Environmental Education for Engineers: An Australian Viewpoint

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Summary

Australian engineering undergraduate courses of 1987 are described as being devoid of any real environmental content. It is suggested that this is an important omission, for engineers should have a duty to consider the environmental impact of their works. Possible ways in which an environmental component could be added to existing engineering courses are outlined.

Introduction

The present paper advocates the introduction of a compulsory environmental engineering component in engineering undergraduate courses. Many works undertaken by engineers result in profound changes to the environment, both bio-physical and socio-economic. As engineers play a significant role in the planning and implementation of virtually all physical development projects, it is essential that they approach these tasks with some knowledge of the potential environmental effects which might result from such works.

A survey of engineering education establishments in Australia was undertaken by the Engineering Panel of the Sydney Division of the Australian Institution of Engineers. It indicated that whilst environmental matters were receiving more attention in contemporary courses, there was a lack of coherent focus in relating these matters to mainstream engineering concerns. Some institutions offered environmental course elements at undergraduate level, whilst others restricted them to postgraduate studies. The courses were usually optional, and it appears that a significant number of students in Australia could complete studies with no formal association with environmental subjects. This is believed to be a serious deficiency in current curriculum arrangements.

The Need for a Compulsory Course

Clause 1 of the Code of Ethics of the Institution of Engineers of Australia, states that:

"The responsibility of Engineers for the welfare, health and safety of the community shall at all times come before their responsibility to the Profession, to sectional or private interests, or to other Engineers."

In fulfilling such an obligation, engineers have a duty to consider the effects of their works on the total environment of the community. Environment in this sense should be understood as including all aspects of the surroundings of man, whether affecting him as an individual or in his social groupings.

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Engineers are traditionally taught to solve specific problems such as the size of beams for a structure, the capacity of a road to cope with traffic, or the size of a motor to pump water at any given rate. The underlying approach to engineering problems tends to be to seek economical solutions to overcome technical problems. Where there are no analytical formulae based on accurate theories, engineering students are encouraged to make simplifying assumptions. They will also tend to design or plan their schemes to have simple geometric forms, so that they become easier to set out and/or calculate. When confronted with an environmental problem which threatens to hinder or complicate the execution of their plans, they may either fail to perceive its existence, or resent it as an impediment to progress.

On a more general level, traditional engineering courses are believed to be deficient in preparing the profession to become involved in questions of community costs and benefits. Ironically, engineers have the earliest awareness of many proposals. Their decisions are usually regarded as first order requirements of a project. If these requirements are applied in an inflexible way, they can constrain all subsequent decisions. Engineers have an opportunity, and a responsibility, to play a leading role in encouraging public discussion and contributing adequate professional assessments of likely impacts. Engineering education must equip engineers to satisfy this need.

Nature of a Course

Although it should be a long term aim to integrate environmental considerations into engineering units, this will not happen in the short to medium term. The depth of environmental concerns in an engineering course will vary with the lecturer, so that while some subjects will have a good coverage of relevant environmental issues, others will, at best, present only a narrow perspective of such problems (e.g. the technical solutions, but not the social and economic ones). A specific environmental course appears to be the only immediate way to achieve appropriate environmental goals.

The question has also been raised whether such training should be at undergraduate or postgraduate level. Environmental training is best undertaken at the undergraduate level since it is the only forum which will reach all engineers. Furthermore, the environmental component of engineering should be an integral part of engineering practice. Hence environmental training at the earliest practicable stage should help promote the automatic inclusion of environmental factors at the initial stages of planning for engineering works.

Course Objectives

It is suggested that a suitable course should satisfy the following objectives:

1. To foster a view that environmental sensitivity is an integral part of all good engineering.

   Environmental considerations are not something of peripheral concern, but are central to the competent design, construction and operation of engineering works. Environmental values should not be optional extras clipped onto a project at great cost after it is fully designed, but must be a fundamental element in project evolution. The objective implies a requirement for knowledge of environmental issues and legislation. It is essential that undergraduate engineers be made aware of potential environmental implications of engineering works. There is a need to engender environmental sensitivity at an early stage in the education process. Good engineering is inseparable from an awareness of sound environmental principles.

2. To achieve a basic understanding of environmental principles.

   This objective implies an appreciation of the differences between renewable and non-renewable resources. Engineering undergraduates should be made aware of inter-relationships between different components of the natural and man-made environment. It is probably best achieved by a systems approach to environmental education.

3. To broaden the horizons of engineering undergraduates.

   It would be desirable to expose engineering students to professional disciplines in the social and natural sciences that they would not encounter elsewhere in their courses. Although this contact would necessarily be relatively superficial, it must be made meaningful. It would also be of benefit to allow students to interact with contemporaries from other faculties having different professional backgrounds, training and values.

4. To enhance the group interaction and communication skills of engineering undergraduates.

The Environmentalist