

# COMMENTS ON THE TEACHING OF SANITARY ENGINEERING IN LATIN AMERICA <sup>1</sup>

Ildeu Duarte Filho <sup>2</sup>

*In this examination of the teaching of sanitary engineering in Latin American universities, some of the most common shortcomings are pointed out and attention is called to the absorption capacity of the market for sanitary engineers. It is urged that training be made adequate to the demand.*

## Introduction

An examination of what the national programs call for in the way of sanitary engineering, and of the available personnel, reveals a difficult situation in Latin America. The exact number of sanitary engineers is not known, but according to a conservative estimate there is about one for each 100,000 population.

One can thus appreciate the magnitude of the problem and its projections for the

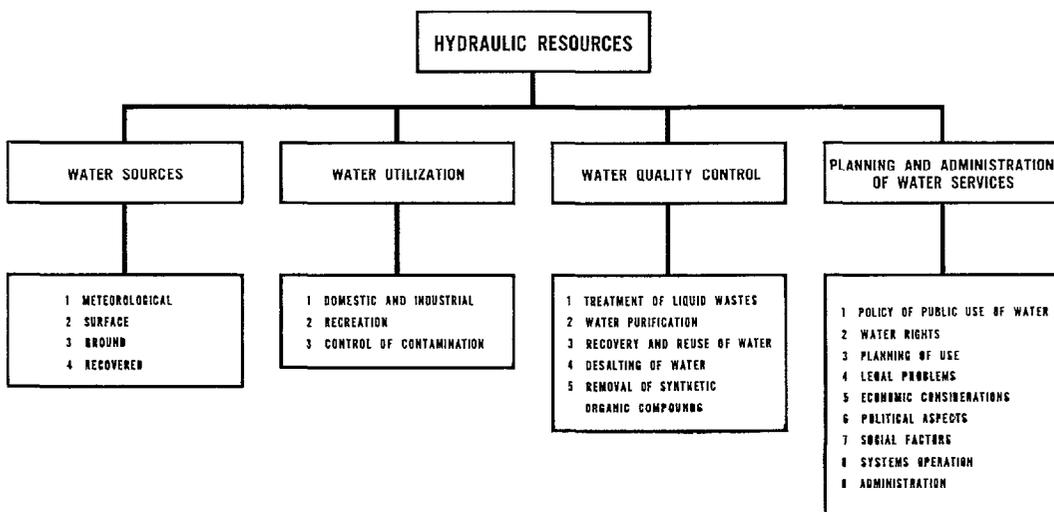
future in view of the increasing needs in environmental sanitation. Manpower is the major factor in the success or failure of the national sanitation programs, for the financing problem has been largely overcome as a result of offers from national and international credit institutions.

The sanitary engineer has been called the Robinson Crusoe of environmental sanitation, perhaps because the field of action of sanitary engineering is so broad. A mere look at the accompanying figure shows the diversity of problems to be faced by an engineer in just one of the representative branches of sanitary engineering—hydraulic

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<sup>2</sup> Consultant in Sanitary Engineering Education, PAHO/WHO, Zone II, Mexico City.

FIGURE 1—One of the Typical Areas of Activity in Sanitary Engineering.<sup>3</sup>



<sup>3</sup> Prepared by Prof. P. M. McGahey, University of California, U.S.A.

resources. The difficulties in the training of sanitary engineers, arising mainly from the extent and diversity of activities for which they are responsible, must therefore be recognized.

The present paper seeks to comment on the problems in the teaching of sanitary engineering in Latin American universities, the solutions that have been adopted, and some of the common shortcomings; to call attention to the needs for sanitary engineers in Latin America; and to encourage Latin American universities to take part in society as instruments of progress in the field of sanitary engineering.

#### University Teaching

Sanitary engineering is taught in Latin American universities at the undergraduate level, at the postgraduate level, and through intensive short courses. Students of civil engineering generally acquire an elementary background in sanitary engineering by various methods. Some universities offer an annual course of about 100 hours; in others the principles of sanitary engineering are a specialty of civil engineering; a few give five- or six-year courses.

Sanitary engineering is taught at the postgraduate level in the more heavily populated countries of Latin America, and in recent years a large number of universities have been organizing intensive short courses, which have become increasingly popular.

Each of the three levels of instruction will be examined briefly.

*Undergraduate courses.* At the Seminar on the Teaching of Sanitary Engineering in Latin America, convened by the Pan American Health Organization and held in Lima, Peru, in 1961, a thorough study was made of the teaching of this discipline as part of civil engineering courses. The conclusions of the Seminar (1) are still valid, particularly with respect to "promoting and improving courses on sanitary engineering in the civil-

engineering curricula and, when it is considered appropriate or desirable, establishing an elective in or a complete course in sanitary engineering."

Interestingly enough, this recommendation differs from the decision reached at the Conference on the Education, Training, and Utilization of Sanitary Engineers, held in Washington, D.C., in 1957, which recommended against separate undergraduate courses leading to a degree in sanitary engineering or professional specialization in the civil-engineering curricula at that level (2).

Some Latin American countries—among them Venezuela (3)—favor making sanitary engineering an "option" or specialization in the civil-engineering course. The feeling there is that civil-engineering students should receive a greater number of hours devoted to sanitary engineering subjects, especially chemistry, microbiology, and treatment of water and liquid wastes.

In Peru and Colombia undergraduate courses of five and six years, respectively, are given in schools of sanitary engineering; a degree is given on completion. In an extremely interesting paper, Patrick Owens of the Rockefeller Foundation, visiting professor at the University of Valle in Cali, Colombia, defends the teaching of sanitary engineering as an independent profession at the undergraduate level (4).

*Postgraduate courses.* An important recommendation of the Lima Seminar was as follows: "In accordance with the degree of development of these countries [the most developed ones in Latin America], and when the demand for such professionals so requires, postgraduate or regular courses in sanitary engineering should be established" (1).

The courses established in Brazil and Mexico almost 20 years ago are eminently international in nature. In Guatemala a postgraduate course was recently set up in a school that covers the entire region of Central America. Unfortunately, the num-

ber of students in regular courses in sanitary engineering is small, and there is no evidence that it is tending to increase significantly. It is rather disheartening to note that the rise in the number of engineering students in general does not include postgraduates in sanitary engineering.

*Intensive short courses.* Intensive courses on sanitary engineering topics are becoming more and more widely accepted in the Latin American countries (5). Some of the reasons for their success are as follows:

1. The great amount of information they provide in a short period of time without requiring the participant to abandon his customary work.
2. The employment of highly reputed professors and professionals.
3. The publication of manuals.
4. A closer relationship between the universities and the public and private institutions operating in the various areas of sanitary engineering.

#### Current Limitations in Teaching

The Regional Conference on Water Supply in the Americas held in Washington, D.C., under PAHO sponsorship in October 1965 noted certain shortcomings in the training of personnel for water programs: "In the undergraduate courses, specialized teaching of sanitary engineering subjects is limited, because the largest part of the time available is devoted to basic, over-all training of the future professional. In turn, the graduate courses in sanitary engineering have trained a very small number of technicians, because of the time and expense they entail" (6).

In other words, the teaching of sanitary engineering imparted in the civil-engineering courses may be said to suffer from a basic defect: it covers a wide area but lacks depth.

In his last years at the university, the civil-engineering student directs his attention toward professional practice; he is hardly

going to be interested in subjects that are primarily descriptive or general.

In the regular five- or six-year courses the student has an opportunity for long, close contact with different problems in the various branches of sanitary engineering. But it must be recognized that these regular courses are rather local solutions to a general problem (7).

It is believed that the small number of students in postgraduate courses results from a series of difficulties that should be listed and examined.

1. *Lack of balance in teaching programs.* With respect to the activities shown in Figure 1, in the postgraduate curricula excessive priority has been given to water utilization and to water quality control.

The courses in hydraulic resources concentrate on such subjects as water supply, sewerage, treatment of water and liquid wastes, stream sanitation, sanitation chemistry, sanitation microbiology, and so on, covering in detail the use of water for domestic, commercial, and industrial purposes. The utilization of water sources is usually taught not in the department of sanitary engineering but in that of hydrology or geology (where such departments exist) and the subject is often optional for sanitary engineers. Very few universities offer courses on the planning and administration of water services, which are as important to the sanitary engineer as purely technical activities.

As a result, many persons who have taken postgraduate courses have received detailed instruction on the design of complex sewage treatment plants but know little, or virtually nothing, about well hydraulics or about the selection and use of sanitary engineering equipment. And when the "specialist" in sanitary engineering cannot manage to set up a water-rate schedule he feels a sense of failure.

2. *Misinterpretation of teaching methodology.* A difficulty that often appears in postgraduate courses is an overconcentration

on working methods and insufficient emphasis on the principles (which constitute the basis of solid teaching) and their practical applications.

This situation is aggravated by an inadequate background in the postgraduate student. Because of the shortage of time in the undergraduate courses, a large part of the postgraduate courses is devoted to making up, in one way or another, for the student's ignorance of basic subjects with which he should already be familiar.

3. *Insufficient number of fellowships.* The shortage of fellowships is impossible to overlook. A graduate engineer can hardly afford the expenses of a year of postgraduate work.

In Latin America, with few exceptions, the number of fellowships in sanitary engineering offered by national institutions remains very limited. In the United States of America the proportion of students not receiving some such financing is extremely small.

The Pan American Health Organization, the U.S. Agency for International Development, and the Organization of American States have cooperated with the Governments by providing a certain number of fellowships. Since these are not normally offered for studies in the fellows' own countries, the postgraduate courses in some Latin American countries sometimes have a higher percentage of foreign students than of nationals.

4. *Time limitations.* The academic year in Latin America is traditionally short. It consists theoretically of 32 weeks, but a relatively high proportion of the scheduled period is not fully utilized.

One of the resolutions of the Study Conference on the Graduate Education of Sanitary Engineers, held in 1960 in Cambridge, Massachusetts, under the sponsorship of the American Sanitary Engineering Intersociety Board, deserves mention. Referring to the period of study for the master's degree, the Conference resolved that the necessary

period of postgraduate instruction, or of continued study for the degree in sanitary engineering and environmental health, should be one calendar, rather than academic, year (8).

Besides those that have been listed, there are other causes, such as the shortage of literature in the languages spoken in Latin America, the lack of recognition of the profession of sanitary engineer, and sometimes the paradoxical lack of opportunities for employment, that have contributed to the small number of students enrolled in the postgraduate courses in sanitary engineering.

Intensive short courses are unquestionably valuable as a supplement to the training of the sanitary engineer, but they should be considered examples of the continuing education undertaken by all professionals, often on their own initiative and in limited fashion. It is not claimed that short courses can substitute for the regular teaching of sanitary engineering; their purpose is to accelerate the training of personnel in specific technical aspects.

#### The Market for Sanitary Engineers

As in any branch of a profession, the number of students enrolled in sanitary engineering courses is directly dependent on the demand for them in the specialist market.

This means that, even in the most favorable training conditions, the absorption capacity of the market for sanitary engineers must not be lost sight of if the production is to meet the demand, within the available resources.

In view of the shortage of sanitary engineers in Latin America, there is a need for quantifying the needs so that long-range training programs can be planned. This is a challenge to the universities, which should establish very close contact with the public and private institutions that employ sanitary engineers.

A step in this direction has been taken with the start of continuing education programs through the intensive short courses.

The second step will probably be agreements between government institutions, industries, or consulting firms and the universities, with a view to developing programs of applied research in sanitary engineering.

### Recommendations

The doubts and concerns expressed in the present paper suggest the need for another meeting similar to that held in Lima in 1961, in which directors and professors from the main Latin American institutions for the training of sanitary engineers participated. The principal objectives of this meeting would be to examine and recommend measures for the following purposes:

1. To orient properly the teaching of sanitary engineering at various levels.
2. To conduct a survey of the needs for sanitary engineers in Latin America.
3. To promote closer liaison between the universities and the public and private institutions operating in the field of sanitary engineering.

### Summary

The author draws attention to the magnitude of the task that must be accomplished in the environmental sanitation field in Latin America, and to the urgent need for training enough sanitary engineers to carry out that task.

Comments are offered on the methods used and problems encountered in the teaching of sanitary engineering in Latin American universities at the undergraduate level, the postgraduate level, and in intensive short courses.

An examination of the training given at these various levels brings out some of its basic shortcomings: (a) the broad scope and the lack of depth of the instruction in sanitary engineering in the civil engineering curricula; (b) the lack of balance in teaching programs, misinterpretation of teaching methodology, insufficient number of fellowships, and time limitations in the postgraduate courses; and (c) limited scope of the short intensive courses.

The author emphasizes the need to promote closer liaison between the universities and the public and private institutions operating in the field of sanitary engineering, and suggests that there should be organized a second meeting of directors and professors of the main Latin American institutions providing training in sanitary engineering, similar to that held in Lima, Peru, in 1961. □

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