

Pythagoras: An innovative training package on Indoor Environment Quality

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ABSTRACT

The aim of the Pythagoras project was the development of an innovative national training material in the sector of indoor environmental quality.

The need for education in this specific sector is dictated by the significant indoor environment deterioration and associated health hazards as these become evident through a series of studies and measurements carried out by the research team. Given the fact that the use of air conditioning systems in the country is rising exponentially while the general knowledge around the importance of good design, installation and maintenance of these systems is scarce, the indoor environment is expected to continue to deteriorate, forming a major problem for the public health. For this reason, building architects, designers, constructors, technicians, owners and users should be educated on how to design, function and maintain healthy buildings.

Early in the project, a review was undertaken of the international literature and the syllabuses of foreign research and educational institutions active in indoor environment quality issues. At the same time, the requirements of the Greek educational and broader society, related to issues of indoor pollution and health, were determined. A training methodology is consequently developed, with the objective to optimally cover all the parameters associated with the indoor environment quality, for trainees of various disciplines.

The training material is produced both in printed (book)

and integrated electronic (e-learning) format. Additionally, four seminars have been organized covering the respective sections of the training package. The training package has been assessed both by trainees and international experts in the sector of indoor environment quality.

1. PURPOSE OF THE WORK

Aim of the Pythagoras project was the development of pre-graduate and post-graduate level national training material in the sector of indoor environmental quality. The need to provide education in this specific sector stems from the reported deterioration of the indoor environment, as well as from the lack of relevant educational material in the Greek country.

Low ventilation levels, combined with the use of many modern building materials, lead to a significant decline in the indoor environment quality, aggravated by pollutants emissions that can harm the health of building occupants. The pollution of indoor environment forms a major problem in both developed as developing countries. Contemporary studies in the developing world have shown that indoor pollution is the cause of death of more than 4 million people per year (WRI, 1996), while almost 30 to 40% of the respiratory diseases caused are the result of high levels of particles indoors (World Bank, 2000). Main cause of these problems is the use of open fire sources and inappropriate fuels inside residences. Recent studies have proved that indoor levels of particles and smoke frequently supersede by 10 to 100 times the

recommended or acceptable limits (Saksena and Smith, 1999 and WHO), while in parallel, the concentration of indoor pollutants like CO, formaldehydes, VOC's etc. are far above the limits. The problem becomes more severe as a result of low ventilation levels. In developing countries, where residences often consist of only one small common area, and especially during the raining season, the ventilation levels are very low. It is shown that almost 60 % of the residences in India do not fulfill the requirement levels for ventilation (Singh et al, 1996). But indoor pollution is as important for the developed world as well. Since 1984 the World Health Organization has concluded that worldwide as much as 30% of the new and refurbished buildings show problems of indoor air quality, while the European Statistics Agency reports that 13% of the European residences have humidity problems (Healy J.D. and J. Peter Clinch, 2002). Humidity has proven to be a major cause of respiratory problems and of the development of allergies and asthma (Williamson et al, 1997).

Relevant problems with indoor pollution are also shown in many Greek buildings. Measurements carried out in residential buildings have shown VOC's concentrations which exceeded the limits in as much as 95 % of the cases, while particles pollution was measured in more than 80 % of the buildings (Santamouris et al, 2006). Similar results were extracted from measurements carried out in schools (Synnefa et al, 2003), hospitals, office buildings etc. The CO₂ values measured in school buildings are not considered to impose severe healthy risks, however, they can be responsible for a serious reduction of productivity and mental activity. In parallel, the maximum VOC concentration levels fluctuated between 0.21 and 5.34 ppm, whereas concentration levels between 0.80 and 6.64 ppm could be responsible for health problems. A whole chapter of the training material is dedicated to describe the total of indoor environment studies carried out in the Greek country.

As such, the education material developed within the framework of the Pythagoras project aimed to educate the broader greek public to understand indoor environment and how to create and maintain healthy buildings. The scope of the Pythagoras project was to define and study all the parameters that constitute the national body of knowledge on indoor environment issues, in order to develop a market driven educational material. The project started on March 2004 and ended in December 2006. It was co-funded by the Ministry of National Education and Religious Affairs, Managing Authority of the "Operational Programme for Education and Initial Vocational Training" and the European Social Fund. The research team consisted of five education institutions¹.

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2. METHOD OF APPROACH

In order to develop a training material that covers all related parameters and integrating all the disciplines associated with indoor environment quality, the research team has carried out four specific tasks:

Task 1. A review of international literature, syllabuses and research activities.

A review was undertaken of the international literature and the syllabuses of educational institutions as well as the research activities in indoor environment quality issues. Research has been carried out on related bibliography, education material, distance learning programmes, scientific journals and publications, international conferences, standards, guidelines and legislation on the subject. Specific attention has been paid to the education and research material available at the national level.

Task 2. Determination of the national need for education on indoor pollution and health.

The Greek society's educational needs related to issues of indoor pollution and health are determined through a questionnaire that was developed and distributed to a broad range of building experts (architects, scientists, building service companies etc.), building owners and users, as well as national institutions, chambers, agencies, universities, associations and offices in various areas of the country.

According to the answers provided, there should be no specific indoor quality related problems encountered; the main sources of indoor pollution are considered to be outdoor, while no symptoms have been reported so far by occupiers of the specific buildings. However, this could possibly be just an indication of ignorance regarding the subject, as well as of a significant deficiency in communication and reporting. In fact, since in the majority of buildings mentioned smoking is allowed and in many of them natural ventilation is not considered sufficient, it seems more realistic that the indoor air quality is not good at all.

The study has shown that there is a definite and specific market need for education material and training package on related issues. It has been pointed out that the indoor environment is considered a subject of great importance, but the means and knowledge for assessment and control of its quality are scarce.

Task 3. The development of a training methodology
Consequently, a training methodology is developed, with the objective to optimally cover all the parameters associated with the indoor environment quality, for

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trainees of various disciplines. The training material is hierarchically structured and includes multiple outgoing links; i.e. each study unit includes a number of special links leading to further reading material. This way, a standard and fixed linear study methodology is provided by the teacher while, additionally, optional deeper levels of information are available for the student to explore the cognitive subject and fulfill his/her personal need for supportive study. The methodology can be visualized in the form of a tree trunk, which stands for the core education material, and its branches that represent the outgoing links.

Task 4. The training package

The training material is already produced in printed (book) format by the publisher Tekdotiki-4M-Selka and is widely distributed in the bookstores. The book is of specific educational and practical importance for the total of building experts and users. It covers all aspects related to the design, construction, use and maintenance of healthy buildings, including parameters that influence the environmental indoor quality as well as solutions to recover relevant problems.

This very successful scientific redaction is composed by a group of teaching and academic staff of the cooperating educational institutes, who are carefully selected, based on their scientific adequacy, their working experience, their publications and citations, their familiarization with the field of education, as well as the practical application of their scientific work. The work was carried out under the scientific supervision of a well-known in his sector academic professor.

The training material is now about to be integrated into the National and Kapodistrian University of Athens's Vocational Training Centre for Distance Education Training Programs as an all-integrated e-learning programme. This e-learning programme includes a list of questions and case studies and also provides a forum for exchange of views and information.

The training package is already being used as pre-graduate and post-graduate material within 2 Universities and 1 Technical Educational Institution in the country.

3. STRUCTURE OF THE TRAINING PACKAGE

The national training package now consists out of more than 500 pages covering 13 different fields of attention in the order described:

- Chapter 1. The general issue of indoor environment quality
- Chapter 2. Physical parameters defining the indoor environment of buildings
- Chapter 3. Deterioration of the indoor quality from nuclear compounds

- Chapter 4. Chemical pollution of indoor environment
- Chapter 5. Pollution of indoor environment by particulate matter
- Chapter 6. Biological indoor pollution
- Chapter 7. Contribution of HVAC systems to indoor environment deterioration
- Chapter 8. Solution techniques for indoor environment problems
- Chapter 9. Impact of indoor environment quality on human health
- Chapter 10. Towards harmonization of the labeling systems for indoor products based on their emissions
- Chapter 11. National and international regulation, standards and exposure limits related to indoor environment
- Chapter 12. Assessment methodologies of indoor environment
- Chapter 13. Research and measurements of indoor environmental quality in Greece

4. CONCLUSIONS

The study of the indoor environment quality carried out within the framework of the Pythagoras project has shown that there is a definite and specific market need for education material on related issues. There are clear indications that the means and knowledge for assessment and control of the indoor quality are scarce and that the necessary communication and reporting skills are missing.

The development of the Indoor Environment Quality training package in the course of the Pythagoras project, has resulted in significantly broadening the scope and outreach of the research team and their associated institutions in the pre-graduate and post-graduate levels, in the sector of indoor environment quality and pollution. Furthermore, the educational material is considered to be a prototype in its kind in the country and it is expected to contribute considerably in the improvement of the indoor quality and the maximization of the well-being of building users.

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