CURRENT AND FUTURE TRENDS IN CONTINUING ENGINEERING EDUCATION IN THE WEST INDIES

by

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SUMMARY

This paper presents a brief review of the state-of-art of continuing education activities for engineers and technicians in the West Indies with particular emphasis on the roles of the University of the West Indies (UWI), professional bodies and industry in promoting such activities. Also presented are some of the more important results of two recent surveys on continuing education needs of engineers and methods of course development and operations which were carried out by U.W.I. and the Council of Caribbean Engineering Organizations (CCEO) over the six month period October 1978 to March 1979.

The paper concludes with a comparative discussion of some of the results with those obtained in the United States and gives a set of guidelines which should prove useful to directors of continuing engineering education programmes, not only in the West Indies, but also in other developing countries, in planning and conducting such courses.

1. INTRODUCTION

The need for Continuing Education of practising engineers is now fully recognised and accepted by most professional engineering associations, universities and employers throughout the world (1) (2), in order that engineers may keep abreast of the ever increasing technological advances being made in the engineering field today. Failure to pursue some form of continuing education or mid-career training as it is sometimes called can well lead to an engineer's skills and knowledge becoming obsolescent within several years after graduation. Consequently many professional societies in various developed countries now have mandatory continuing education for either license renewal or continued society membership. Standards for continuing education professional development range between ten hours to fifty hours per year with an evaluation on either a two year or three year basis. Furthermore, in some countries such as France there is now a legal obligation on the part of employers to set aside a portion of their employees wages to be used exclusively for continuing education. Under a French law passed in 1971 (3), employers with more than ten employees are required to contribute 1.0% of their payroll to provide for further education and training.

The World Federation of Engineering Organizations (WFEO) in a recent policy statement defined continuing education and training as all formal and non-formal educational and training processes which engineers should be encouraged to follow, after they first join the profession as engineers-in-training after taking their degrees or diploma, until they reach the end of their professional career, and it is interesting to note the proliferation of terminology currently used to describe such education as follows:-

postgraduate education
post degree education
refresher education
updating education
recycle education etcetera.

However, in broad terms continuing education can be classified into four main categories as follows:-

(i) Refresher courses which provide the necessary updating of an engineer's knowledge and skills in an era of rapidly developing technology.

(ii) Specialized courses whereby an engineer broadens his knowledge in his own particular field.

(iii) Multidisciplinary courses during which an engineer diversifies his skills and obtains training in other fields such as management.

(iv) Postgraduate courses which enable an engineer to pursue a formal programme of academic training and research leading to a higher degree or diploma.

2. METHODS OF CONTINUING EDUCATION

Various methods and formats have been used in different countries involving both traditional and non-traditional approaches in the running of such continuing education courses. The inherent dangers of using non-traditional methods have already been discussed at various forums (4) (5).

However, in order to meet the ever increasing and diverse needs for continuing education at all levels of the profession, it is generally accepted that full use must be made wherever possible of the non-traditional methods available, such as correspondence courses, instruction through radio and television, satellite links, video-cassettes and programmed learning. One of the main reasons for reluctance of the academic institutions to fully accept non-traditional instruction has been the lack of complete assurance that quality control would be maintained in all cases and it has therefore become necessary to ensure proper planning of such courses in order to minimise some of these inherent dangers. The advantages and disadvantages of the various methods have been discussed by Klus (6). In selecting a particular method for any continuing education activity it is essential to take into consideration the following factors:-

(i) Convenience to the participants.

(ii) Convenience to the lecturers.

(iii) Comparative costs.

(iv) Quality of learning available through that system.

(v) Required motivation.

(vi) Nature and flexibility of course content.

Both the Faculty of Engineering at the University of the West Indies (UWI) and the Council of Caribbean Engineering Organizations (CCEO) have recognized the need for such activities and have in recent times established Continuing Education Committees which are charged with the responsibility of identifying and conducting appropriate continuing education courses for practising engineers of the region.

3. ROLES OF UWI, PROFESSIONAL BODIES AND INDUSTRY IN PROMOTING CONTINUING EDUCATION IN THE WEST INDIES

Since the establishment of the Faculty of Engineering in October 1961 with an initial enrolment of twenty-eight students there has been a steady increase in the number of students and graduates as can be seen from Figure 1 which gives an indication of the annual total number of graduates from 1964 to 1978 by discipline. For the period 1964 to 1979 there was a total of 1041 graduates. Table 1 gives a territorial breakdown of the total number of graduates by discipline for the period 1964-1978. It can be seen that Civil Engineers account for the greatest number of graduates followed by Mechanical and Electrical Engineers. It should be noted from Table 1 that most graduates come from the three main island territories of Jamaica, Barbados and Trinidad and Tobago.

The first phase of the planned expansion of the Faculty of Engineering which is being funded by the Trinidad and Tobago Government is currently in progress and it is expected to be completed by 1982. This will cater for an increased student enrolment in the four traditional areas - Chemical, Civil, Electrical and Mechanical, and also in the new areas of Agricultural, Industrial and Petroleum Engineering. It will also include postgraduate, continuing education and extension service programmes in Construction Engineering and Management, Petroleum Engineering, Production Engineering and Management, and Electronics and Instrumentation. The latest statistics of actual and projected student enrolment in the various programmes are given in Table 2.

Since 1972, the Faculty of Engineering of UWI has successfully organized in close collaboration with the various professional engineering associations and regional bodies a wide range of continuing education short courses on such topics as solar energy, food technology, petroleum engineering, sugar technology and construction management techniques and materials. Details of such courses have been described elsewhere (7). In addition, the projected number of postgraduate and continuing education short courses in such areas as construction engineering and management, production engineering and management, petroleum engineering and electronics will no doubt assist in the career development of

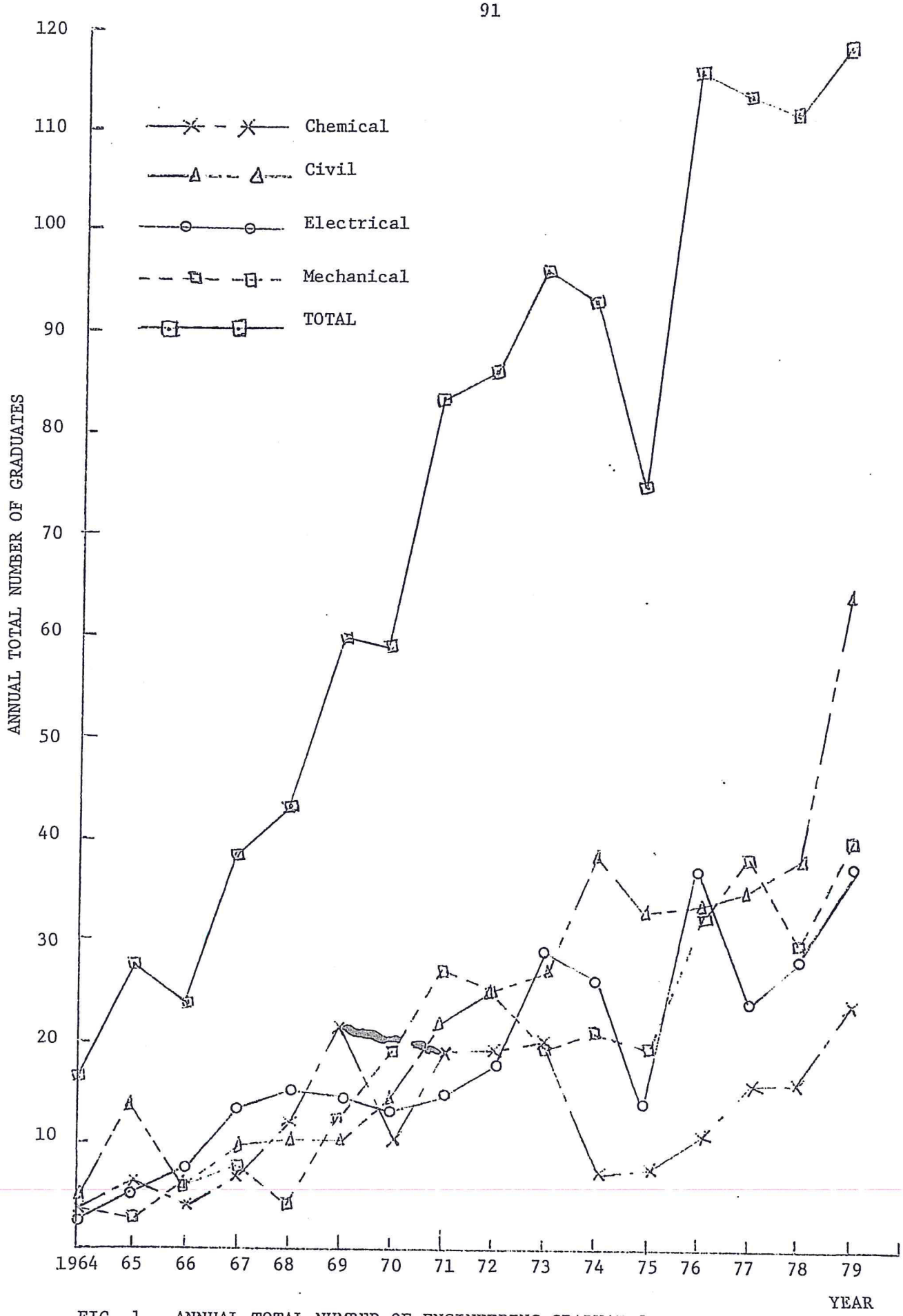

FIG. 1 - ANNUAL TOTAL NUMBER OF ENGINEERING GRADUATES
U.W.I. 1964-1979

TABLE I - NUMBER OF GRADUATES BY DISCIPLINE AND BY TERRITORY 1964-79

TERRITORY	DISCIPLINE			
	Chemical	Civil	Electrical	Mechanical
Antigua	2	6	5	1
Bahamas	1	1	2	-
Barbados	14	24	14	4
Belize	2	7	7	6
Br. Virgin Islands	-	2	-	-
Cayman Is.	-	2	-	-
Dominica	-	7	1	1
Grenada	2	1	6	2
Jamaica	61	145	116	120
Montserrat	-	2	2	1
St. Kitts	1	2	1	-
St. Lucia	2	10	-	-
St. Vincent	-	3	2	2
Trinidad & Tobago	96	128	117	135
Guyana	13	23	11	26
Other	2	1	2	1
	196	377	286	298

TOTAL 1964- = 115

West Indian professional engineers in order to meet the challenges of the twenty-first century. There must however be continuing close collaboration between the UWI and professional associations and industry in order to ensure proper planning and utilization of these activities. Professional bodies can also provide valuable inputs in respect of the types of courses to be mounted and "experts in the field".

Two interesting developments in recent times are :

(i) The proposed two year pilot seminar program in construction and project management to be conducted by U.W.I., in collaboration with the Canadian International Development Agency (CIDA) to be conducted as a series of two week intensive seminars in two centres over a one year period.

(ii) The feasibility study into the use of satellite communications for educational purposes in the West Indies which will be undertaken in collaboration with the United States Agency for International Development (USAID).

4. CONTINUING EDUCATION OF TECHNICIANS IN THE WEST INDIES

Throughout the various West Indian islands, several facilities exist for the initial training of technicians and this has been, up to the present time, the main thrust of the various institutions in attempting to meet the continuing demands for more technicians throughout the region. However, in recent times some of the technical institutions have initiated continuing education courses for upgrading technicians in various fields. Of particular significance is the day release course for highway engineering works supervisors which was started in February 1979 at the John S. Donaldson Technical Institute (JSDTI) in Trinidad. The course ran for a period of twenty-four weeks on the basis of two full days attendance each week. Another important development in the continuing education of technicians for the telecommunications fields occurred in May 1976 when a project for the training and retraining of 80-100 telecommunications technicians per year was implemented at the JSDTI in collaboration with the United Nations Development Programme (UNDP) and the International Telecommunication Union (ITU). A similar programme has also been started in Jamaica at their College of Arts, Science and Technology (CAST).

In Guyana, the University of Guyana (U.G.) commenced offering the General Technical Diploma (GTD) and Higher Technical Diploma (HTD) in September 1969 in Civil and Electrical Engineering and Architecture and Building Technology. In 1972 courses were offered in Mechanical Engineering at the HTD level. Basically the aims of the GTD are to produce technicians who could be employed by industry at the first line supervisory level and also to prepare students for entry to the HTD. In addition, as the need arises the Faculty of Technology at U.G. offers a one-year specialized course beyond the HTD level in a particular branch of engineering and awards a Bachelor of Technology (B.Tech.) Degree. In 1972 such a course was offered in the field of Public Health Engineering and this was followed by a similar course in 1975 in the field of Highway Engineering.

Graduates of U.G. who wish to upgrade themselves into engineers are usually given first year exemption of the B.Sc. Degree in Engineering at the U.W.I. In the case of CAST graduates from Jamaica these are given exemptions from Part I of the B.Sc. degree based on their performance.

5. SURVEYS UNDERTAKEN

5.1 Introduction

At the third meeting of the UNESCO working group in Continuing Education of Engineers and Technicians held in Paris, France on 25-28 April 1977, it was agreed that Surveys on Continuing Engineering Education Activities should be undertaken in selected countries and the West Indies was selected as one of those to be surveyed. As a result two surveys were carried out by U.W.I. in collaboration with CCEO over the six-month period October 1978 to March 1979.

The objectives of the first survey were to:-

(i) Determine the needs of practising engineers in respect of continuing education in order for them to keep abreast of the rapid developments in engineering.

(ii) Determine the most appropriate formats for such activities.

(iii) Establish the number and types of programmes to be offered and the likely enrolment.

(iv) Compare the activity in the West Indies to that in the other countries.

The second survey was aimed at directors of continuing education programmes and was accomplished by means of personal interviews utilising a questionnaire which was developed by the University of Wisconsin for a similar exercise (8). The survey included subjective information on areas such as idea sources, needs assessment, staffing and evaluation methods and was aimed at determining how continuing education programmes were planned, course content established and evaluations conducted.

Details of the questionnaire used in the surveys may be obtained elsewhere. (9).

5.2 Overall Response

In all 660 questionnaires were distributed/mailed to engineers and organizations in the West Indies and the responses are given in Table 2.

TABLE 2 - QUESTIONNAIRE SURVEY RESPONSE

COUNTRY	NO. OF QUESTIONNAIRES SENT OUT	NO. RETURNED	% RESPONDING
Trinidad & Tobago	300	110	36.7
Barbados	100	16	16
Jamaica	100	4	4
Guyana	100	2	2
Bahamas	60	0	0
TOTAL	660	132	20

In the second survey personal interviews were conducted amongst staff of the Faculty of Engineering, U.W.I., to determine how many have directed continuing education programs and their responses are summarized in Table 3.

TABLE 3 - INTERVIEW SURVEY RESPONSE

NO. INTERVIEWED	NO. WHO DIRECTED PROGRAMS
30	13

The results of the questionnaire survey will first be presented followed by those obtained from the interview survey.

5.3 Results of Questionnaire Survey

(i) Educational background of respondents

The basic educational backgrounds of those responding are given in Table 4.

TABLE 4 - TYPE OF ENGINEERING BACKGROUND OF THOSE RESPONDING TO QUESTIONNAIRE SURVEY

TYPE OF ENGINEER	NO. RESPONDING	%
Chemical	17	12.9
Civil	45	34.1
Electrical	30	22.7
Mechanical	29	22.0
Other	11	8.3
	132	100

(ii) Number of C.E. courses attended

The numbers of continuing education courses attended in the past two years by those responding are given in Table 5.

TABLE 5 - NO. OF CONTINUING EDUCATION COURSES ATTENDED IN PAST TWO YEARS

No. of C.E. Courses	0	1	2	3	4	5	6	>6	
No. responding	34	35	17	16	14	6	7	3	132
%	25.7	26.5	12.9	12.1	10.6	4.6	5.3	2.3	100

(iii) Organizations conducting courses

Of the courses given in Table 5, 26.4% were conducted by overseas organizations whilst 22.3% were conducted by either the respondents own organizations or by a university. 15.8% of the courses were conducted by professional societies and 10.8% by Government agencies.

(iv) Subject areas for courses

The subject areas which were of the most interest to the respondents and in which they were most likely to participate are given in Table 6.

TABLE 6 - SUBJECT AREAS OF INTEREST

		%
Project Management	61	23.4
Finance/Accounting	31	11.9
Construction	31	11.9
Civil Engineering	25	9.6
Structural Engineering	21	8.0
Electrical Engineering	18	6.9
Electronics	13	5.0

		%
Industrial Engineering	11	4.2
Mechanical Engineering	10	3.8
Petroleum Engineering	9	3.4
Chemical Engineering	7	2.7
Others	24	9.2
	261	100.0

(v) Postgraduate courses

50.8% of the respondents were not interested in pursuing a Masters' Degree or Postgraduate Diploma course through continuing education courses whilst 49.2% expressed an interest in so doing with 72.3% opting for a Masters' Degree.

(vi) Incentive from employers

83.3% of the respondents obtained released time from work from their employers whilst 63.6% also obtained payment of fees from their employers.

(vii) Times of courses

On the question of the most convenient time for participating in Continuing Education courses the survey revealed that 31.8% preferred April to June whilst the same percentage preferred July to September. 19.9% chose January to March and 16.5% selected October to December.

(viii) Optimum duration of course

32.6% of the respondents considered one day per week spread over a number of weeks to be the optimum duration of a continuing education course whilst 31% favoured five days. 23.5% considered two weeks to be the optimum duration whilst 12.9% felt that courses should be of one to three days duration.

(ix) Preferred Formats

The preferred format for continuing education courses was felt by 78.8% of the respondents to be those held full time during the day. 16.7% showed a preference for evening classes whilst 4.5% preferred correspondence study.

(x) Renewal of professional body membership based on continuing education courses

In response to the final question 67.4% did not agree that renewal of membership of a professional body should be dependent on the completion of a number of continuing education courses every two years. The remaining 32.6% agreed that it should.

5.3 Results of Interview Survey

Directors of continuing education programmes were interviewed in order to obtain some information on how they planned and conducted their activities. The questionnaire used in the interview survey covered the following areas:-

(i) source of ideas

(ii) needs analysis

(iii) promotion

(iv) evaluations

(v) staffing

(vi) funding.

Thirteen staff members from the Faculty of Engineering, U.W.I., were interviewed and their responses are summarized below.

(i) Source of ideas

The most often used source of ideas for courses was cited by 76.9% of those interviewed as personal communications with or from industry and the least used was current news of popular magazine topics.

On the question of how important were the sources of ideas all the respondents considered personal communications with or from industry as very important whilst 69.2%, assigned the least importance to current news or popular magazine topics. Figure 2 gives the response in graphical form.

(ii) Need analysis

50% of the respondents stated that need analyses were conducted prior to course planning and the most frequently used methods were telephone inquiries to selected engineering management (50%) and consultation with advisory groups (50%). The least used method was inquiries to editorial personnel of industrial/technical periodicals (75%) (Fig. 3).

(iii) Promotion

Form letter announcements were used by 92.3% of the respondents for promoting their courses. The least used method of promotion was general annual catalog listing. Mailing lists were obtained mainly from inhouse lists and from professional societies.

(iv) Evaluation

Three types of evaluation were probed viz. course, student and instructor. 61.5% of the respondents often used a subjective questionnaire to the student in overall course evaluation and 69.2% considered it to be very important as a means of evaluation.

For evaluation of students performance in non credit activities the most frequently used method was program director judgment whilst written or oral examinations were not used at all in 61.5% of the responses.

In the case of instructor evaluation 69.2% of the respondents relied on and considered very important evaluations by the program director whilst 41.7% used student evaluations as a basis for evaluating the instructor. 53.8% of the respondents considered student evaluations of the instructor to be very important.

Figure 4 graphically demonstrates the data collected from the responses.

(v) Types of directors

The majority (92.3%) of the respondents used adhoc staff for conducting their courses.

(vi) Funding

53.8% of the respondents stated that their courses were funded by part fee/subsidy whilst 38.5% funded their courses by fee income entirely.

5.4 Comparison With Klus/Jones Survey in United States

Both surveys showed similar results in the case of sources of ideas for continuing education courses whilst need analyses were not carried out as often as in the U.S.A. Two significant differences were found in the methods of promotion and funding. In the West Indies form letter announcements were more often used for promotion and most courses had to be subsidized from outside sources such as international agencies and industry. This confirms that funding is a major constraint in developing countries for conducting continuing education activities.

6. CONCLUSIONS

From the results of the two surveys it is possible to make the following conclusions:-

1. Continuing Education Activities for Engineers and Technicians are now being given greater attention in the West Indies by the academic and professional institutions and industry.

2. There is need to organise on a more regular basis a greater number of courses in subject areas such as project and construction management and finance/accounting throughout the region in order to upgrade the skills of engineers and technicians. In this connection the two year pilot program being funded by CIDA should provide some interesting results in respect of formats and possible academic credit for such courses.

3. The Faculty of Engineering of the University of the West Indies should give serious consideration to the establishment of a Division of Continuing Education Studies in order to co-ordinate and promote all such activities in the region.

4. Greater attention should be given to the continuing education needs of technicians in the region and the technical institutes should be encouraged to initiate more programs aimed at upgrading their skills.

5. Continuing Education Courses in the West Indies should be programmed preferably during the second and third quarters of the year and should be either one day per week spread over several weeks or full time for one or two weeks.

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TABLE 2 - STUDENT ENROLMENT

ENROLMENT IN UNDERGRADUATE DEGREE PROGRAMMES

	Traditional Areas*				New Areas			
Actual	Chemical	Civil	Elec.	Mech.	Agric.	Indus.	Petroleum	Total
1975/76	62	110	105	109	–	–	–	386
1976/77	68	140	115	118	–	–	–	441
1977/78	82	183	109	111	–	–	–	485
1978/79	90	172	108	134	–	–	18	522
1979/80	87	174	127	146	10	6	12	562
Projected								
1980/81	82	204	134	160	11	67	22	680
1981/82	82	218	134	195	13	78	40	760
1982/83	82	241	134	220	15	90	58	840

ENROLMENT IN POSTGRADUATE DEGREE PROGRAMME (M.Sc. M.Phil. & Ph.D.)

	Traditional Areas*	New Areas						
Actual		Prod. Eng.	Agri. Eng.	Const. Eng.& Mgmt.	Elec. & Inst.	Ind. Eng.	Pet. Eng.	Total
1975/76	18	–	–	–	–	–	–	18
1976/77	23	–	–	–	–	–	–	23
1977/78	29	–	–	2	3	–	–	34
1978/79	26	11	–	2	–	–	–	39
1979/80	26	33	–	10	–	–	4	73
Projected								
1980/81	46	–	3	8	8	6	8	79
1981/82	48	–	3	9	9	7	9	85
1982/83	50	–	4	9	9	8	9	89

* Chemical, Civil, Electrical and Mechanical

PROJECTED ENROLMENT IN FULL-TIME DIPLOMA AND CERTIFICATE PROGRAMMES AND IN SHORT COURSES (NEW AREAS ONLY)

	Construction Engng. & Management			Petroleum Engineering		Electronics & Instrumentation	Food Tech.
	Dip.	Cert.	Short Courses	Dip.	Short Courses	Short Courses	
Actual							
1977/78	8	–	–	14	–	–	–

	Construction Engng. & Management			Petroleum Engineering		Electronics & Instrumentation	Food Tech.
	Dip.	Cert.	Short Courses	Dip.	Short Courses	Short Courses	
Actual							
1978/79	23	-	57	7	-	40	9
1979/80	21	-	47	-	-	-	11
Projected							
1980/81	12	24	140	-	140	70	-
1981/82	14	24	160	-	160	80	-
1982/83	14	24	160	-	160	80	-

FIG. 2 - SOURCES OF IDEAS FOR C.E. COURSES

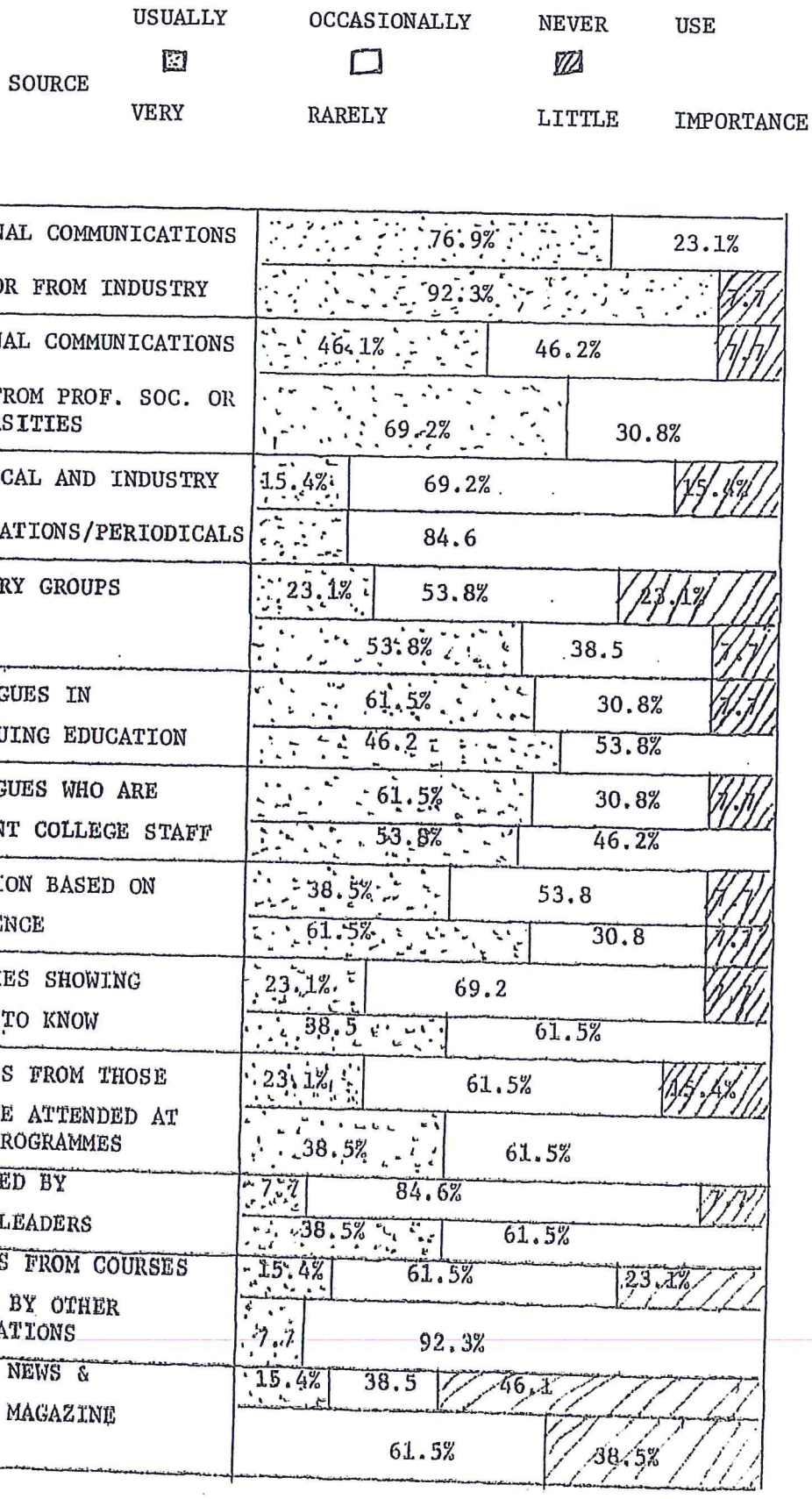

FIG. 3 - USE OF NEED ANALYSIS CONDUCTED PRIOR TO COURSE PLANNING

USUALLY ▨ OCCASIONALLY □ NEVER ▨

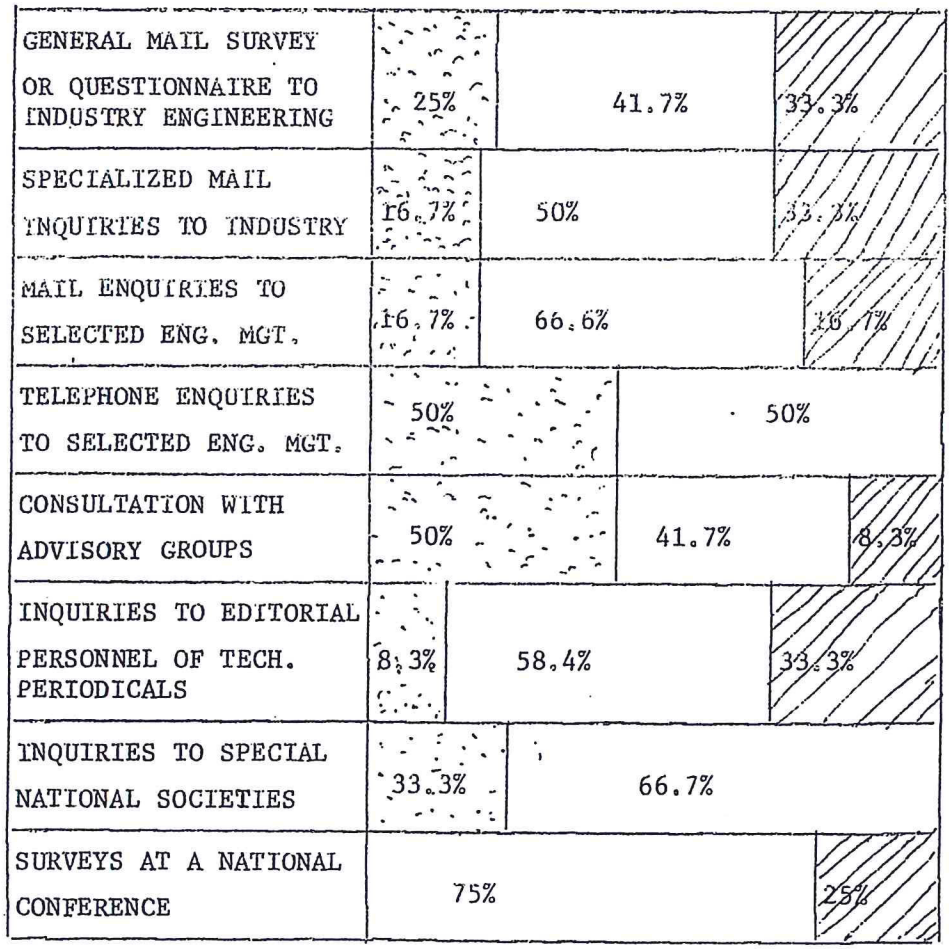

FIG. 4 - USE AND IMPORTANCE OF EVALUATIONS

USUALLY	OCCASIONALLY	NEVER	USE
VERY	SOMEWHAT	LITTLE	IMPORTANCE

TYPE OF EVALUATION