	He can recognize conditions installation	PL	PL
S17	environmental protection	Is able to apply/use, explain, recognize and handle building materials	PL GE	PL GE

Symbol	Skills		3	4
S18	universal design	Is able to install elements of textured pavement markings		
S19	universal design	He can install loops induction		
S20	universal design	I can install stair platforms for the disabled		
S21	radiation protection	Can perform tight insulation of foundations and floors on the ground using roofing felt or foil - also to protect against radioactive radiation	GE	GE

Symbol	Responsibility and autonomy		3	4
C1	environmental protection	Feels responsible for environmental protection	PL GE	PL GE
C2	environmental protection	Understands the importance of ecology	PL GE	PL GE
C3	environmental protection	Understands the need to choose human/environment-friendly building materials	GE	PL GE
C4	clean air	Understands the importance of maintaining proper ventilation and air quality in the building to maintain a healthy indoor environment	GE	PL GE
C5	universal design	Understands the diversity of needs of different people in the light of universal design		
C6	radiation protection	Understands the need for protection against radiation	GE	GE

5TH AND 6TH LEVEL OF EDUCATION

Symbol	Knowledge		5	6
K1	thermal comfort	Knows the physical properties of various thermal insulation materials		GE PL
K2	thermal comfort	Knows construction techniques in the field of thermal insulation		EG PL
K3	thermal comfort	He knows technical physics		GE PL
K4	thermal comfort	Has knowledge about green construction		GE PL
K5	thermal comfort	Has knowledge of building materials technology		GE PL
K6	thermal comfort	Has knowledge about the possibilities of using solar energy to heat building interiors		GE PL
K7	thermal comfort	Has extensive and specialized knowledge of the detailed requirements for energy-neutral buildings	NL	
K8	thermal comfort	Has extensive and specialized knowledge of energy-neutral materials	NL	
K9	thermal comfort	Has extensive and specialized knowledge of energy-neutral activities based on legislation, regulations and requirements for a passive house and an active house	NL	
K10	thermal comfort	Has extensive knowledge of aspects of human well-being in life, work and living environment	NL	
K11	thermal comfort	Has extensive knowledge of control tools enabling practical verification of undertaken activities	NL	
K12	thermal comfort	Has knowledge of more complex energy performance calculations	NL	
K13	thermal comfort	Has knowledge about energy storage	NL	
K14	humidity comfort	Has detailed knowledge of the building's tightness		GE PL
K15	humidity comfort	Has detailed knowledge about thermal bridges in the building		EG PL
K16	humidity comfort	Has detailed knowledge of building physics in the field of protection against moisture in buildings		GE PL

Symbol	Knowledge		5	6
K17	humidity comfort	Knows waterproofing materials		GE PL
K18	humidity comfort	Has detailed knowledge of the impact of humidity on thermal comfort		GE PL
K19	humidity comfort	Has knowledge of methods for drying buildings		PL
K20	clean air	Has knowledge about environmental toxins in the human body		GE PL
K21	clean air	Knows the regulations regarding air cleanliness standards in buildings		PL
K22	clean air	Has knowledge about the extraction of these raw materials and any negative consequences for the environment and/or people	NL	
K23	clean air	Has knowledge of more sustainable, alternative raw materials/products to burdensome raw materials/products	NL	
K24	natural light	Has general knowledge about the impact of sunlight on the human body		GE PL
K25	natural light	Knows the regulations regarding the required time of natural lighting in rooms		PL
K26	natural light	Knows the types of light sources and their impact on people's eyesight		PL
K27	acoustics	Has general knowledge about the impact of sounds and infrasound on health		PL
K28	acoustics	Knows the principles of acoustic insulation and vibration isolation		GE PL
K29	acoustics	Knows the principles of designing buildings with regard to protection against noise and vibrations		PL
K30	acoustics	Knows the acoustic insulation requirements of building partitions		GE PL
K31	environmental protection	Has knowledge about the impact of building materials on the environment		GE PL
K32	environmental protection	He knows what material can be reused		GE PL
K33	environmental protection	Has basic knowledge of the life cycle of materials		GE PL

Symbol	Knowledge		5	6
K34	environmental protection	Has general knowledge about carbon footprint		GE PL
K35	environmental protection	Has general knowledge of material passports (DPP)		GE PL
K36	environmental protection	Has general knowledge of what green construction is		GE PL
K37	environmental protection	He has detailed knowledge of what sustainable construction is		GE PL
K38	environmental protection	Knows the basic criteria of multi-criteria certification BREEAM, LEED, FITWEL, WELL, DGNB		GE PL
K39	universal design	Has detailed knowledge of the principles of universal design		PL
K40	radiation protection	Knows the types of soil with higher radon content		PL
K41	radiation protection	Knows the principles of ventilation in the building		PL
K42	radiation protection	Knows which building materials have the highest content of radioactive elements		PL
K43	radiation protection	Knows the permissible values of the annual equivalent radon concentration in rooms of a building intended for permanent human stay		PL
K44	e-smog	Knows the regulations governing the location of buildings with rooms for people to stay in order to protect against the effects of electromagnetic fields		PL
K45	universal design	Knows the principles of universal design		PL

Symbol	Skills		5	6
S1	thermal comfort	Is able to apply nanotechnology in construction, research, development, service, maintenance and assembly		PL
S2	thermal comfort	Is able to use specialized software in thermal analyzes of a building		PL
S3	thermal comfort	Is able to prepare an energy balance of a building		PL
S4	thermal comfort	Can operate a thermal imaging camera		PL
S5	thermal comfort	Is able to calculate heat transfer coefficients		GE PL
S6	thermal comfort	Is able to select materials and technologies that ensure adequate thermal insulation		GE PL
S7	thermal comfort	Can design an energy-efficient building		PL
S8	thermal comfort	Is able to integrate energy-neutral solutions with digital building models	NL	
S9	humidity comfort	Is able to properly design connections of walls, ceilings and roofs in order to avoid thermal bridges		PL
S10	humidity comfort	Is able to select waterproofing materials, vapor barrier and vapor permeable foils		GE PL
S11	humidity comfort	Is able to determine the cause of moisture in building elements		PL
S12	humidity comfort	Is able to calculate water vapor condensation in building partitions		PL
S13	humidity comfort	Can perform simple measurements, e.g. tightness measurement	NL	
S14	natural light	Knows how to select sun protection systems		PL
S15	natural light	He knows how to choose window joinery		PL
S16	natural light	Is able to calculate the sunlight exposure in rooms		PL

Symbol	Skills		5	6
S17	acoustics	He can measure and calculate interior acoustics		PL
S18	acoustics	Is able to select appropriate materials and technologies for acoustic insulation and anti-vibration protection		GE PL
S19	universal design	Is able to design buildings with eliminated architectural obstacles		PL
S20	radiation protection	Is able to select building materials with low radioactivity		GE PL
S21	e-smog	He can design the partitions of a Faraday Cage		PL

Symbol	Responsibility and autonomy		5	6
C1	environmental protection	Feels responsible for environmental protection		GE PL
C2	environmental protection	Understands the importance of ecology		GE PL
C3	environmental protection	Understands the need to choose human/environment friendly building material		GE PL
C4	universal design	Understands the diversity of needs of different people in the light of universal design		GE PL
C5	radiation protection	Understands the need for protection against radiation		GE PL
C6		Is able to participate in multidisciplinary design and construction teams	NL	PL

Conclusions

Based on the conducted analyses, it was found that obtaining qualifications related to health-promoting construction requires changes in teaching curricula.

These changes can be implemented in three areas: knowledge, skills and social competences.

On the basis of identifying the needs related to Internet areas, survey research was carried out using surveys and interviews. The surveys were prepared in Google Forms using open questions with the option of providing a broad description. The surveys were conducted electronically and on paper.
The group of respondents included teachers and managements of technical schools from the construction industry, technical universities and construction companies from the design, construction and appraisal sectors.

The survey results and working meetings among the project partners allowed for the preparation of guidelines related to the proposed changes in teaching programs in the context of health-promoting construction.
These changes have been prepared in the form of a competence matrix divided into individual levels of education.

Occupations whose programs may be subject to modifications have also been identified.

Matrices for levels 3 and 4 and 5 and 6 were combined due to recurring learning outcomes, which were highlighted in the following topics:

- thermal comfort,
- humidity comfort,
- clean air,
- natural lighting,
- acoustics,
- environmental protection,
- universal design,
- radiation protection,
- e-smog.

Data Sources

EQF - The European Qualifications Framework

https://europass.europa.eu/en/european-qualifications-framework-eqf

The EQF is an 8-level, learning outcomes-based framework for all types of qualifications that serves as a translation tool between different national qualifications frameworks. This framework helps improve transparency, comparability and portability of people's qualifications and makes it possible to compare qualifications from different countries and institutions.

Finland - The Finish Qualifications Framework

http://www.oph.fi/qualificationsframework

The Finnish National Qualifications Framework (FiNQF) **is an 8-level system** that classifies all formal education—general, vocational, and higher education

https://eurydice.eacea.ec.europa.eu/eurypedia/finland/national-reforms-vocational-education-and-training

Italy -The National Qualifications Framework (Quadro Nazionale delle Qualifiche QNQ)

https://eurydice.eacea.ec.europa.eu/eurypedia/italy/national-qualifications-framework

The Italian NQF (Quadro Nazionale delle Qualificazioni, QNQ) **is structured in 8 levels**, covering qualifications from general, technical and vocational.

Netherlands - The Dutch Qualifications Framework (NLQF)

the Dutch Qualifications Framework (NLQF) is a comprehensive system **of 9 qualification levels** = ***system*** (Entry **Level 1 + 8 levels**) That classifies Dutch education and training, ranging from basic education to doctorates.

Poland - The Polish Qualifications Framework (PQF, Polska Rama Kwalifikacji)

https://prk.men.gov.pl/en/1en/

The Polish Qualifications Framework (PQF) is a reference system for qualifications awarded in Poland. There **are 8 levels** in the PQF.

Dziennik Urzędowy Unii Europejskiej 15.6.2017 ZALECENIE RADY z dnia 22 maja 2017 r. w wydaniu prawnym ram dla uczenia się przez całe życie i uchylające polecenie Parlamentu Europejskiego i Rady z dnia 23 kwietnia 2008 r. w sprawie ustanowienia legalnego ram certyfikatu dla nauki się przez całe życie (2017/C 189/03)

https://ec.europa.eu/ploteus/sites/eac-eqf/files/en.pdf