

Education Enhancement of Communication Engineering in Taiwan, ROC

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Abstract: Owing to the highly demand of communication engineers for the construction of the national information infrastructure (NII) and the prosperous development of communication industry, the Ministry of Education in Taiwan, ROC, has proposed an enhancement education project in communication engineering since 1993. The goal of the project is to improve the course contents and to enhance the experimental environment and instruments in the areas of communication engineering such as wireless communications, networking, communication systems, optical communications, communication software, and digital signal processing. This project has supported fund of over 500 millions of NT dollars (18 M USD) for the past 7 years. An application procedure and an evaluation process are included in the proposal. This project is indeed good to the communication, electrical, information engineering departments and beneficial to the communication industry.

Keywords: communication engineering, education, experiment

1. Introduction

The communication infrastructure of a nation will help the nation to increase its productivity and to improve its living quality. Taiwan intends to be the Asia Pacific Operation Center and Technical Kernel Place in Pacific Rim. This feasibility relies on how well the National Information Infrastructure is constructed. In the six-year national construction plan beginning from 1994, the Directorate General of Telecommunication, Taiwan, ROC, committed to deploy more fibers, intelligence, and mobility business for the networks. On the other hand, Taiwan's personal computer (PC) industry tends to saturate, while the PC incorporated with wire or wireless communication capabilities or the development of the portable wireless handset would be the trend. Also, the Integrated Services Digital Networks (ISDN) terminal equipment (TE) and the network equipment (NT), the network transmission facilities, and the multimedia video equipment have the growing market potential, and they are within the development capability of Taiwan. The Taiwan government has regarded the communication industry as one of its proposed ten promising and encouraging industries.

The technology needed for the construction, operation, and maintenance of the communication infrastructure for information flow changes rapidly. And the various solutions for mobile business model, broadband access networks, and intelligent services are also waiting for qualified persons to develop and innovate.

Based on the above-mentioned facts, energization of the communication hardware and software facilities for teaching and training in the university must be continuously added and enhanced. The Ministry of Education, Taiwan, ROC proposed three-term projects to the Executive Yuan to enhance the education in communication engineering. The first term project lasted three years, beginning from 1993 to 1996; and the project emphasized in four main areas including the transmission techniques, the switching and network techniques, the image and signal processing techniques, and the voice signal processing techniques. The second term project took four years, starting from 1996 to 2000; the main themes of the project contained seven fields such as national information infrastructure, wireless communications, networking, communication systems, optical communications, communication software, and audio/video signal processing. And the third term project is planned to have four years, ranging from 2001 to 2005; the project lays emphases on the communication software used in the areas of communication systems and signal processing technology, and networking technology.

In order to attain the goals of the projects, in the mean time, the Ministry of Education also designs a complete

process for the application of the project, the review of the proposal, the execution of the project, and the evaluation of the project. The review process considers principles such as whether the goal of the proposal from the department is clear, whether the expected performance is justified, whether the school curriculum is appropriate, whether the practice experience is improved, and whether the instructors are professional. And the evaluation process takes the document of teaching materials and on-site review into account. The on-site review will check whether the equipments committed to purchase are ready, how the experiments are performed, and what the reactions from the students are. Some evaluation factors are designed, and these evaluation results will be considered as reference for the next year or the next term application.

The rest of the paper is described as follows. In the Section II, the status of communication education in universities and the personnel requirements of communication industry in Taiwan are presented. In Section III, the application and evaluation processes are given. Section IV describes the execution of projects of the first two terms and the planning the third term project. Finally, the conclusions are remarked in Section V.

2. Status

Recently, owing to the liberation and deregulation of telecommunications in Taiwan, the telecommunication industries have been prosperously developed. All universities expand their faculty members in communication fields and the number of students who want to major in this field has also been increasing. Many colleges and universities are trying to design or have had courses such as optical communications, wireless communications, high-speed networks, multi-media systems, and communication VLSI design in the curriculum. These courses can give students basic knowledge and fundamental theory. They even outline course schedules of different communication fields in every semester. And students are asked or forced to take one or more series of courses in order to have inter-discipline training. However, these energy quantum levels of students trained in the schools mismatch the requirement of engineers needed by the communication industries. Reasons could be that, in addition to the technical level problem or the management problem in the industry itself, many school instructors directly come to colleges or universities after graduation; they lack of industry experiences. Therefore, theoretical courses are more emphasized, or the explanation of principles cannot accompany with some practical experience implication. And the technical or experimental training is disregarded. How to fill up the gap between the university and the industry is the goal of the enhancement project in the education of communication engineering.

Multimedia communications, 3G wireless communications, broadband IP-based networks, and optical networks are the trend of the communication industry. According to the survey by the ITIS, CCL, ERSO, the communication industries will manufacture or design the equipments such as the synchronous digital hierarchy (SDH), x-digital subscriber loop (xDSL), IP-PBX/KTS, cable modem, mobile handset, gigabit switch/router, wireless local area network, and so on. They also design key components and the chip sets. The development of all these communication devices needs capable engineers educated in the areas of wireless communications, radio frequency (RF) circuit design, switching techniques, transmission techniques, network management, protocol engineering, and digital signal processing. The well-educated students with more hand-on experiences in some of these communication fields would strengthen the development capability and fasten the development cycle for the industry.

3. Application process and evaluation process

The Ministry of Education in Taiwan has proposed a three-term project to enhance the education in communication engineering since July 1993. In order to carry through the project more solidly, an application process and a performance evaluation procedure are designed. These processes are documented and sent to all departments or posted in the web site for access. The paper depicts the application process in the Fig. 1 and the evaluation process in the Fig. 2.

4. Education enhancement project

The education enhancement project in communication engineering has three terms. In the following, we describe the project term by term from the viewpoints of the scheduled main themes, the budge scale, the number of supported departments, performance results, and suggestions.

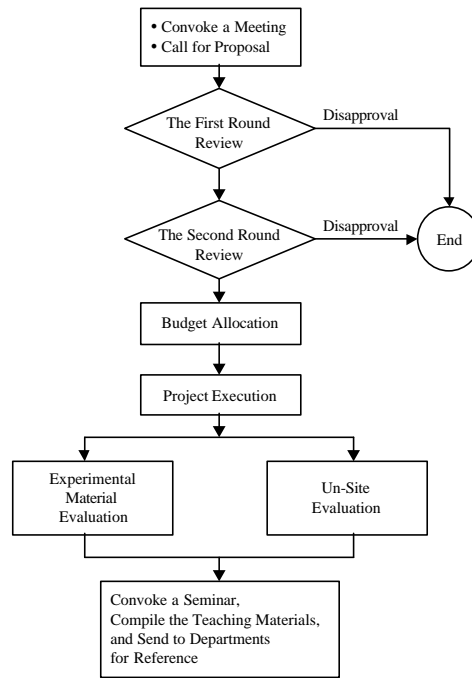


Fig. 1. The application process

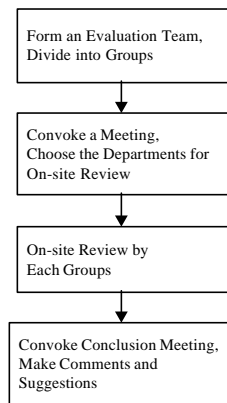


Fig. 2. The evaluation process

4.1 The first term project

The first term project lasts three years, starting from July 1993 to June 1996. The proposed main themes in the project emphasize in four areas: transmission techniques, switching and networking techniques, image and signal processing techniques, and voice signal processing techniques. The targets of the project are to help the related departments to improve their teaching laboratory environment and facilities for fundamental and core courses, and to encourage instructors to design and write the experimental materials. This project totally supported 199 courses proposed by 52 departments from 29 universities or colleges. The expenses are over 204 million NT dollars, within which 170 millions of dollars supported by the Ministry of Education and the 34 millions of dollars come from the budget of each department. Table 1 lists the detailed results.

The Advisory Office, Ministry of Education requested all related departments to submit proposals. In the proposal, it must state how the courses, in the above mentioned four areas, is enhanced and improved by adding some experiments; it should consist of the contents of the experiment and the required equipments, which should be clearly designed and described. The Ministry of Education then invited experts from industry, academy, and research institutes to form a review team. The review team determined which departments were approved, how many budget were allocated by the Ministry of Education, and how many budget were supported by the department itself.

In order to understand the execution effectiveness of the project, the Ministry of Education also formed an evaluation team to perform the on-site review. The evaluation team, containing four groups, went to a total of 46 departments in 26 universities. It checked how the supported budget is used to purchase, how well the teaching and experimental materials are written, and how good the experimental reports submitted by students are. Besides, the evaluation groups talked with professors and students to understand what and how they thought, desire, expectation, and comments. The results and suggestions were sent to the chair of the evaluated department for reference. The Ministry of Education presented medals to the professors and departments who had good performance in the project. And the good teaching and experimental materials were selected, compiled, and then put on the web for all departments to access.

Table 1

Supported		The Number of Universities	The Number of Departments	The Number of Courses	Budget from MOE (K NTD)
Fiscal Year					
1993.07	1994.06	20	32	59	54,766
1994.07	1995.06	23	35	70	56,100
1995.07	1996.06	24	38	70	59,292
Total		29	52	199	170,158

The general comments and suggestions from the evaluation team are stated as follows:

1. The first-term project helps the electrical and information departments to set up the experimental labs for communication fundamentals. Although the financial support from the Ministry of Education is limited, the scheduled courses are offered in the curriculum. This project does good to the communication industry and then the economics of the country,
2. The national universities have more faculty members and experimental facilities, the private universities have less faculties and facility resources. But the private universities still work well in the project, including good teaching materials written and interesting experiment designed.
3. The communication measurement equipments are very expensive. How to efficiently use the equipment is the problem; the department should pay more effort on the utilization.

4.2 The second term project

The second term project takes four years, beginning from July 1996 to June 2000. The main goal of the project is expected to help some departments in the universities, having good energy in the communication areas and good performance in the first term project, to establish a complete experimental laboratory. This lab must focus on a special track planned by the department, considering the department expertise. And the track should conform the themes of the second term project, which contains 7 areas in the fields of national information infrastructure (NII), wireless communication, networking, optical communications, communication software, and audio/video signal processing. The goal of the project also extends that of the first term project.

The second year project totally supports 253 courses from 57 departments. The overall budget is almost 300 million NT dollars, among which 250 millions are provided by the Ministry of Education and 50 millions come from the departments. Table 2 lists the yearly allocation.

The models of the review, the execution, the evaluation, and the promotion in the second term project are similar to those in the first term project. However, the emphasis of the project is to encourage departments to move from the experimental practice for individual courses to an integrated laboratory along with a series of courses. The second term project supports to establish 21 integrated experimental labs, among which there are 6 wireless communication labs, 8 networking labs, 1 communication systems lab, 3 optical communication labs, and 3 communication software labs.

Table 2

Supported		The Number of Departments	The Number of Courses	Budget (K NTD)
Fiscal Year				
1996.07	1997.06	40	63	51,520
1997.07	1998.06	57	64	47,224
1998.07	1999.06	48	67	53,331
1999.07	2000.06	42	59	50,178
Total		57	253	202,253

The general comments from the review and evaluation teams are stated in the following:

1. It should sponsor some regular workshop, seminar, or demonstration yearly for professors to exchange the teaching experiences.
2. Some design contest should be held; the superior work should be praised and the supervised professors would be encouraged.
3. The integrated laboratory in the department should be more focused; it could be cooperated with the industry.

4.3 The third term project

The third term project is to link up with the first and the second terms projects. Based on the previous results, this project will focus on more communication software and continuously enhance the experimental environments for the departments in the universities. The key areas include the communication systems and signal processing, and the networking. Note that the communication software related courses should be emphasized.

The budget allocation is listed in Table 3. It should not be lessened by the Legislative Yuan or other organizations, hopefully.

Table 3

Calendar Year	Equipment Budget (K NTD)	Routine Budget (K NTD)	Total Budget (K NTD)
2001	80,000	44,000	124,000
2002	84,000	45,000	129,000
2003	88,000	46,000	134,000
2004	88,000	46,000	134,000
Total	340,000	181,000	521,000

The explanation meeting have been held on May 17, 2000. The application due date is July 15, 2000. The beginning day of this project is January 1, 2001.

5. Conclusions

This project has provided fund of over 500 millions of NT dollars (18 Million USD) allocated to related departments in universities, Taiwan since 1993. It does beneficial to many departments in universities and then the communication industry. Many courses are incorporated with experiments, and many integrated experimental labs are set up, for training of students. It would be much better if the head count of the communication-related departments could be increased.