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## NEW LEARNING METHODOLOGIES ON SUSTAINABLE CONSTRUCTION

**Abstract:** Today's education programs do not sufficiently include topics of energy efficiency and sustainable construction. These deficiencies were recognized by the Faculty of Civil Engineering in Zagreb and the Croatian Engineering Association, and within the framework of several EU projects they developed a training system on energy efficiency and sustainable construction. The paper will showcase projects CROSKILLS, FIT-to-nZEB, Net-UBIEP, which are oriented towards educating construction workers, architects, designers, contractors and supervisors in the area of energy efficiency and BIM technology. The CPD4GB project will also be presented. The mission of the project is to encourage the development of sustainable partnerships of higher education institutions, professional associations and volunteers in the development and implementation of the socially useful learning for sustainable/green construction. The overall goal of the project is developed of methodology and simultaneous application through which students acquire practical knowledge and skills and use that to solve local community projects, with mentoring, which enables them to gain competences. It is a pilot project that should be the basis for new approaches to interdisciplinary formal and non-formal learning.

**Key words:** education, energy efficiency in buildings, sustainable construction, volunteers

## NOVE METODE EDUKACIJA ZA ODRŽIVU GRADNJU

**Rezime:** Današnji programi obrazovanja ne uključuju u dovoljnoj mjeri teme energetske učinkovitosti i održive gradnje. Na Građevinskom fakultetu u Zagrebu (GF) i u Hrvatskom inženjerskom savezu (HIS) prepoznali su te nedostatke, te su u okviru nekoliko EU projekata razvili sustav obrazovanja na temu energetske učinkovitost i održive gradnje. U članku će biti prikazani projekti CROSKILLS, FIT-to-nZEB, Net-UBIEP koji su orijentirani na edukaciju radnika, projekatana, izvođača i nadzornih inženjera u području energetske učinkovitosti i BIM tehnologije. Također je prikazan projekt CPD4GB. Namjera projekta je poticanje razvoja održivog partnerstva visokoobrazovnih ustanova, profesionalnih udruga i volontera u razvoju i provedbi društveno korisnog učenja za održivu/zelenu gradnju. Cjelokupni cilj projekta je razvijanje metodologije i istodobna primjena kroz koju studenti stječu praktična znanja i vještina koja koriste za rješavanje projekata lokalne zajednice. uz mentorstvo, što im omogućava stjecanje kompetencija. To je pilot projekt koji bi trebao biti temelj za nove pristupe interdisciplinarnom formalnom i neformalnom učenju.

**Ključne reči:** obrazovanje, energetska učinkovitost u zgradarstvu, održiva gradnja, volonteri

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## **1. INTRODUCTION**

A new way of education in the field of sustainable building, which promotes the knowledge, skills and competences of students through formal education and the continuous professional development of experts through non-formal education, contribute significantly to the sustainable development, circular economy and the ability of society to assume responsibility and find solutions to today's challenges. Acquiring knowledge, skills and competencies is required at all levels of education as outlined in this paper, citing several projects being carried out.

## **2. EDUCATION OF BUILDING PROFESSIONALS FOR NZEB**

Nowadays, energy efficiency in buildings (EE) is very important for construction sector, especially after the many years of construction recession. The EU predicts that the EE will be a priority until 2050, until the entire fund of existing buildings is planned to be renovate to the nZEB standard. To carry out a quality renovation of buildings, there is a need for continuous training of both architects and engineers, as well as blue collar workers who are involved in EE renovation of buildings.

One important barrier that hampers the development of Nearly Zero-Energy Buildings (nZEBs) and effective renovations (up to nZEB levels) is the lack of adequate construction competences (knowledge, skills, autonomy and responsibility). Improving the competences of middle- and senior-level building professionals, as well as the various trade professionals (construction workers) in sustainable energy efficient construction is therefore of key importance.

Practical experience demonstrates that many construction mistakes happen, particularly when details and joints are considered, which can greatly affect the energy performance of the building and the appearance of construction damage. Several relevant examples of buildings in Croatia show us, that in the field of energy efficiency increased control and quality assurance is needed to improve the quality of works. Besides the fact that the lack of quality is often caused by the lack of competences, building professions also need to be aware of new and upcoming challenges relating to nZEBs. These include new materials and products, the integration of renewable energy sources, new systems or processes, and the use of Building Information Modelling (BIM) tools.

All of this leads to the conclusion that upskilling towards energy efficiency and NZEBs should be done throughout the entire value chain of the buildings sector (including designers, architects, engineers, building managers, technicians, installers and workers including apprentices).

There are several initiatives to upgrade professional competences in nZEB design and construction, thus increasing the experts' capacity to tackle nZEB implementation in actual building stock throughout Central European Initiative Member States.

Accordingly, the efforts made in Croatia through the CROSKILLS project (BUILD UP Skills initiative through CIP IEE programme) on development of training scheme of construction workers and pilot training of more than 300 workers in 6 professions: bricklayer, plasterer, carpenter, house painter, roofer, drywall installer, as well as the Ordinance on the system of training and certification of construction workers which install building elements that affect building's energy efficiency (OG 67/2017). The training modules was developed for each of the six priority construction professions.

The duration is between 20 and 30 hours per each training course, depending on the workers EQF, whether they are qualified or unqualified workers. Each training course consists of a theoretical and practical part, and at the end the workers take the exam. As a result of the

CROSKILLS project, it is important to emphasize both manuals for trainers and manuals for workers which are shown on Figures 1 and 2.



Figure 1 – CROSKILLS manuals for trainers [1]



Figure 2 – CROSKILLS manuals for workers [1]

The efforts on developing new competences are continued through the Horizon 2020 projects developing multi-country qualification and training schemes such as Fit-to-nZEB (Innovative training schemes for retrofitting to nZEB-levels) and Net-UBIEP (Network for Using BIM to Increase the Energy Performance). These two projects are primarily oriented towards strengthening the competence of architects and engineers in the field of energy efficiency. Through the project Fit-to-nZEB, a plan and a program of workshops were developed for designers and contractors, to improve their competences for EE in the building industry. Demonstration models were also developed to properly solve the various details of building performance, especially the details of thermal bridges.

In order to make energy efficiency jobs more efficient, it is necessary to carry out the education of architects and engineers for the BIM. The Net-UBIEP project will develop a program for BIM education workshops specially in the area of EE.

### **3. CONTINUOUS PROFESSIONAL DEVELOPMENT FOR GREEN BUILDING, CPD4GB**

#### **3.1. About the CPD4GB project**

Project Continuous Professional Development for Green Building, CPD4GB, is funded by means of grants from the European Social Fund under the program 2014-2020, and within the operational program "Effective Human Resources 2014-2020"

This project seeks to address the challenges of sustainability and environmental protection in the field of construction through the establishment of socially useful green building learning programs.

The Project emphasizes the importance of cooperation between higher education institutions and civil society organizations (association) in the education of socially responsible and active citizens, thereby contributing to the overall development and improvement of the community. Socially useful learning is recognized as an effective way of connecting students and higher education teachers to civil society organizations and social community, as well as an important incentive in finding the first job after graduation.

The project involves three associations and four higher education institutions of the University of Zagreb, students and young professionals as volunteers.

Students in this project will gain the opportunity to learn and work with mentors on relevant projects, to apply acquired knowledge and skills and develop professional competences for green building. Mentors will be teachers and employees from associations. Volunteers, experts from different professions, will be involved as well, that greatly contributes to the idea of a new way of learning.

The project was supported by the University of Zagreb and the Academy of Technical Sciences of Croatia, which recognized its value and contribution to the modernization of educational programs by including the contents of green building within the framework of formal and informal education.

The letters of support for the project were also given by several cities, which will participate in the project through their programs and projects.

Why green building? Green building refers to the building and processes that are environmentally responsible and resource efficient throughout the lifecycle of the building. It has an impact on reducing energy use, increasing comfort in buildings and increasing environmental protection, including the use of acceptable building and other materials / products, taking care of raw materials, affecting human health, transportation, human and material resources, production, construction, recycling and disposal at the end of the lifecycle of the building. It supports sustainable development and takes care of the environmental, social and economic aspects of sustainability. There are only 3 buildings certified according to the international certification system for green building in Croatia, which means that we are at the very beginning, we need to improve and intensify our approach.

Why socially helpful learning? Socially helpful learning, a new, innovative way of transferring knowledge and skills enables professionals to recognize tasks quickly and effectively and transfer their knowledge to address the specific problems of the society / local community. Socially useful learning encourages interdisciplinary approach to learning and a multidisciplinary approach to problem solving, as well as teamwork, which is necessary in establishing green building.

### **3.2. Goals, target groups, innovation approaches, local community**

The overall goal of the project is to enable students with acquired practical knowledge and skills to address specific social problems and community development, while specific goals are to strengthen the professional, analytical capacities of associations, through cooperation with higher education institutions and to establish sustainable programs of socially useful learning at higher education institutions as part of a systematic approach to strengthening the social responsibility of teachers and students.

The Project title Continuous Professional Development for Green Building (CPD4GB) points to project sustainability, and enfaces to the possibility that similar projects in the field of informal education will be implemented in the future. The methodology that will be established during the project in the future will serve for formal education programs at university level, and nonformal on all educational levels

The project is fully aligned with the Call objectives and will offer solutions:

The first specific target of the Program will be realized through mutual cooperation between associations and faculties-partners on the development and implementation of socially useful learning programs for green building. Solution: Creating a methodology for socially useful learning on education programs of green building

The second specific target of the Program will be achieved through the establishment and implementation of CENTER that will give support, bring all project partners together and will be open to inclusion of other relevant organizations and faculties of the University of Zagreb to ensure the participation of many stakeholders which are competent to maintain and improve

the education program in future. Solution: Establishment of the virtual CENTER for these and future education program under University or under association responsibilities.

Target groups of the project are students, teachers of higher education institutions, employees of civil society organizations and volunteers. In the project activities will be included: 40 graduate students; 10 teachers from faculties of the University of Zagreb, 5 civil society organizations employees and 8 volunteers with about 2500 volunteer hours.

Students have difficulties to find work which derives from the mismatch between educational programs and the needs of the labor market is the problem students encounter. For teachers of higher education: the problem is associated with hardly changeable the prescribed programs and subjects, which is the reason why they cannot prepare students for taking an active civic role in society in their areas of knowledge and skills. The changes of education are long lasting and difficult. For associations' employees problem is the lack of adequate engagement in educational in solving problems related to sustainable development, environmental protection and pollution reduction. The problem of volunteers concerns the lack of opportunities for working with students / course participants on activities that are simultaneously beneficial to students / course participants and to the community. Volunteers role are unrepresented in society.

In order to address these problems of target groups in the process of education, it is necessary to introduce some innovations.

The project include: a new approach to learning (social useful learning) and inclusion of new educational content (sustainable / green construction) in higher education. New education approach strongly support an interdisciplinary formal and non-formal education at University and associations levels and also encourage students/young professionals to create competences for their (new) jobs and to manage their career by choosing from various educational content, thus responding to the needs of the modern labor market.

The cities participating in project is very important and will ensure cooperation and access to the necessary information in order for students to be able to identify problems and needs of the local community, to analyze, offer solutions and to make projects.

### **3.3. Activities of the project**

The main activities of the project are: Preparation, development of a methodology for socially useful learning program for green building (collecting data through a survey, analysis and synthesis, SWAT analysis and identification of positive indicators) and the establishment of the CENTER; Participation of students in a program of socially useful learning for green building (lectures, workshops, discussions, preparation of project tasks and projects, preparation of materials for future education programs on the basis of acquired knowledge, skills and competences (way of knowledge testing).

Apart from the real achievements project's success depends on the visibility of the project. A large contribution to the visibility of the project is a project website (Croatian and English), and presentations about the project on various congresses and expert meetings will help reach the goals and prepare the base on new projects in the future.

### **3.4. Project sustainability**

Implementation of the project will provide guidelines for continuing the Constant Professional Development for Green Building through non-formal learning programs, respecting project methodology, socially useful learning for green building programs as well as guidelines for implementing the same or similar programs through formal education at higher education institutions, with particular emphasis on interdisciplinary studies. For that reason CENTER is established.

The CENTER represents a virtual organization which connects and brings together project partners, civil society organizations (associations) and higher education institutions (components of the University of Zagreb) as well as other targeted groups in project, students and volunteers in order to develop methodology for continuous professional development for green building. The CENTER supports the implementation of the socially-useful learning (SUL) for green building, it supports the implementation of the project CPD4GB and it also supports project sustainability



*Figure 3 – CPD4GB –web page, logo project [2]*

#### **4. CONCLUSION**

Instead of conclusion a few words about the end users of the project to which the project has an impact on.

The ultimate beneficiaries of the project are the society in general, young experts, higher education institutions and civil society organizations. The Society will benefit because the knowledge and skills of green building acquired in the way of socially useful learning contribute to increasing the quality of life of people, relieve local infrastructure, increase air and water quality, protect biodiversity and eco-system, and improve the health of users. Within the project, a program of socially useful learning in the field of green building will be developed and continue to be implemented in the future, while besides the students, young experts who want to acquire practical knowledge and skills in the green building sector and who want to continue their professional development in that direction, either in the profit or non-profit sector, will be able to participate too.

It is important to emphasize the role of CENTER. For the purpose of this project the Center includes all project participants; user, partner associations, higher education institutions partners, students and volunteers. The Center should include other associations and components of the University with technical competencies as well as associations and components of the University of Zagreb, which carry and develop social and economic competences directed at sustainable development and green building, after the implementation of the project.

The project represents a pilot project that seeks to establish the criteria and preconditions which need to be fulfilled in order to make the transition of socially useful learning program for the green building from the informal to formal educational system faster and more efficient.

#### **5. REFERENCES**

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