inter·noise 96
25th Anniversary Congress – Liverpool

INCE: 07

EDUCATIONAL PROBLEMS IN ACOUSTICS IMPLEMENTED IN ARCHITECTURE AND ENVIRONMENTAL PLANNING

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1.INTRODUCTION

Acoustics and noise control have widespread implementation in architecture, environmental planning and environmental engineering. Both room acoustics and noise problems receive great attention in our day, enhancing the importance of education in these diciplines. Especially in developing countries, including Turkey, which is a dynamic society, the acoustical problems have emerged in bigger dimensions and impact in recent years bringing a sudden increase in the demand for acoustical solutions coming from the various sectors of the public. Accentuating education in acoustics and setting up the right goals of education, of course, play an important part in solving the problems. This paper discusses the state of acoustics education in various countries and steps to be taken, with the emphasis on university education.

2. THE STATUS OF ACOUSTICS IN ARCHITECTURE,ENVIRONMENTAL PLANNING AND ENGINEERING

In architecture, environmental planning and engineering, planned environments and the designed buildings must satisfy all human needs. Contemporary architecture must provide full service in all areas from environmental issues and infrastructure to healthy and comfortable inner spaces.The physical environment of humans are controlled by passive and active systems regarding illumination, acoustics, climatisation, sanitary systems etc.and the right solutions must be found. All these necessitate special expertise and the urban planner and architect cannot be expected to have a performance in all, however, theoretical and practical knowledge can be provided in such a way that these professionals can recognize the problems they face and refer them to

the experts. But certain realities of applying acoustical methods in these professions are worth mentioning:

1.Acoustics in architecture and urban planning is solely one of the numerious planning and designing factors and are not handled with sufficient emphasis by the architects and planners.

2.It is not easy in architecture and urban planning to make decisions to solve the entire noise problem, because there are various scales for taking measures during planning and designing, namely; a) land-use compatible with noise, b) neighbourhood planning, c) selection of location and orientation of buildings, d) preparation of architectural project e) selection of building materials and elements, f) construction, g) usage, maintenance and operation.

3.Cooperation with the other fields of expertize and optimization are essential. Since any acoustical solution usually entails other problems, it becomes necessary to involve numerious persons in the decision making process, such as constructors, mechanical and sanitary engineers, lighting experts, interior architects, renovators, etc. Inability of checking the measures at the work site and proprietory and other legal and economical problems maybe involved with. Therefore the acoustician may face to rather complicated situations.

4.Architects, planners and environmental engineers must be informed on the various aspects of acoustics and an acoustician working in this field either must come from one of these disciplines or must know about planning and design, physical properties and interactions of building materials and components as well as construction techniques.

3.DEMANDS, IMPLEMENTATION, EDUCATION RELATIONSHIPS

Discussions at scientific congresses demonstrate that even in developed countries there is a multitude of noise problems [1]. The matter is much more critical in developing countries due to the various reasons discussed before [2].

Demands

Demands in the field of acoustics are the inputs of the implementation process given in Figure 1. In developing countries the accumulated problems await solutions, since nowadays there are more complaints and less tolerance for noise. Demands are numerous including taking measures especially concerning the noise generated by industry and mechanical systems, in touristic and residential areas. Because of the lack of knowledge on the part of architects, engineers and planners, acoustics experts are needed, but there are too few experts. Moreover, even those making demands are unaware of the depth and weight of the issue and generally oversimplify their demands and even withdraw them whenfaced with the volume, length and cost of the work to be

accomplished. In order to develop an efficient solution to the problem the demands must be well defined and there must be an awareness of how people approach to the problem .

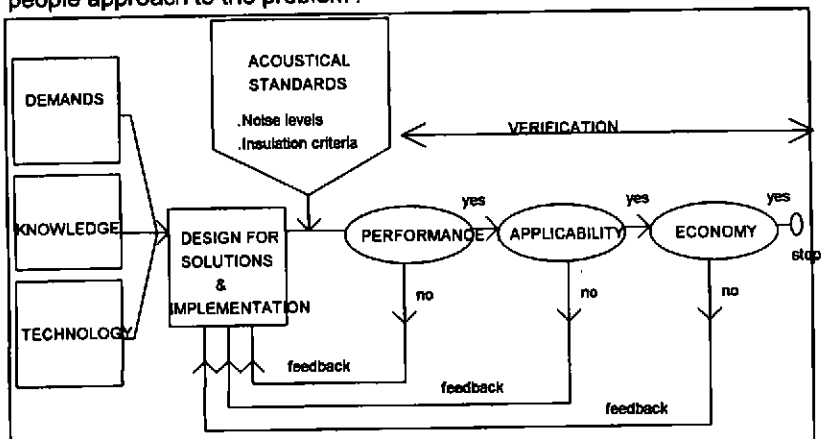

Figure 1. Process of implementation of acoustics in architecture and urban planning.

Implementation

An acoustician can do the following in the context of implementing acoustics: setting standards, designing the solutions for acoustical problems, decision for alternatives during implementation, concultancy, and inspectation. It is necessary to establish relations with various fields of expertise at this phase, such as project-architect, urban planner, desicionmaker, controllers, electrical mechanical, installation engineers, etc.The experience gained by the consultant acoustician following the academic education is very important.

Some of the problems emerging during implementation are: As the project and the implementation usually cannot be inspected, there are misapplications and it is not always possible to measure the performance of the proposed solutions after implementation and to make the nessary corrections. In some cases the acoustics projects cannot be implemented properly for various reasons. Suppliers sometimes make misrepresentations to sell their products and can give misinformation which affects the implementation, when they are asked also for consultancy. There may also be a lack of some materials, components and systems which may be vital for efficient noise control.

Education and its principles

The most important input of the implementation process is information, which is provided by education. The objectives, types,

weights of the methods to convey acoustics education must be carefully devised and the education must be well organized.

The objectives of the education; is to train manpower of sufficient numbers, adequately knowledged, to satisfy the above mentioned demands. Education may be considered as; university education (undergraduate and graduate), technical education with the purpose to give certificates of varying degrees and in various fields of expertise and nonformal education (giving the public awareness through Media and campaigns). In developing countries the absolute solution in the short term is to disseminate the education that will provide the possibility to establish acoustics consultancy firms. But in some of these countries, schools to train acoustics consultants are either nonexistent or do not have international accreditation. Education in this field is not emphasized sufficiently in the universities.

Weight of education: A. Determining the necessary knowledge according to the educational background of the students, that is whether the student is an architect, an environmental planner or environmental engineer, etc. The curriculum of the programs to be applied must be chosen according to the ability of the students to grasp theoretical subjects, and information about acoustics must be related to the existing programs. The following must be included, in general, in acoustics education:

- Basic knowledge on the application of the theories and principles of acoustics to architecture, urban planning and environmental engineering,
- In order to emphasize the importance of the subject, information about hearing impairment, physiological, psychological and performance effects of noise, criteria and standards, community reactions,
-Problem analysis; a)Techniques of field studies, b) estimation methods for present and future acoustical conditions,
-Different solutions for designs; information directed to closely observing technological developments and determining the performance of the measures taken,
-Explanation on the legal dimensions of the issue,
-Sufficient information to write intelligible reports.

B. Conveying knowlegde: a) Way of conveying: The above mentioned subjects must be taught in relation to planning and designing process. It must be explained where and how they will be handled as a part of basic processes. It must be demonstrated in what way the proposed solutions will influence the other designing and planning factors. b) Conveying techniques; Architects and urban planners are interested within their sphere of activity in attractive modern techniques, and environmental engineers are interested in empirical methods and technological knowledge. Examples of acoustical projects, visual media and simple design guidelines may be used. Experimental studies, demonstrations and computer simulations are important for the architects and the others to grasp the subject. The changes in sound perception and effects

according to the form and the materials of the designed space, reverberation, spatial effects must be demonstrated to the students through laboratory tests.

There are certain problems in conveying knowledge in education: a) Incompatibility of standard estimation methods: There are great variations among the results obtained by the design guides which have been prepared in each country and by the different institutes [3]. b) Shortage of text books:The compulsory and auxiliary text books about the application of noise control,especially in architecture and environmental planning are not sufficient. c) Inadequacy of laboratory data: There are great variations between the measurement results of different labs to be used as acoustical data of building materials. d) Insufficient utilizations of computer simulations: Educational institutions can not afford the expensive softwares. There must be international support to make the advanced technology available to universities.

Organizing of education: It has been discussed before to have a single department of acoustics in universities and to have each discipline form separate units in line with its needs [1].It is believed that the former solution is more economical and practical in developing countries which do not have sufficient teachers and laboratory facilities in the universities.

4. REVIEW OF THE EDUCATIONAL PROGRAMS IN VARIOUS COUNTRIES

Yıldız Technical University in 1983 and Istanbul Technical University in 1995 made surveys, looking into the contents and weight of the acoustics education in the architectural schools in various countries and at which level of education it was given. The first survey included a total of 90 schools in 25 countries and 33 answers from 12 countries were evaluated. The second survey encompassed 43 schools in 8 countries [4,5].

Evaluation of results: Some of the findings are as follows:

1.The status of acoustics within education: Acoustics education shows a varied distribution as to the semesters. Looking at the hours, it seems that 50% of the courses are not offered regularly during one semester, but are divided into 2 or more semesters in the form of 2 or 3 seminars. These courses may be given together with other subjects of physical environment, provided that each subject be recognized the appropriate weight.

2.The weight of the course within the entire program in terms of hours varies from 10 to 28 hours. It was observed that the courses in acoustics were offered as a part of courses like Environmental Control and Building Physics. According to the findings of the second survey, in Britain and Germany the subject of acoustics is taught as an independent course and in other countries, under the different course titles. Of these courses, Environmental Control Systems I and II have the highest frequency of 21 in the USA and is taught as a 3-credit course,3/18 week/hours in the 5th

and 6th semesters. Then comes Environmental Technology I and II with a frequency of 8, in the 4th-7th semesters, 3/5 weeks / hours.
3. As to whether acoustics courses are compulsory or elective, it was found that 66% was compulsory, 19% elective and 15% both.
4. Regarding the contents of the courses, building acoustics and room acoustics are taught in 22% of the schools, only building acoustics in 26%, general information is given in the context of a common program in 52%. Room acoustics is taught in 58 % of the schools and only with a narrow scope. Noise measuring is included in the curriculum of only 22% and special subjects in 22%.

5.CONCLUSION

The wide interest in room acoustics and noise control has emphasized the importance of education in these disciplines. Especially in developing countries environmental noise problems are of such magnitude and the demands coming from the various sectors of the society are so much that the significance of education is much more vital than in developed countries which have already taken the necessary steps to a large extent and have completed their statutory arrangements. In many schools, the acoustics courses are not given as individual courses but within a group of subjects related to design and planning, or among other environmental issues. In general, acoustics courses are dispersed to numerous departments with poor coordination. Theoretical courses only are insufficient to grasp the subject, students must also do studio work and prepare acoustical projects. Acoustical courses must be given in the middle years (2nd and3rd) of the program since students will not realize the importance of this course during the early years and will not have the chance to use this knowledge in their projects in the final years.Acoustics courses must be compulsory like the other technical subjects, since acoustics education is an inseparable component of architecture.

From the survey explained above, acoustics courses are given in a scattered way, are below the desired level at most of the schools, and do not conform to the above mentioned eductional principles considering the demands, implementation and education interactions in the community underconcerned..

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