DOCUMENT RESUME

ED 391 873 CE 070 144

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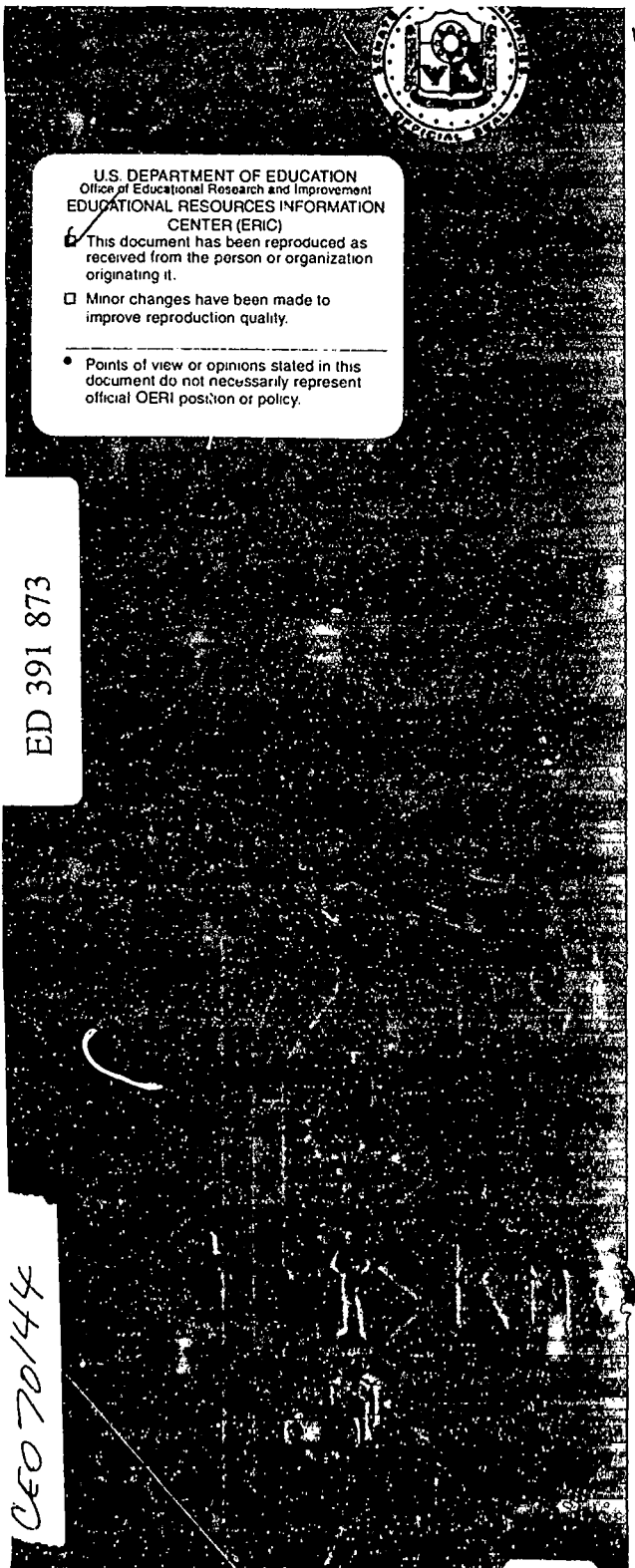
TITLE The Challenge of a Knowledge Society. A Philippine Plan of Action.
INSTITUTION Philippine Congress, Manila. Congressional Oversight Committee on Education.
REPORT NO ISBN-971-8827-22-6
PUB DATE 95
NOTE 135p.
PUB TYPE Books (010)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Corporate Education; Educational Change; *Educational Innovation; Educational Methods; *Educational Technology; Foreign Countries; National Programs; On the Job Training; Postsecondary Education; Secondary Education; *Technological Advancement; *Vocational Education
IDENTIFIERS *Philippines

ABSTRACT

This volume explores the potentials of advanced technologies as they apply to education and training and looks at efforts to exploit these potentials in three areas: vocational-technical training, formal education, and corporate programs. An introduction, "The Age of Knowledge Work" (Emmanuel T. Velasco, Gayla C. Carreon), defines concepts--future work, knowledge workers, information superhighway, networks, interactive multimedia, and other terms that arise to describe rapid developments in the fields of information technology and electronic communications. It describes the changes that technology has wrought in the world of work and the effects that these have had on other areas. Chapter I presents a summary of the findings from surveys on the use of computer technology in the three sectors in the Philippines: "Using Computer Technology for Worker Education and Training (National Manpower and Youth Council Survey Results)"; "In Search of the Leading Edge in Formal Education (Philippine Association of Colleges and Schools of Business Survey Results)"; and "Computer-Based Training in Business and Industry (Philippine Society for Training and Development Survey Results)" Chapter II presents the sectoral action plans, as generated by groups involved in separate conferences of the three sectors. The three sections are as follows: "Using Computers as Skills Instructors: The Evolution of a Policy" (Rony V. Diaz); "Turning Classrooms into Interactive Networks" (Elizabeth S. Samia); and "Technologizing the Knowledge Worker" (Emmanuel T. Velasco). A conclusion, "A Policy Response to the Challenge: The Establishment of a Leading-Edge Educational Technology Center," provides a summary of a proposal to establish a national center to rationalize the adoption of leading-edge educational technologies. Appendixes include the following: House Bill No. 12328: An Act Creating the Leading-Edge Educational Technologies (LEET) Foundation, a congressional initiative with its basis in the proposal discussed in the conclusion; detailed results of the three surveys; a workplan for the establishment of the LEET Center; 25 endnotes; and author biographies. Contains 50 references. (YLB)



COCED

Rony V. Diaz
Elizabeth S. Samia
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The allenge of a wledge Society

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The Challenge of a Knowledge Society

A PHILIPPINE PLAN OF ACTION

GAYLA C. CARREON
Editor

CONGRESSIONAL OVERSIGHT COMMITTEE
ON EDUCATION
Congress of the Republic of the Philippines
Manila and Quezon City, 1995

Published by the Congress of the Philippines under the auspices of the Congressional Oversight Committee on Education with Senator Leticia R. Shahani as chair, Representative Salvador H. Escudero III as co-chair, and Representatives Ciriaco R. Alfelor, Angel M. Carloto, Andrea D. Domingo, and Cirilo Roy G. Montejo and Senators Ernesto F. Herrera, Santanina T. Rasul, Vicente C. Sotto III, and Wigberto E. Tañada as members.

Book design by Rony Diaz
Logo concept by D.A. Rola
Logo design by Malang
Production by Corporate Friends, Inc.

Printed in the Philippines.

ISBN 971-8827-22-6
Limited Edition
First Printing, 1995

The Challenge of a Knowledge Society

A PHILIPPINE PLAN OF ACTION

Contents

Foreword

The structural and curricular reforms which the education and training system is undergoing today may be attributed to the informed nationwide discussions and debates engendered by the 1990-1992 Congressional Committee on Education (EDCOM). To be sure, leaders and officials of educational institutions and organizations had been making their own recommendations based on studies of their respective areas of interest. But these had not attracted nor sustained as much national attention as the EDCOM reports did. Nor had Congress been more concerned and focused on education and training matters than when EDCOM and its successor body, the Congressional Oversight Committee on Education (COCED), articulated positions that drew varying responses.

The debate continues.

COCED believes that intelligent and critical discussion of issues related to education and training must be encouraged in order to keep the system ever alert and responsive to a dynamic environment or, even better, to contribute to the dynamism of that environment where it plays its many self-fulfilling and productive roles.

It was therefore the unanimous decision of COCED, whose worthy members are Representatives Ciriaco Alfelor, Angel M. Carloto, Andrea D. Domingo, and Cirilo Roy G. Montejo and Senators Ernesto F. Herrera, Santanina T. Rasul, Vicente C. Sotto III, and Wigberto E. Tañada, that books would be the most appropriate way of stimulating and maintaining constructive discussion and debate. Furthermore, books record ideas faithfully, thus dispelling fallacious inferences. They afford fuller analysis of ideas and reach a wider readership spanning generations. They set the level and quality of debate and dictate its tone. Lastly, they contribute to the yet lean corpus of our serious literature on education.

Each of the four books published by COCED deals with one of these topics: education and poverty, the language issue in education, the crisis in higher education, and the use of leading-edge educational

technology. These subjects have been favorites in the arena of intellectual debate. They will invite lively, albeit emotional, responses; arouse greater public interest; even lead to more reforms. Who knows. The gain is that the life of the intellect is nourished and kept alive.

This volume, entitled **The Challenge of a Knowledge Society**, explores the potentials of advanced technologies as they apply to education and training, and looks at efforts to exploit these potentials in three areas: vocational-technical (voc-tech) training; formal education; and corporate programs. The desired outcome is a set of action plans that would integrate the use of advanced technologies in the educational system of each sector.

The book is introduced by an article that defines concepts -- future work, the knowledge worker, the information superhighway, networks, interactive multimedia, and other terms that arise to describe the rapid developments in the fields of information technology and electronic communications. The article goes on to describe the changes that technology has wrought in the world of work and the effects that these have had on other areas, among them, education.

To establish a base level for, or know the present state of, the application of advanced technologies in the three sectors, and to make the study approach empirical rather than speculative, the authors decided to gather information through surveys. This was done with the assistance of the National Manpower and Youth Council, for the voc-tech sector; the Philippine Association of Colleges and Schools of Business, for the formal tertiary sector; and the Philippine Society for Training and Development, for the business sector. A summary of the findings from the surveys is given in Chapter I of the book, and more details are provided in Appendix B.

The findings from the surveys were presented in separate conferences of the three sectors, during which discussions were held to develop sectoral action plans. Chapter II presents the action plans, as generated by the groups involved and as refined by the authors. The results of the multisectoral study support and validate a proposal, previously developed, to establish a national center to rationalize the adoption of leading-edge educational technologies.

This proposal has since been translated into a congressional initiative known as the Leading-Edge Educational Technologies (LEET) Bill. The proposal is summarized in the Conclusion; the text of the LEET Bill is included in this volume as Appendix A.

The process has exposed the tremendous gap that exists between practice and promise in this country. On one hand, we have gained almost unlimited access to the high-speed world of electronic technology. On the other, our educational system continues its snail-pace growth. Those who have seen what leading-edge technologies can do for education, as the authors of this volume have, understandably tend to speak a different language. This is not meant to impress but to inspire decision-makers about the potentials of this new subject and mode of learning in the hope that they will give it higher priority.

In the final analysis, the measure of the value of any innovation is its cost-effectiveness. At the rate and with the efficiencies that improvements in this field are being made almost by the day, we expect this value to increase considerably in the very near future.

While not as controversial as the subjects of the other books sponsored by COCED, the employment of advanced technologies in education and training is a matter whose time has come. Other runners -- the national leadership, the economic strategists, businessmen and investors -- have brought the country to where it is in the race toward industrialized status. But if our educational and corporate institutions fail to take hold of the opportunities within their grasp to organize human resources required by industry, the country will remain far behind. In the global track, the only way to survive is to stay out front -- to be, as the computer people say, at the leading edge.

Sen. Leticia R. Shahani
Chair
Congressional Oversight
Committee on Education

Rep. Salvador H. Escudero III
Co-Chair
Congressional Oversight
Committee on Education

Acknowledgments

This book is the product of the efforts of many individuals and organizations sharing a common dream -- to see the Philippines enter the information age as quickly as possible. All of those who have lent their ideas and expertise to this project believe that this can happen through the path of education. To them, our gratitude:

- Sen. Leticia R. Shahani and Rep.Salvador H.Escudero III as well as the other members of the Senate and House Committees on Education for their leadership and commitment to education in our country which inspired this book project;
- the Congressional Oversight Committee on Education's Dr. Dionisia A. Rola and Angela Singian;
- the National Manpower and Youth Council (now the Technical Education and Skills Development Authority) through Director General Jose D. Lacson, Ma. Susan P. de la Rama, Chief of the Office of Manpower Planning and Coordination, and Gloria Gabilla, NMYC consultant for this project;
- the Philippine Society for Training and Development through its President, Norman Goss;
- the Philippine Association of Colleges and Schools of Business through its President, Fr. Dionisio Cachero, and Executive Vice-President, Leonida T. Africa;
- the guest speakers and participants in the conference workshops held to report on the results of the surveys and to develop strategic plans for promoting the use of leading-edge educational technologies in the various areas of education and training;
- the schools and business organizations that participated in the surveys;
- Teofilo R. Asuncion Jr. of Andersen Consulting, for his support and encouragement;

- Arnie D. del Rosario of Ateneo de Manila University, for his advice and comments on the manuscript for the formal education sector; and
- Gayla C. Carreon, for polishing and augmenting our work.

We thank our families, for their encouragement and forbearance as we focused our attention on the planning and development of the book.

Most of all, we thank the Lord for endowing us with the ability to undertake this project, directing our efforts, and giving us health and strength to see it through.

Rony V. Diaz
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INTRODUCTION

The Age of Knowledge Work

Peter Drucker, the management guru, defines a knowledge society as one in which artisans work with their minds rather than their hands. [1] It is a world in which value is created by productivity and innovation, both applications of knowledge to work. As the world moves forward into the Information Age, the need for more of these mental artisans becomes greater.

Is the Philippines ready to become a knowledge society? Not by a long shot!

True, some global-type organizations in the country today are eager to take up the challenge of evolving into a knowledge society. But you can count them with the fingers of one hand. They are the few transnationals operating in the country. Yet not even all of them will make it.

Are we, as a nation, preparing ourselves to be a knowledge society? We have to act here and now.

This monograph underscores the pressing need to make our national leadership aware of the urgency of moving this country into the 21st century. In the area of training and education, such appreciation should be translated into a desire to formulate an action plan that would put in place educational technologies that will enable our educational systems, both formal and nonformal, to produce the kind of human resources we need to operate and manage a knowledge society.

The question that may well be asked is this: Why talk about advanced technologies when the educational system continues to be weighed down by age-old problems: lack of classrooms and other facilities; low-quality teaching; disproportionate number of students going into professional degree courses; the choice of medium of instruction? The answer is: Traditional solutions have not worked. More schools and classrooms, higher pay for teachers, administration of qualifying exams for collegiate entry, a compromise language -- these have not improved the quality of graduates in the country.

The inclusion by COCED of Leading-Edge Educational Technologies as one of the critical issues for study in education points to the possibility that there could be another approach to the problems of education -- an approach whose perspective is the future rather than the past.

Whatever the perspective, whether the past, the present, or the future, the measure of an effective educational system remains the same. It is how adequately and appropriately the system prepares graduates for productive work.

Perhaps our educational system was good enough for an agrarian, basic manufacturing economy. Those who did not make it to college or even through high school worked in the farm or the factory, or tried their luck overseas. Those who obtained degrees accepted any form of employment, here or abroad, no matter how far removed it was from their course. Screening occurred, not before students incurred the costs of tertiary schooling but after, when only the best and the brightest, or the wisest, landed the good jobs. The system, somehow, served its purpose.

But in the vision of Philippines 2000 -- of an industrialized and developed economy that, our leaders hope, lies in the near future -- the premises change. It has been realized that aside from the perennial budget and trade deficits, the Philippines suffers from a serious education deficit. This need must be addressed even now, if the country desires to meet the target of the National Information Technology 2000 plan of making 80% of the student population computer-literate by the turn of the century. (In 1983, the United States declared computer literacy/competence as the fourth basic skill, in addition to the three R's [reading, writing, arithmetic] that students should acquire.) [2]

Future Work

Mass production and mass distribution, as we know them in industry, are going the way of the dinosaur -- not simply getting extinct through the slow process of natural selection, but rapidly, cataclysmically, disappearing with the diffusion of technology. Economies, specially in the developed countries, are de-massifying. [3] Production is changing from assembly-line manufacture to customized, one-on-one, just-in-time operations. These changes are creating profound alterations in the nature of work and in the way human beings are being prepared, that is, educated, to perform work.

Work, in the Industrial Age, involved the physical manipulation of materials to take on the form and shape demanded by human beings. In today's Information Age, work involves modifying the very nature of materials to make them assume the form and shape we want. (It is said that the Information Age came about in 1991 when capital expenditures for computers and telecommunication equipment exceeded those for industrial capital goods.) [4] The world is moving toward a future in which work will no longer be the outcome of strength and power but of information and imagination.

Necessarily, the capacities and skills required at work will become different. Where before, muscles were the desired attributes of workers, today, the mind is what matters. Alvin Toffler, who

introduced the term Third Wave to describe the changes being brought about by the shift from the Industrial Age to the Information Age characterizes the future worker thus: "The Third Wave worker is more independent, more resourceful, no longer an appendage of the machine. Typically, a worker with skills or specialized knowledge. And like the artisan before the industrial revolution, who owned a kit of hand-tools, the new 'mind-workers,' if you want to call them that, have skills and information that amount to a kit of head-tools. They own the 'means of production,' in a way that unskilled factory workers never could." [5]

How, then, will our antiquated educational system make this quantum leap from disgorging yearly tens of thousands of ill-equipped graduates into the labor stream to creating a reservoir of knowledge workers who can supply skills where and when they are needed?

The only way is through the employment of technology.

Leading-Edge Technologies

Computers started it all. With their capacity to store tremendous amounts of data and to process these at remarkable speeds to provide needed information, computers have revolutionized the way most things are done. Further developments in computer technology as well as in other fields of learning portend more changes. The following are just a few of the possibilities.

MINIATURIZATION

Miniaturization is the ability to squeeze millions of components into microprocessors, the brains of a computer, and into memory chips. This means that even as the storage and processing capacities of computers expand, the cost to produce them goes down. (Moore's Law says that computer power doubles every 18 months.)

FIBER OPTIC TECHNOLOGY

The capability to send messages by switching lasers on and off billions of times a second and coursing light rays through glass fibers that may be thousands of miles long is known as fiber optic

technology. We are close to the time when long-distance telephone calls will be cheaper and can be made more efficiently (by a factor of 10,000 times) because of this technology. At some point in the future, fiber optic cables will bring not only phone calls but audio, video, and other communication media into our homes.

NETWORKS

Networks are invisible electronic webs that let people share information, exchange messages, and relate in other ways over physical distances. They consist of personal computers (PCs) or work stations linked together with access to applications and information through on-line services such as Internet. Networks will redefine the workplace. They are already doing so in high-technology countries where organizations have their workers in separate locations linked with each other and with a central area.

INFORMATION SUPERHIGHWAY

The much-talked-about information superhighway is simply a high-speed telecommunications network that allows the interchange of computer data, voice, and still and moving images. It involves the merging of computers, telephones, and television. Once all these technologies are working together, a person in his home can talk to another person by phone, see that person on a television screen, watch a show, word process, and work with another person on a spreadsheet -- all at the same time.

COMPUTER-BASED TRAINING

Computer-based training or CBT is a training delivery system involving interaction between the learner and the computer. CBT is ideal for teaching well-defined, repetitive tasks, specially those involving the use of computers. In recent years, the concept has evolved into Computer-based Education and Training (CBET).

MULTIMEDIA APPLICATIONS

Multimedia is the integration of two or more different media -- text, graphics, animation, video, and audio -- with the personal computer. This technology allows the user a choice of the best

combination of media to achieve his purpose, whether this be to inform, to convince, or to entertain. It provides the user control over what, when, and how information is presented. (It is said that people remember 20% of what they see, 40% of what they see and hear, and 70% of what they see, hear, and do.)

INTERACTIVE MULTIMEDIA

The use of a combination of text, graphics, animation, video, and sound in a way that allows people to become involved in the process of working, communicating, or learning is what is referred to as interactive multimedia. Interactive multimedia enables people to experience learning in exciting and innovative ways using many of their senses. "With interactive learning applications, information is delivered on demand, accommodating individual learning styles and providing students with appropriate feedback to reinforce concepts. This kind of reinforcement dramatically reduces learning time and boosts student performance." [6]

CYBERSPACE

Cyberspace is the inside of the computer. It has been called "the land of knowledge." This world of knowledge allows "users" to move through "gateways," access "servers," keep out "hackers" by building "fire walls," and send "e-mail" via the Internet. [7]

VIRTUAL REALITY

The technology that enables one to create "real-time" environment in the computer, that is, in cyberspace. Some examples of these environments are a virtual school (cyberschool or home schooling); a virtual bank; and a virtual machine. This technique involves high-tech simulations of tasks performed in such settings.

Technological improvements are continuing, giving promise that all these technologies will be accessible to everyone who wishes to use them. Computers are getting faster and cheaper; storage media are growing larger; software keep getting better and easier to use; manufacturers are making their products more compatible; and people who produce the content are becoming more capable. In fact, it is

claimed that in five years' time, economically advanced countries will have homes buying more multi-media PC systems at affordable prices than television sets. [8]

What do all these developments indicate?

Technologizing Education

The implication is ineluctable. Our educational system must change. Toffler summarizes the changes that must be made: "Break up the mass education system. Today's schools are turning out still more factory-style workers for jobs that won't exist. Diversify. Individualize. Decentralize. Smaller, more local schools. More education in the home. More parental involvement. More creativity, less rote. . . ." [9]

For us in the developing world, the gap between the present and the desired state of technology is much too wide and filled with entrapments, such as supposedly more urgent concerns, politics, and insufficient knowledge. As our surveys of the three education and training sectors -- vocational-technical, formal, and corporate -- show, the use of computers in education and training at present is minimal, if at all existent. Certainly, there have been commendable initiatives in this area, particularly in adequately supported universities such as Ateneo, De La Salle, and the University of the Philippines. Yet, these are isolated efforts.

The plans and proposals offered in this volume are meant to serve as a starting point for a more rational approach to the task of technologizing Philippine education. It is no longer a matter of whether it can be done. The reality is, **it must be done**. And the sooner our policy makers recognize this, the faster we can reach our goal for the coming century.

CHAPTER I: TECHNOLOGY IN EDUCATION AND TRAINING: THE PRESENT STATE

Using Computer Technology for Worker Education and Training (NMYC Survey Results)

The survey on the use of computer technology in vocational and technical education and training was conducted under the auspices of the National Manpower and Youth Council (NMYC). The survey results were presented by the NMYC consultant for the project, Ms. Gloria E. Gabilla, during the Conference-Workshop on the Use of Computer Technology in Vocational-Technical (Voc-Tech) Education and Training in the Philippines co-sponsored by COCED and the National Manpower and Youth Council (NMYC). It was held on August 29, 1994 at the Occupational Safety and Health Center, Visayas Avenue, Quezon City.

The Survey Proper

This study was undertaken to determine the changes, innovations, and technological developments that have evolved in the field of voc-tech education and training. Specifically, it sought to: (1) collect data on the state of these developments; (2) assess the capabilities of the respondent schools' professional computer management and staff; (3) establish criteria in the selection of trade skills areas for pilot testing; and (4) prepare a strategy and investment plan for computer-based training in voc-tech education and training.

The study covered selected voc-tech schools and educational institutions in the NCR (National Capital Region), Region IV (Southern Tagalog), Region VII (Central Visayas), Region X (Northern Mindanao), and Region XI (Southern Mindanao), using 385 samples located in the areas with electricity and with high enrolment sizes (200-1,000 and over). Data were collected through a questionnaire for respondents, and through interviews of experts and authorities. Covered in the collection were data on: enrolment in technical and technician courses in respondent schools; the state of technological developments, changes, and innovations in these schools; their hardware and software inventory; respondents' evaluation of their courseware; qualifications of those in charge and others involved in computer-based training; problems encountered by schools in courseware production and CBT work; and, respondents' comments on the use of CBT.

The study showed that the introduction of computer technology in voc-tech institutions has achieved the following:

- Improved many traditional methods of teaching;
- Adapted many information processing methods to education;
- Adapted many teaching methods to the development of training materials;
- Brought new and useful experiences to the classroom; and,
- Improved communication, conferences, and coordination work.

The study revealed, however, that the use of computer technologies in the voc-tech system is not extensive. Courseware is not sufficiently used to meet the instructional needs of students in

the five regions. Video and replay technology is not fully exploited in the classroom. Use of audio and graphics in training and of telecommunications in networking is likewise very limited. Computer-Based Information Systems find limited use mostly in Region VII. NCR and Region X stood out as locations of users of Simulation/Modeling as a medium of instruction. Region VII led in the number of both extensive and limited users of CAD-CAM.

On the other hand, the five regions showed a much higher level of accomplishment in the upgrading or training of teachers or trainors than in the use of courseware, audio-video, graphics, and other computer applications, with Region VII and Region X leading the way. Internship training of engineering students in voc-tech schools was practiced progressively in NCR, Region IV, Region VII, and Region X.

About 3,000 computers were inventoried in the schools covered by the survey. Of these, 742 were experimental technology computers (XTs) and 2,200, advanced technology computers (ATs). Region VII led in the number of both XTs and ATs particularly in the use of AT/286 with 20-40 MB hard disks; Region IV, in AT/386 with 80-120 MB hard disks.

Most of the schools used standard software such as word processors, spreadsheets, graphics, and programming languages. Not many use work-related applications such as CAD/CAM. The computer management and staff of the schools appear to be a mixed bag of people with high and low computer backgrounds.

The areas suggested for pilot courseware development are automotive and motor vehicle repair, electronics, and driving, among others.

Problems associated with CBT/courseware development can be grouped into four

- Hardware and software acquisition;
- Repair and maintenance of equipment;
- Training of teachers along new modes of instruction; and
- Lack of guidelines for courseware development.

The view of key informants of the study is that the future of voc-tech education promises (1) wider usage of technology in the classroom and (2) use of computer-assisted and computer-managed instruction or computer-based training. Most of the respondents and interviewees feel that authorities in education and training as well as in industry should fully exploit the advantages offered by these technologies.

The informants predicted a significant change in technical education as a result of computer technology, based on the following indicators:

- Education authorities are increasingly becoming uncomfortable with traditional modes of instruction;
- More students are taking computer engineering and computer science courses;
- Complaints are increasing on the quality of school graduates as well as on the competence of teachers and the ability of schools to retain qualified faculty members;
- Requests for computer equipment and computer-trained staff are increasing; and
- The national aspiration to attain industrial status is being pursued more zealously.

The informants stressed the need for a plan to promote efforts toward adopting newer or alternative instructional methodology. This study recommends that this suggestion be threshed out in a forum where policy makers, educators, practitioners, and even computer hardware and software dealers are represented. Supporters of the plan should complement one another in the provision of funds and infrastructure and encourage the design of information systems for wider acceptance of new instructional methods. Both respondents and informants also pointed out that the government should take the initiative in providing equipment support to institutions with strong internal scientific and engineering communities or in training teachers on new methodologies, such as computer-based training. (Please see Appendix B for more details on the survey results.)

In Search of the Leading Edge in Formal Education (PACSB Survey Results)

The Philippine Association of Colleges and Schools of Business (PACSB) co-sponsored the survey on Leading-Edge Educational Technologies, more specifically on the use of computer technology in formal education.

While the target of the survey was not limited to business schools, the nationwide network of PACSB, consisting of about 250 schools, was considered sufficient to reach a relatively large number of schools.

The purpose of the survey was to find out to what extent tertiary schools have adopted computers as an alternative training medium. The survey questions generally followed the same format used in two other surveys: those on vocational-technical education and on corporate education.

Methodology

Letters were sent to about 200 schools explaining the objectives of the survey and requesting the respondents to fill out the questionnaire. A total of 30 responses were received.

The survey included questions that covered a brief background about the school, course offerings related to computer education, recent technological developments in the school, an inventory of the computing systems being used, including the hardware and software, other administrative uses for computers, and problems met in the use of computer technology.

The results of the survey were presented in a PACSB-COCED Conference-Workshop on LEET, held on October 3, 1994, at the Science Teacher Training Center, U.P. Diliman, Quezon City.

Findings

Most of the respondent schools (36.7%) are located in Metro Manila. A good number (26.7%) are based in the Visayas. Majority (73.3%) have enrolment of more than 1,000. Four schools reported enrolment of 8,000 and above.

Since the institutions surveyed are schools or colleges of business, it was logical that the courses providing computer subjects are business courses: BS Business Administration/Commerce (18 schools); BS Accountancy (15); and BS Computer Science (12). Three schools offered MIS, Office Management, and Information and Computer Science as major fields of study.

Many of the respondents offer computer subjects and application courses, the most common of which are programming, computer fundamentals, and word processing. Most incorporate specialized and technical computer subjects as optional fields.

An interesting finding was the extent of technological development in the schools. Most of the respondent schools offer computer courses, use computers in administration and other functions, and employ computer-based training in varying degrees.

This is reflected in the following summary:

Nature of Technological Development	No. of Schools
• Introduction of Computer-Based Courses	29
• Development of Computer-Based Materials	27
• Use of Video Equipment in Teaching	28
• Use of Audio Equipment in Teaching	26
• Use of Computer Graphics in Teaching	26
• Use of Telecommunications in Networking	19
• Use of Computer-Based Information System	24
• Use of Computer-Based Data Processing System in Administration	26
• Use of Electronic Mail/Teleconferencing	15
• Consistent Updating for Teachers	25
• Computer Internship for Students	23
• Support for Computer-Based Course Materials	24
• Software Development	22

(Details of these and other results are given in Appendix B).

While all the schools surveyed have computers, only 19 have 386s and only 8 have the more advanced 486s that would enable them to extensively use computer-based training materials. Four schools (two in Manila, one in Cebu, and one in Zamboanga) reported the use of CD-ROM auxiliary drives.

Five schools have CAD/CAM work stations; four schools have local area networks.

What the schools seem to have in abundance are software for all types of applications. Apart from operating systems, the schools use compilers, word processors, spreadsheet software, data base management systems, project management systems, graphics software, communication software, utilities, and software for financial and administrative applications. The survey did not look into whether or not the software used are registered.

The schools clearly expressed their desire to increase the technological component in their education and administrative functions. However, they cited many hindrances to their ability to pursue this goal.

The problems they cited lie in the following areas:

1. The fast pace of technological development and the resulting obsolescence of their equipment.
2. Budget constraints that prevent them from upgrading both hardware and software.
3. Personnel limitations in terms of knowledge and skills to use the technology and lack of competent faculty.
4. Other problems, such as the lack of familiarity with the operation and maintenance of the machines, lack of reference materials, and so on.

Despite these problems, the respondents as well as the participants in the Conference-Workshop shared the opinion that leading-edge technologies hold the key to a new world of learning, particularly for students aiming to enter the stream of professional work. Initiatives, such as educational television and participation in digital data networks, taken by a number of institutions were commended.

Computer-Based Training in Business and Industry (PSTD Survey Results)

The survey conducted by the Philippine Society for Training and Development (PSTD) focused on the use of computer-based training (CBT) in corporate education and training. The common survey questionnaire designed by the COCED team was sent out to 150 organizations. Of these, 41 responded. The survey results were presented and discussed in a joint COCED-PSTD Workshop held on September 6, 1994, at the SGV Development Center.

Of the respondents, only 8 reported using computers in their training programs; 33 are non-users of computer-based training. The respondents who indicated that they have not considered using computers for training were asked their reason(s). The three main reasons given were the following:

- Lack of knowledge about CBT (23%)
- Not a priority in their training plan (26%)
- High initial investment (18%).

Most of these companies did indicate, however, that they would study the feasibility of using CBT in their organization in the future.

The companies that use CBT adopted this method at the initiative of their top management (44%), training department (28%), parent company (14%), or EDP department (14%).

The user companies use CBT in the following applications:

- Use of computer-based application systems (40%)
- Development of managerial skills (27%)
- Development of technical skills (20%)
- Orientation of new employees (13%).

Expectedly, the companies that use CBT have higher-end computers -- mainframes (IBM 4831), midrange computers (IBM AS/400), and IBM 486s. A good number (23) have multimedia capabilities.

Interestingly, half of the companies (14) that have CBT materials acquired them either from commercial sources or from their parent company. The other half developed the CBT lessons themselves, either on their own or with assistance from a training firm or a consultant.

Reflecting the greater availability at more reasonable cost of CBT materials over the past two years, usage has increased tenfold, from about 20 trainees in 1990 to over 200 in 1994.

Although the companies recognize the benefits that can be derived from using CBT, they are prevented from optimizing the method by certain constraints.

The 17 companies that use CBT cited the following advantages:

1.	Flexible training schedule	22%
2.	Consistency of CBT lessons	18%
3.	Ability to transfer to other sites	18%
4.	Less need for highly paid trainers	12%
5.	Self-paced method of learning	12%
6.	Ease of updating CBT lessons	6%
7.	Ability to customize lessons to trainees	6%
8.	Reduced training time	6%

The problems encountered by 13 companies in implementing CBT in their organization are as follows:

1.	High cost of hardware	31%
2.	Lack of off-the-shelf lessons	23%
3.	Limited trainee-computer interaction	15%
4.	Lack of staff with technical skills	15%
5.	High cost of CBT lessons development	8%
6.	Insufficient interest of trainees	8%
7.	Slow response time	
8.	Lack of support from vendors	

The educational sector that is expected to have the best capability and resources to employ new technologies for training, that is, the corporate training sector, unfortunately shows the same limited application as the formal and voc-tech education sectors. With the decreasing costs of the technologies, however, and the entry of more and more hardware and software suppliers, the use of computers for corporate training is bound to increase. As much was promised by the participants in the conference. They likewise gave their commitment to support the proposal to set up a leading-edge educational technologies center to bring together efforts in this area.

RONY V. DIAZ

CHAPTER II: TECHNOLOGY IN EDUCATION AND TRAINING: THE DESIRED STATE

Using Computers as Skills Instructors: The Evolution of a Policy

Although there is still no national policy on the application of advanced technology to technical and vocational training, the National Manpower and Youth Council or NMYC (now the Technical Education and Skills Development Authority or TESDA) has taken careful but pragmatic steps in that direction.

The first step was its participation in 1989-91 in a regional investigation of this subject under the aegis of the Asian and Pacific Skills' Development Programme of the ILO.

The second was the convocation on August 20-24, 1990 of a national workshop on computer-based training.

The third was the examination by the senior staff of the NMYC during its 1993 corporate planning session of the operational problems

of introducing advanced technology in vocational training, particularly the training of software engineers and technicians.

The fourth was a national survey in July 1994 on the extent of the use of computer technology in public and private vocational training institutions. The book-writing project on leading-edge technology of the COCED collaborated in this survey and jointly sponsored with the NMYC a workshop on the results.

And the fifth was the preparation of a plan of action (1995-96) that will develop a policy, build the appropriate institutions, and install the mechanisms that will actualize the use of advanced technology in vocational training.

In introducing advanced technology to vocational training services, the ILO recommended that "options . . . be kept open for alternative patterns of technological change including the blending of advanced technology and traditional technology, as well as technological 'leap-frogging.'" It warned that "denying the importance of advanced technology at the present time would mean foregoing significant opportunities, particularly in terms of economic growth." [1]

The ILO also recommended a definition:

> Advanced technology, from the perspective of vocational training, may be defined as the innovative application of scientific principles in enhancing the efficiency and effectiveness of the manufacturing and operational processes and the quality/functionality of the products and services provided by industry. It invariably requires acquisition of new skills and is characterized by the replacement/improvement of existing technology. It is relative to the country context and has a time dimension. [2]

From this definition, one can generate a list of advanced technologies for which vocational training courses may be profitably devised. These include: communication technology, computer-aided design (CAD), computer-aided manufacturing (CAM), flexible manufacturing systems (FMS), computerised numerically controlled machines (CNC), computer technology (hardware), computer technology (software), industrial robots, maintenance of high-tech

machines, process control technology, tool and die making, transportation technology, and biotechnology.

The training that these technologies require is heavy on conceptual, diagnostic, and reasoning rather than manipulative skills. They also require a more thorough understanding of science and mathematics than is normally given in a typical training establishment.

Since these technologies also affect the pace and nature of production, the supervisory and managerial skills required are also different. The emphasis is on the interrelationships of the various components of the total production system rather than on discrete sub-systems that are typical of mass, assembly-line production.

In brief, the introduction of advanced technology will affect profoundly the curricula, course content, and standards of technical and vocational training. But will these technological changes bring about "de-skilling"? The evidence is mixed. Harry Braverman thinks that these new technologies allow managers to arrange production in such a way as to control labor and therefore the level of skills of workers. [3]

On the other hand, Henry Levin suggests that de-skilling occurs not only because of changes in production processes but also because of the shift of labor from higher skilled manufacturing to lower skilled service occupations brought about by industrial or economic restructuring. This is evident in the United States where the increase in high-technology jobs is relatively rapid, but they still represent only a small share of total employment compared to lower skill clerical and service jobs which account for over half of the labor market. [4]

The ILO has confirmed the same trends in Asia. The World Bank reports that "traditionally male, blue-collar, skilled jobs in manufacturing are declining." [5] The largest share of new jobs are low in skill requirement. This is particularly true in the production of electronic goods in both developed and developing countries where the work force (predominantly women) tends to be less educated and less skilled.

These were, by and large, the guideposts that the NMYC considered when it ventured into the field.

Computer-Based Training (CBT) in the NMYC lexicon is a generic term that includes Computer-Aided Instruction (CAI), Computer-Managed Instruction (CMI), and Computer-Assisted Testing (CAT).

The national workshop on CBT established for the NMYC a number of important conclusions. Among these are : (1) CBT is more flexible than traditional instruction; (2) CBT is more cost-effective because of decreased training time; (3) CBT, being self-paced, does away with cumbersome and expensive group training; (4) the training materials are relatively easy to update and to adjust to specific job requirements.

The downside of CBT, however, are the following: (1) instructional design experts and professionals are scarce; (2) hardware and software are expensive; (3) it is not easy to match CBT equipment to present and future job training needs.

On the basis of the results of the workshop, the NMYC decided to develop the full range of CBT capability. For this they sought and got financing from the World Bank.

During the 1993 corporate planning session, Col. Fermin P. Javier, the managing director of the National Computer Center, was invited to explain how software engineers and technicians are trained and the role of private computer schools in their training.

It became clear that the key role of an agency such as the NMYC would be in policy direction, technical advice, and standards setting. Private computer schools should be encouraged rather than regulated to upgrade, expand, and develop their facilities according to the needs of the market. Multinational corporations engaged in software development should be enticed through appropriate incentives to offer more training either by themselves or in cooperation with schools.

With all this background information, the NMYC launched the last phase of its preparatory work. In July 1994 it began collecting through questionnaires and interviews of key informants in five regions data on the extent of technological innovations and developments among vocational and technical training institutions, the quality of their faculty and staff, and criteria for trade skills. The

aim was to prepare a strategy and investment plan for computer-based training in technical and vocational education and training.

As more or less expected, the use of computer technologies in vocational training was found to be limited. The articulation of technology and job training left much to be desired. The quality of the training staff was low and the courseware they were using were, in many instances, inappropriate to the training objective.

The key problems were the cost of hardware and software, the difficulty and cost of repairing and maintaining equipment, lack of adequately trained teachers and trainers in CBT, and lack of expertise in instructional design and courseware development.

There was, however, keen enthusiasm for the introduction of CBT in training institutions.

As the report put it:

> The informants predicted a significant change in technical education as a result of computer technology, considering that education authorities are increasingly becoming uncomfortable with traditional modes of instruction, more students are taking computer engineering and computer science courses, complaints are increasing on the quality of school graduates, as well as on the competence of teachers and ability of schools to maintain quality faculty manpower, requests for computer equipment and computer-trained staff are increasing, and the national aspiration to attain high industrial status is being pursued more intensely. [6]

In short, the environment is now hospitable to the entry of advanced technologies, particularly CBT, into schools and training institutions.

The lead organization in pursuing this goal is the NMYC, which has evolved into the Technical Education Skills Development Authority (TESDA). The TESDA has developed a two-year action plan with ten distinct but interrelated components.

From January to March 1995, a project team will study the feasibility of setting up a national center and a network for advanced technology in vocational training.

From March to October 1995, a core group will identify the vocational courses for which courseware will be developed. The aim is to develop prototype courseware that will be tested and evaluated in selected sites.

After validation, CBT trainers and managers will be trained. At the same time more courseware will be developed for testing, evaluation, and validation. This will go on until March 1996.

A computerized training materials bank, initially for 11 occupations, will be set up and will become operational by the end of 1995.

In the meantime, promotion, marketing, and networking with public and private training institutions will be undertaken systematically year round.

In 1996, the TESDA hopes to be ready to implement a policy of accreditation and equivalency based on agreed procedures and standards.

Two parallel activities will be running alongside those described above. These are the establishment of a Center for Computerized Integrated Manufacturing Systems (CIMS) and Computerized National Manpower Information System (NMIS).

The TESDA has the mandate and the resources to carry out these plans. But for them to have an impact on industry, stronger operational linkages will have to be forged. At the same time, the TESDA will coordinate with the National Computer Center and the Commission on Higher Education for those agencies' participation in the total educational technology scheme.

Investment decisions on advanced technology should be assessed and made on the basis of their real and potential returns to the entire economy rather than on their usefulness to only one sector.

Thus, it is important that we understand as fully as possible the repercussions of advanced technology interventions on employment, the demand for skills, and the changes in skill profiles of various categories of human resources in order to forestall or mitigate possible adverse social consequences.

ELIZABETH S. SAMIA

Turning Classrooms Into Interactive Networks

More than ever, the crisis in education is being acknowledged. The country's leaders now recognize that for the Philippines to remain competitive in the global environment, it needs workers with increasingly sophisticated skills. Our educational system simply cannot deliver those skills unless dramatic changes are made **NOW**.

Efforts exerted by our educational policy makers, school administrators, and teachers have been impressive. But they are not enough. What we need is a national program to develop new instructional technologies and supporting technology. We need to develop a new educational system that integrates the wisdom of our best theorists, managers, and teachers and at the same time responds to demands of the workplace.

Education and the Knowledge Society

Since we have gone from the Industrial Economy to an Information Economy wherein the creation, processing, and dissemination of information are the key driving forces, we need a new approach to make our schools world-class -- one that focuses on achieving efficiency in learning and not just teaching; one that leads to continuous improvement in productivity and performance. Changing educational methods, which has been done in the past, will no longer suffice. If we expect to achieve this redirection, we need to make significant investments in advanced educational technologies. Investments in this area will be preferable to spending increasing sums that will be used only to maintain old methods, with mediocre results.

Our educational system, which was largely patterned after the American model, was developed during the Industrial Age of the 19th century, when only a small portion of the population needed to be well educated. This system is becoming increasingly irrelevant. It is geared mostly to a median level of instruction that tolerates failure and does not challenge the gifted; it weeds out students not suited for the managerial class and accepts a high rate of dropouts.

Today's Information Economy does not have room for dropouts in the way that the Industrial Economy used them for menial labor. In a world that will be driven by knowledge, even students who have had basic schooling must know more than the "three R's," and more critical/higher order thinking and collaborative working skills.

A commitment to excellence is needed, and a program to design a technology-based education system suitable to the needs of a Knowledge Society must begin. A new system in education should be aligned to the changes that our own business establishments are going through to meet the challenges posed by global competition in the Information Age. The new system must be designed to meet the unique training needs of individual students, rather than the assembly-line model geared to the norm. It must also be more productive than today's system, if it is going to achieve the goal of upgrading each student's knowledge level at limited additional cost.

Traditional schooling provided training for individuals to work in manufacturing or management during the Industrial Age. The school methodology matched the industrial assembly line: memorize content, then proceed to the next course. Pass or fail, students generally ended up doing routine jobs. It worked well at that time. However, as Peter Drucker pointed out in his book, we have moved to the "post-capitalist society" -- the knowledge society. Has our educational system kept pace?

Knowledge work has made memorization obsolete. Finding new ways to solve problems does not permit rote answers. Today, in a post-industrial Information Age, repetitive training has gone the way of the assembly line -- automated out of existence.

Integrating Information Technology in the School Curricula

The school curriculum should be evaluated on the basis of its relevance to the needs of the workplace. There is also a need to make classroom time more productive: to teach higher-order thinking skills in addition to basic skills; to put more emphasis on math and science; to enhance social skills required by a collaborative workplace; to familiarize students with computer technology; and others. For this to be accomplished, the existing curriculum should be constantly examined and revised so that lesson plans do double duty, and multiple learning objectives are met simultaneously. For example, the use of computers should be fully integrated with standard academic subjects such as language, science, and mathematics. The benefits include covering more material during class hours and making the classroom more relevant to real life -- which is not so tidily compartmentalized. This also reinforces learning that has taken place.

Since computers are at the forefront of the Information Age, their use in our schools becomes a necessity for our students to meet the needs of today's workplace. It has been said that the best learning situation is one that is individualized or tailored to the needs of each student who receives the undivided attention of the teacher. But

since we have opted for universal education, this one-on-one instruction is out of the question. Besides, there just aren't enough teachers to go around.

In recent years we have seen the adoption of conventional teaching methods in which many students are taught by teachers with instructional aids such as books, films, videotapes, educational television, and the like. The problem with these methods is that the students have little or no control over the kind of material covered and the pace at which it is presented. The same material is presented in the same way to both students who learn quickly and students who have learning problems. Thus, some students become discouraged when difficult material is covered too rapidly and others get bored when they understand ahead of others what is being taught. The cumulative and paced learning process that is made possible by computers approximates the conditions of individual instruction more closely.

The interactive nature of the computer captures and holds students' attention in ways that more passive media cannot. In fact, today's multimedia systems are a dynamic combination of text, sound, graphics, animation, and video that present information through the medium that best communicates each aspect of the subject matter being taught. PC-based multimedia tools, in combination with effective educational design, help put control in the learner's hands, allowing navigation through a course at the learner's own pace. Learners can quickly work through familiar concepts and focus more closely on new ideas and information. Moreover, the images and sounds that the learner receives in a multimedia training session stimulate all of his or her senses. It has been demonstrated that the more senses are involved in the experience, the deeper the understanding. This new approach helps students engage in active education and have fun at the same time.

Education with multimedia will open avenues for creative problem-solving, individual critical thinking, and interdisciplinary learning. There are specialized organizations such as the Institute for Learning Sciences at Northwestern University that are doing cutting-edge research on how the human mind processes information.

These institutions are using their findings to develop multimedia software and applications that teach individually. Examples of these are story-based or scenario-based teaching to present new information at the point of need. Electronic just-in-time teachers are being produced to let learners ask their own questions or to navigate through the information they can access through the computer. These software have the capability of accessing video databases of experts who can share their knowledge or "stories" about the topic. Software that can index learner responses can be used to change available answers and follow-up questions based on the previous question or response, or the learner's shifting interests.

Virtual reality, the next frontier in information technology, may provide the optimal means for realizing the objectives of the experiential approach to learning. Emerging technologies that recreate virtual environments will allow learners to immerse themselves in the learning experience through direct sensory perception. Virtual reality technology will allow learners to explore places and interact with objects, all without leaving their seats.

Thus, the education paradigm shifts from passive learning to interactive, on-demand training creating new and more effective learning possibilities. The new training technologies can greatly enhance the learning process at each level of schooling in the formal school curricula.

Some examples of how computers are being used in the formal education sector follow:

EARLY CHILDHOOD EDUCATION

The use of computers in early childhood education has been well documented particularly in the use of the software called Logo. Through Logo, children are taught programming skills. Another useful program is "Writing to Read" which lets children use the computer to learn how to read and write. "Writing to Read" has been tried out in the Philippines at Pinyahan Elementary School in NCR at the Grade 1 level. The results are encouraging, and wider use of the system has been recommended. Many other software

designed for pre-school children which help them learn in novel and fun-filled ways are now commercially available.

PRIMARY EDUCATION

There are also many commercially available software packages that can be used in the school curriculum for all grade levels and subject areas. These packages use a variety of instructional approaches to teach students concepts and skills in various subject areas including drill and practice, tutorials, games, simulations, problem solving, and multimedia. These software may be used alone or to support other learning media in the classroom. They may also be used as supplementary lessons for remedial and compensatory education.

SECONDARY EDUCATION

Similarly, in secondary education, computer software can be integrated into the school curricula. Computer literacy and computer studies can also be introduced at this level.

One IT-based approach that is already being used in the Philippines by a few schools such as Colegio de San Lorenzo, Sunnyhill Learning Center, and Holy Rosary Academy, is Smart-School, derived from the Blackstock High School learning center in the US. The Smart School concept is a computer-based educational system that allows students to follow individual paths to learning. Teaching is done by objectives, not lessons.

HIGHER EDUCATION

Degree programs in computer science and information technology are offered in college. These programs are designed to develop information technology professionals. On the other hand, other disciplines include computing subjects in the curriculum as a programming course or use them to teach computer literacy and applications as in accounting, business, secretarial science, engineering, and so on.

An introductory course on Computers and Society for all degree programs as part of the general education curriculum addresses the

need to create an awareness of the impact of computers in our daily lives. Computers can be expected to affect our lifestyles more than any other invention. Like other technological innovations, computers have the potential for both great benefit and great harm. People must have an understanding of the benefits of this new technology and at the same time also avoid its undesirable side-effects. To cite the obvious benefits, because of their enormous capacity for information processing, computers offer us more control over our lives, greater freedom of choice, and the opportunity for richer interaction with our fellow human beings and the world around us.

Such a course will enable students to have an understanding of the computer itself, its history, components (hardware and software), and how it works. It will also focus on computer applications and their impact on society including the home, education, the arts, medicine, telecommunications, transportation, government and politics, manufacturing, law and peacekeeping, business and finance. It will also help students in understanding how people can relate or interact with computers. It will answer questions ranging from invasion of privacy and universal identifiers to ergonomics, the science of making computers easier to use. It can also provide an introduction to programming languages, concepts, and techniques.

The survey of colleges and business schools showed that while computer hardware and software as well as curricula for teaching about computers and their applications are already available in our colleges, access to them is still limited, particularly with regard to their use in instruction specially for non-computer courses. In fact, only a few of the schools surveyed had the hardware configuration that would support the extensive use of computer-based training courseware. The survey also yielded information on problems encountered by these institutions in the use of computer systems and computer-based training including: (1) fast development of technology; (2) lack of qualified and trained personnel; (3) difficulties in sourcing funds for hardware, software, and maintenance; (4) lack of materials in CAI and text references; and (5) technical problems associated with computer use, such as viruses. (See Annex B-2 for the results of this survey.)

SPECIAL EDUCATION

Computers have been used to enable students with special needs to learn. In advanced countries, this is a well-developed area. For example, in Israel's Center for Educational Technology, a multimedia computer program to allow exceptional children with special needs to use all their senses -- sight, sound, and even touch -- in learning to read was developed and employed in about 150 Israeli schools. In fact, the method has been so successful that the software has been adapted for use by regular preschool three- and four-year olds at home and in nursery school. The material was written to meet the specific needs and the pace of special education pupils. By using the latest computer hardware -- audio cards, touch-screen monitors, and advanced color graphics -- the designers have succeeded in creating an innovative, dynamic, and entertaining learning situation that allows children to use all their faculties in learning.

Computer Studies

This involves the offering of programs where the computer is the object of study, as in computer science and information technology courses. Information technology courses offer the students a more interdisciplinary program of study including training in a core area, functional and technical training in business functions, organization development, strategic analysis, and computer technology.

Computers for Research and Development

Computers can also be used in data encoding, processing, and reporting of research studies. Because of the enormous capability of computers to store large amounts of data and to process these data quickly and accurately, computers have become a necessary tool in academic and other forms of research.

Today's researchers could also avail themselves of computerized libraries, text retrieval systems, research databases, and access to

the information highway, all of which offer fast retrieval and exchange of information.

INTERNET

An important and interesting development for researchers is access to today's information highway. The Philippines has entered the state-of-the-art global information facility known as Internet. The Department of Science and Technology (DOST) spearheaded the opening of this gateway in 1993 through the establishment of the Philippine Network Foundation, Inc. (Philnet). Philnet/Internet can be used for electronic mailing, file transfer, information search and retrieval, remote log-in, and online conferencing. It offers the user unlimited personal and geographic access, inexpensive access to up-to-date information, and immediate, two-way communication between and among interested parties. Its potential for business, education, and government multiplies as more and more information becomes available on the Internet.

From the initial four institutions in July 1993, the participants in Philnet have increased to nine institutions with access node connection to Internet. These institutions are: the Department of Science and Technology, Ateneo de Manila University, De La Salle University, University of the Philippines - Diliman, UP Los Baños, University of Santo Tomas, University of San Carlos, Xavier University, and St. Louis University. Additional access nodes are being set up at the Asian Institute of Management, the Mindanao State University, and the Department of Education, Culture, and Sports. Many more institutions should be convinced of the value of participation in this network. According to Daniel P. Hamilton, the Philippines had only 65 Internet host computers as of July 1994 compared to Thailand's 1,194 and Japan's 72,409. [7]

Computers for School Administration

The versatility of computers lends support to school authorities in decision-making, record-keeping, and reporting. Functions such

as accounting and finance, personnel, planning, facilities administration, library services, student records, and communications can be greatly facilitated with the use of computers.

Computers in Teacher Training (Pre-service and In-service)

Many teachers welcome the use of computers in the classroom. But there will still be teachers who will refuse to become involved with them and even actively oppose their use. This is because a large number of teachers have never seen computer-assisted instruction in use and so are skeptical of its value. Like many other professionals, teachers are reluctant to set aside years of hard-won experience for new and unfamiliar ways of doing their job. Some teachers also doubt their own ability to deal with computers, which could seem forbiddingly complex and technical despite the increasing user-friendliness of computers. Some teachers even see computers as a threat to their jobs, fearing that computer-assisted instruction will reduce the number of teachers needed to handle a given number of students.

Much of this resistance will soften as computers become more widely used in schools and teachers have more opportunity to see them in use. By observing their colleagues who are using computer-assisted instruction, teachers will be reassured that computers can be used effectively, that they are not too difficult to work with, and that their use does not lead to teachers being fired from their jobs.

As Education Undersecretary Erlinda C. Pefianco stated in a speech she delivered during a seminar in Manila on *Improving Science Instruction Through the Use of Multi-Media*,". . . While technology is here, while we talk of the multi-media approach in science teaching, the teacher still remains the key figure in the teaching-learning process. The face-to-face encounter of a competent teacher and the learners, complemented/supplemented by multi-media, would undoubtedly result in more effective learning."

Resistance to using computers in the classroom can also be greatly minimized if teacher-training institutions will include using computers in pre-service teacher education. Computers in instruction and in managing the classroom can be taught to teachers as part of their regular curriculum. Teachers must cease to be just pre-programmed knowledge dispensers who pour out knowledge to their students. Instead they should become managers of student learning and the learning environment. Integrated computer-based instructional and administrative systems can record each student's progress automatically as specific milestones are achieved. Teachers can therefore keep fully abreast of student progress and facilitate much more frequent reporting to parents.

The following observations and recommendations were made during the PACSB survey:

- *Distance Education.* The University of the Philippines Distance Education Program is still largely print-based because of cost constraints. It has established a network all over the country to deliver courses and it is linked with international centers of distance education. While migration to audio and video media are used extensively in other countries for distance education, this is still not being done in the Philippines because of the additional cost it will involve. While initial costs are high for migrating to more advanced training technologies including computers, the benefits that can be derived from their use should be weighed against the costs which should be spread out over the increased clientele that can be served and the improved instruction that can take place.
- *Science Education.* Through the Continuing Science Education Through Television (CONSTEL) program, a cooperative project of a number of local educational institutions, foreign financing agencies, and the government television channel, teachers in Chemistry, Physics, and Elementary Science now have a mass media-delivered training option. This program can be enhanced further with the use of leading-edge educational technologies in developing and delivering science subjects in schools. This

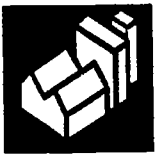
method will be particularly useful to students in remote school sites and schools where there is a lack of teachers to handle specific science subjects.

An offshoot of this university-initiated program is the production by the ABS-CBN Foundation of a 30-minute television series called *Sineskwela* which runs from 9:30 to 10:00 a.m., Monday to Friday, over Channel 2.

- *Teacher Training*. The training of teachers is seen as critical in making instruction more effective in our classrooms. LEET has the potential to make teachers better managers of instruction and more creative in getting students involved in the learning process.
- *Instructional Design and Development*. There is a need to train instructional designers and developers in new training technologies for them to produce materials that will suit the needs of students. Computer-based courseware are already available in the market for nonculture-specific subjects such as science and mathematics. Existing courseware need to be modified or new courseware developed to meet other curriculum requirements.

These recommendations are by no means exhaustive of what can be done to contribute to the richness of the learning environment by using leading-edge educational technologies in our schools. The crucial message is this: the time to act has come to make our educational institutions fully exploit the potentials of technology in preparing a globally competitive workforce for the Philippines in the Information Age that is upon us.

EMMANUEL T. VELASCO



Technologizing the Knowledge Worker

The educational sector that is expected to have the least difficulty and the most to gain from the new technologies is the business or corporate training sector. Businesses are presumed to have the resources -- the funds as well as the people -- to be able to acquire and use the hardware and software required by the changed environment.

Academicians and training and development experts in the business world acknowledge the benefits that technology offers:

> Computers and multimedia software are being used to revamp education and business training. Specialized organizations are doing cutting-edge research on how the human mind processes information, then applying the insights to develop multimedia software and applications that teach individually. These educators use story-based teaching

> to present new information just as a learner needs it. Electronic just-in-time teachers are being produced to let learners choose among pre-determined questions about a topic or even type in their own questions. Then the multimedia software accesses a video database of experts who relay 'stories' about the subject. Indexing software continually changes the available answers and follow-up questions based on the previous question or response, or the learner's shifting interests.
>
> . . .
>
> But now a new era is opening in which productivity enhancements come from using technology, like multimedia, not to cut costs but rather to provide new tools to the core of the work force in the new economy, that large group of higher-paid technical, professional, and managerial workers whose productivity computerization and communication so far has hardly touched. . . .
>
> In the emerging order of the new global economy, those who understand how to use information technology as a productivity booster will do more than ensure the success of their own careers. For productivity growth directly affects the standard of living, and our success or failure in the new global economy. [8]

These ideas imply that in the new world of business, competitive success will depend not so much on the extensive use of labor and capital but on the application of technology to raise the productivity of increasingly limited resources.

What should business organizations then consider in the development of training programs that will prepare their workers for the future?

Training Requirements for Future Work

1. *The new breed of workers who will be handling computerized equipment will expect to be given higher level skills and consequently expect more responsibility.* Because their jobs will demand more of their abilities, they will desire more recognition, over and above their pay, and they will search for

better opportunities. Companies in turn can derive much from the "new worker elite," as this group has been baptized by Louis S. Richman in **Fortune** (August 22, 1994):

> The new power of the technical work force is not only liberating employees from the monotony of the industrial age, but it is also providing companies with the know-how to alter their destiny — to make competitive leaps, to break into new markets, and to offer their employees wider horizons and far more opportunities than any generation of workers has encountered before. [9]

2. *Companies must modify their human resource programs to provide training to employees that have flexible work schedules and dispersed locations*. The value of computer-based training (CBT) in this regard cannot be overstated.

> The core strength of CBT is the flexibility it offers in that training can take place at any time or place without supervision. This offers significant flexibility for professionals who may be stretched thin during normal business hours an. who would rather learn at their own pace at a time that is more convenient. In addition, given CBT's self-paced and personal nature, it can be less intimidating for those that do not care to share their level or lack of proficiency with others. Therefore, it is convenient for those who do not want to admit that they 'don't know.' [10]

CBT is ideal for teaching stable, well-defined processes that do not require instructor-trainee interaction or hands-on learning. In less sophisticated manufacturing organizations, as predominate in this country, CBT would be very useful.

Unfortunately, the results of the PSTD survey of private business indicate that the potential of CBT is not fully explored, mainly because of lack of information on how it works and where it is most appropriate.

The Conference-Workshop on the Use of Computer-Based Training in the Business Sector identified three key results areas for which the group developed specific action plans: experience, expertise, and management support. A summary of the proposals is given on page 40.

Strategies and Action Plans for the Use of Computer-Based Training in Business

Key Result Areas	Strategy	Specific Action	Resources	Timetable
• Lack of success stories	• Create a pilot project	• Identify the *guinea pig*	• Design Team	• Feb. 1995
• Lack of design expertise	• Train	• Get an expert • Publish a newsletter	• Hardware • Software • Content, instructional, audio, video expert	• Feb. 1995
• Lack of top management appreciation of CBT	• Educate • Promote the use of CBT • Develop pilot projects • Educate on computer operating systems	• Present CBT in next PSTD conference • Publish quarterly newsletter • Bring decision makers to venues where CBT can be presented • Work at customer service; orient companies • Network among groups to reduce costs • Enhance computer skills	• PSTD	• Oct. 1995

CBT has lately been replaced by an even more advanced technology called interactive multimedia.

3. *Optimize the use of multimedia technologies.* The combination of video, computer presentation software, slides, and lectures is the forerunner of multimedia platforms.

> Integrated voice, text, music, graphics, and video stimulates the learner in a multimedia training session. These images and sounds engage all the learner's senses. It has demonstrated that the more senses are involved in the experience, the deeper the understanding of skills. Still photos, technical drawings, or illustrations show information like construction details or test results. Charts and graphs are animated, displaying their messages more effectively.
>
> With multimedia, learners can be involved actively in a simulated work environment, acquiring skills and knowledge in the context of how they are used in day-to-day business activities. As learners perform work-related tasks, they are informed about the process that goes behind the task. Because learners understand the processes, they can apply these skills creatively to different situations in the future. [11]

The advantage of multimedia lies in the speed at which a learner will be able to acquire skills required to perform certain tasks. This will not only facilitate retraining when the processes that a company uses change, but it will also be a remedy to what has been perceived as inadequate preparation of school graduates who enter the workplace.

3. *Today, education and training in business are being relied on not only to improve the skills of workers at their jobs but to direct workers to meet strategic corporate goals.* Technologies are enabling workers to contribute more directly to the business.

> . . . The need to create a link between education and training efforts and strategic corporate goals is getting stronger and stronger. This relationship, which stems from innovative corporate initiatives such as employee empowerment, total quality management,

> or business process reengineering, has introduced a range of factors and expectations which impact both the reasons companies seek out training for employees and the type of training sought.
>
> . . . The goal of the education and training department is [also] being restated in terms of improved or increased employee performance, not simply the number of classes taught and attendance during a given time period. This objective requires that an emphasis be placed on assessing the positive impact of education and training programs on specific business operations. Quantifiable gains in employee knowledge and/or productivity must be obtained and methodologies for gathering this data are being developed. [12]

Workers thus become more than unthinking automatons, performing the same tasks over and over. The wider perspective given them by computer programs that show how their work fits into the company's total operations opens opportunities for them to introduce improvements in the way they do things.

The implication to traditional training departments in companies is that they will get out of step with the times if they are unable to revise their view of worker development. Already, businesses are decentralizing training services and making these distributable to the desktop. [13]

4. *Management must build into employee training programs real improvement or performance measures.* The training unit needs to establish methodologies to gather data and administratively measure gains in employee knowledge and productivity.

> As technical complexity increases and IT becomes more critical to business operations, customers of education and training services require hard-and-fast proof of the effectiveness of a training program. Customers seek *a priori* performance guarantees and measurements of the return-on-investment of education and training activities. This places the supplier [of IT-based education and training services] in a position that requires it to develop training management capabilities, skills that are very

different from those required for implementation.

> The interest in certification programs reflects a similar phenomenon. Employers are seeking ways to qualify the technical skills of their staff and identify the true capabilities of potential employees through formal certification programs .... Certification programs are viewed as an important step in understanding and managing the skills of the technical base. [14]

In the same way that skills required for production work are changing, so are skills required to manage operations. Needless to say, management itself must undergo retooling, if it is to effectively implement the new approaches presented by technological innovations.

In summary, many changes wrought by technology are taking place in the work setting. It would do well for managements to prepare for these changes. Some initiatives and experiences that they can look to are the following: [15]

- Carnegie-Mellon University is pioneering in the advancement of education along seven broad thematic lines:
  - Simulating real-life environments
  - Enabling self-paced learning
  - Lowering the intimidation factor (that is, fear of looking stupid)
  - Reducing behavioral problems in the classroom
  - Increasing one-on-one interaction
  - Providing access to more information
  - Implementing "situated learning"
- As networking, multimedia, mobile technology, and better software converge, schools and companies are discovering new ways to improve learning, increase information access, and save money.
- In the information economy, knowledge is power. However, traditional teaching cannot match demand mainly because it is outmoded, expensive, and slow. New technologies can make learning more efficient and productive.

- In companies, centralized training is now giving way to distributed "just-in-time" learning. The result is increased flexibility, better retention, and lowered costs.
- In schools and colleges, students surf the Internet, use Lotus Notes, exchange E-mail, peruse multimedia CD-ROMS, and perform simulations. These techniques break down barriers, customize instruction, and make education more cost-effective.

- Technology alone is not the solution. Reaping benefits of computers first requires extensive teacher training, new curricular materials, and, most important, changes to educational models. For instance, computers permit -- and make economically feasible -- the return of a very old educational model: apprenticeship.
- With computers, teachers become facilitators, collaborators, and brokers of resources. The networks have the information but the students need a guide.
- With networks and mobile access (such as through notebook computers), time and space dependencies of learning are eliminated.
- Applying technology can result in:
  - Stimulation of curiosity, creativity, and teamwork
  - A changed role for the teacher
  - Reemergence of the apprenticeship model
  - Reduced intimidation and frustration among students
  - Reduced behavioral problems and improved concentration and self-image
  - Access to more information (that is, background on demand)
  - Breaking down of the walls of the classroom, integrating home, town, and world.
- In converting to computer-based training, organizations can adopt these Five Golden Rules:
  1. Computers should be used to enhance, not replace, the teacher, and supplement, not supplant, traditional teaching methods

2. No more than 50% of the total information technology budget should be spent on hardware, 30% on software, and 20% on support.
3. It is good to find local partners to help with purchasing, specially of support services.
4. All computers should be networked with outside access.
5. The best pilot classes for any new technology are those that teach teachers to use that technology to enhance learning.

At this time, considering the minimal use of new technologies even in the corporate world, the preceding reminders may seem premature. Yet, improvements in this field are occurring almost by the month. Our position is that, even now, organizations must prepare for the use of technology in training because the trend is for hardware and software to become more accessible and more affordable.

Less than 20 years ago, XTs and ATs began appearing on the desks of workers in the Philippines. Today, these first-generation personal computers have been discarded for the more versatile 386s and 486s. It is just a matter of time before the next innovation becomes a normal part of the work flow.

At Duke University, a course called 2001: A Media Odyssey introduces students to Internet. For all its success in "rescuing those caught between wired-from-birth kids and middle-aged computer whizzes," **Time** magazine's special issue on *Cyberspace* gives it a limited shelf-life:

> Though the quick pace of change ensures that Duke's 2001 is little more than a stopgap remedial course for the time being, Fulton's (Katherine Fulton, the teacher) students will nonetheless graduate with valuable basic knowledge of the modern tools of communication. Soon after the new millenium rolls around, however, such a catch-up Odyssey will probably be unnecessary -- at Duke or anywhere else. By that time it will have become the 21st century equivalent of that 1950s relic, the typing class. [16]

We are left with no choice but to keep pace.

CONCLUSION

A Policy Response to the Challenge: The Establishment of a Leading-Edge Educational Technology Center

I. GENERAL PLAN

The aim of the move to establish a leading-edge educational technology center is to achieve excellence through the effective use of leading-edge educational technologies for education and training.

A National Center for Leading-Edge Educational Technologies (LEET) will seek to create awareness of, enthusiasm for, and working models and programs in the use of advanced educational and training technologies available worldwide. It

will involve various sectors of society to promote and propagate the use of LEET in education and training systems in the country.

LEET will accelerate the application of advanced technologies in the design, development, conduct, and administration of education and training. Training technologies deliver education and training based on high levels of interaction between the learner and the computer. The learner absorbs better, faster, and in a more consistent manner. Furthermore, training technologies have the potential of reaching out to large audiences in a cost-effective manner at the time of need.

The adoption of leading-edge technologies may yet solve some of the problems that plague the country's educational system. So many classrooms may no longer be needed if training can be delivered using mass media. Economies of scale, that is, the need to bring together many students to make investment in education cost-effective, will no longer be an issue. Nor will there be the added cost of transporting students who live in dispersed areas to centers of learning and providing them accommodations.

The inconsistent delivery of content and instruction because of differences in teacher competency and frame of mind will be minimized with the use of standardized courseware. Even teaching capability may be improved through programs that upgrade teachers' knowledge. More importantly, training and education can be adapted to the varying learning capabilities of students. Technologies will enable organizations to provide training where and when the trainees need it.

The LEET Center will be a resource and development center that will bring the country into the thick of the information revolution. It can take any form -- a centrally located physical establishment in which all activities will be undertaken; a network of satellites managed by a core group; a combination of the two; or some other appropriate organizatior It will be fully equipped and staffed to meet its objective of educating

and exposing the most inquisitive minds to the myriad possibilities of leading-edge educational technologies.

The LEET Center will house the following:

- A gallery of exhibits and applications of advanced training technologies in such areas as Computer-based Training (CBT), Interactive Videodisc Instruction (IVI), Digital Video Instruction (DVI), Computer Managed Instruction (CMI), Interactive Multimedia Instruction, Video Conferencing, the Information Highway (that is, Internet), databases (such as Dialogue), and Electronic Performance Support;
- Training rooms fully equipped with multimedia personal computer workstations for the conduct of computer-based training programs;
- Laboratories for research and development in training technologies;
- Auditorium and Electronic Classroom for presentations and demonstrations to groups of people;
- Resource area that will contain reference materials on the use of training technology and technology-based training courseware.

The potential offered by educational technologies is limitless, and the LEET Center will be a vehicle through which this potential can be realized. The Center will provide new tools to the country's studentry and workforce in the new Information Economy where knowledge workers -- that large group of higher-paid technical professionals -- will be the predominant movers.

The LEET Center will demonstrate and promote the use of technologies in creating new and innovative education and training programs to help in the development of a globally competitive and motivated Filipino workforce that will fulfill our vision for the year 2000 and beyond.

The Workplan for the establishment of the LEET Center is included in this monograph as Appendix C. The plan projects a preparatory period of three years during which the following activities will be undertaken:

- Establishment of the Center proper
- Collection and dissemination of information
- Training and development
- Materials development
- Telecommunications and networking

Already, there exists a wealth of materials to which the Center's staff can refer in developing local courseware. Described in the following section are some of these projects and resources that the Center can access.

II. PRACTICAL APPLICATIONS

A. Awareness Raising or Enhancement

1. Adult Component

The Center can undertake projects by itself or in cooperation with appropriate agencies to raise the level of awareness of various clientele groups on the capabilities of interactive multimedia technology for various applications. Some of these are suggested here.

- Skills Accreditation

  This is a program in which people who can demonstrate certain skills can be given accreditation through computerized testing and equivalency standards. An example would be a driving test to establish competencies in theoretical knowledge of road rules and safety procedures. This type of test is already being done in advanced countries such as the U.S.

- Societé Générale de Surveillance Clean Report of Findings (CRF) System/Philexport - Export Development Council/Bankers Association of the Philippines

  These organizations can tap the capabilities of the new training technologies to assist them in

disseminating information to their clientele at the time and place this is needed.

- Higher Education

  A model for this is the Carnegie Mellon University in Pittsburg, Pennsylvania, where millions of dollars have been invested in multimedia research and projects. Its students, faculty, researchers, and scholars are involved in projects dealing with multimedia technologies and their applications. Carnegie Mellon has been a pioneer in combining computing, communications, and entertainment technology for years. Current projects range from a virtual art museum to machine translation, from new video compression techniques to wearable computers. This is one of the centers of excellence that the LEET Center staff could visit to gain appreciation for and concretize their ideas on interactive multimedia applications.

  In higher education and training, Carnegie Mellon has embarked on the following major multimedia projects:

  - *Course Processor*, a highly successful multimedia classroom paradigm that provides educators with techniques and tools to integrate multimedia into the traditional classroom setting. The system also allows educators to extend the experience into an Electronic Agora, an electronic meeting place for students to continue discussions outside of class supported by a networked multimedia environment.
  - *Just-in-Time Learning*, a multidisciplinary project integrating traditional teaching pedagogy (just-in-time lecture) with the assets

of archived media (just-in-time library), enabling users to interact, modify, or annotate lecture and training materials. Computer simulations enable related experimentation (just-in-time laboratory). It provides low-cost "capture" and edit at the desktop with the goal of generating "production quality" multimedia presentations and teaching materials, an analog to today's desktop publishing.

- *Instructional Design-Based Curriculum Analysis and Synthesis Project (IDEAS)*, a program that supports the design of a sound and complete curriculum for virtually any education or training system. Computer analysis tools give feedback to the designer. The IDEAS instruction delivery system then uses the curriculum design to automatically choose lessons for the student.
- *Business Education Programs and Projects* include the Distance Learning through Videoconferencing project; the Experiential Learning Center, which teaches business students economic theories of market behavior, gives them hands-on experience in trading in electronic exchanges, and teaches them how to design artificially intelligent traders; the Financial Analysis and Securities Trading (FAST) Room, a program that uses workstations with real-time data feeds and advanced trading software to recreate the trading floor of a stockmarket; a Multimedia Classroom equipped with one-point control for using several media; and Carnegie Mellon's Virtual University (CMU-VU), which provides remote access to the university's education programs for a wide

variety of end-users including alumni, corporate executives, small business owners, production/service employees, and professional retrainers.

- *Advanced Learning Technologies Project,* which resulted in the development of the world's first artificial intelligence-based all-digital video simulation. It creates a captivating virtual reality workplace. Users experience group-process communication and interactively participate in one of several roles. The result is an intelligent tutoring/interactive digital video system that provides self-paced education while replicating the interactive and adaptive aspects of classroom-style, group-paced education.
- *Art and Multimedia Technologies,* a program offered by the university's Department of Art in the form of 8 undergraduate Media Studio courses and 14 advanced offerings in Electronic and Time-based Work to help students explore their creativity using multimedia technologies.

Another model for Higher Education is the Texas Center for Educational Technology established by the University of North Texas. This was the product of the Texas Board of Education's policy document, "Long-Range Plan for Technology: 1988-2000" and the approval by the U.S. Senate of Senate Bill 650 in 1989 which dealt with the uses and applications of educational technology in public education. The Texas Center was created to be a self-sustaining institution with a membership consisting of schools, colleges, and private companies.

- Government

  The Civil Service Commission (CSC) and the Professional Regulation Commission (PRC) may embark on a program for training as well as testing and accreditation for government employees and the country's professionals using the new training technologies.

  President Fidel V. Ramos has, in fact, approved the full computerization of all government licensure examinations administered by the regulatory boards under the PRC. Executive Order 200 instructs the PRC to issue guidelines to implement the PRC information technology scheme. The guidelines will cover examination objectives, standards, and nature; operation of a computerized test bank; correction of test papers and grading; deliberating; decoding; and release of test results.

2. Children and Youth Component

- Basic Education

  The cooperative project known as Continuing Science Education Through Television (CONSTEL), which offers teachers televised training in elementary science, physics, and chemistry, will upgrade teacher competencies in teaching these subjects. CONSTEL was launched on November 11, 1994 over the Public Television Channel 4. It consists of 40 episodes of 30 minutes each targeted at third and fourth year high school students and fifth and sixth grade teachers.

- Learning Technologies for Basic Education Project (LearnTech)

  This project, administered by the Education Development Center, Inc. (EDC), is supporting

developing countries in the appropriate use of technologies to address critical needs in basic education, teacher training, and out-of-school learning for children, youth, and adults. It is rooted in almost 20 years of research and development involving the use of Interactive Radio Instruction (IRI). It uses various learning technologies to improve educational quality, pupil access, and teachers' skills. LearnTech has already moved toward the use of computer-based training and multimedia instruction for instructional delivery in basic education.

- Collaborative Courseware Development

  This is a program initiated by one of the private schools associations to develop multimedia courseware for use in schools in collaboration with a personal computer distributor. It will enable schools to share resources that would otherwise be expensive for just one school to implement.

- Carnegie-Mellon University

  Carnegie-Mellon has also pioneered programs for use in children education. Some of these are described below:

  - *Cognitive Tutors Program*, a program that hopes to combat illiteracy and promote learning across a broad front. The work with intelligent tutors is highly cross-disciplinary and finds its focus in the Center for Design of Educational Computing at the university. Carnegie Mellon is the sponsoring agency for a large educational technology consortium called the Pittsburgh Area Educational Consortium. Its members include the Pittsburgh Public Schools, the Maya Design Group, Educational Testing Service, Apple Computers, several regional educational

entities and school districts, and the federal government.

- *Project LISTEN* offers a new approach to combating illiteracy by enabling computers to listen to children as they read aloud and prompting them when they stumble or make mistakes.
- *Computer Music*, an area in which Carnegie Mellon is a leading center for advanced research. Among its achievements in this area are a process of synchronizing music with live performance, a new technique for the synthesis of realistic orchestral instrument tones, the Video Harp musical instrument, and systems for interactive music and graphics. Computer composition software is under development at the Studio for Creative Inquiry.

- Computer Laboratories Program for Secondary Schools

  The Center for Corporate Citizenship, in collaboration with the Department of Science and Technology (DOST), is introducing this program to provide basic computer literacy training to high school students. The program aims to establish computer laboratories in public high schools to enable them to include computer literacy and proficiency subjects in their curriculum, raise students' level of interest in science and mathematics through hands-on computer classes, and improve the academic performance of students in science and math.

  A standard laboratory, as designed by the Science and Education Institute of DOST, will contain 30 computers, computer tables, and the appropriate electrical wiring, lighting, and air-

conditioning systems. The total cost of putting up one laboratory in a room to be provided by the school is ₱680,000. CCC hopes to attract corporations to make their social investment by donating these laboratories.

- Centre for Educational Technology

  The Centre for Educational Technology (CET) in Israel, established in 1971 as an independent organization, leads in the development of multimedia courseware for basic education for children, even for those with disabilities. CET's programs involve close cooperation with the Ministry of Education and Culture, the Ministry of Labor, the Israel Defense Funds, and the Educational Television Station.

3. Vocational-Technical Training Component

- Maintenance
  - Digital Equipment Coporation (DEC) found that interactive video reduced the training time for service engineers by as much as 47 percent compared to self-paced instruction. Furthermore, DEC was able to save about $40 million a year due to the accelerated learning cycle and decreased laboratory equipment requirement.
  - ICOM saved $26 million over five years by using CBT for telecommunications equipment maintenance because it reduced staff and facility requirements. It estimated that $3 million in revenue was lost in a single year because the equipment was removed from the field to be used for training.

- Training in hazardous occupations
  - Simulation for the training of car, truck, and heavy equipment operators resulted in faster training with no accidents.
  - Simulation for the training of aircraft pilots and navigators resulted in considerable savings without loss of training quality.
  - Simulation or CBT for the training of crane operators in container yards saved time, money, and equipment downtime, and minimized accidents
- Trade Testing
  - The theoretical part of a trade test can be done more reliably, with immediate feedback, using computer-assisted testing. The computer generates the relevant questions at random thus preventing cheating. The data base of item banks is easy to expand, correct, or modify.
  - Certain skill tests for welding, automotive mechanics, and consumer electronics can be simulated accurately with multimedia software.

B. Action

- Distance Education

  Distance education programs aim to remove spatial and temporal constraints through new concepts in education such as lifelong education, remote education, just-in-time education, portable education, and modular education. Technology can offer opportunities to provide the learning materials and experiences to a wide clientele at reasonable cost.

  The UP Distance Education Program, patterned after the United Kingdom's Open University, consists of 80% print materials and 20% videocassettes and

tutorial and examination materials. Through the UP Los Baños DZLB school-on-the-air radio program and the diploma program for science and mathematics, teachers provide rural audiences in Southern Tagalog and teachers in high school access to a UP education. Action is needed to upgrade some of the materials, starting with key modules of the program, to make them appropriate for interactive multimedia.

House Bill 13484 proposes the institutionalization of the open university system in the country to allow millions of people to earn college and post-high school degrees without having to go to the classroom. This measure seeks to elevate the quality of manpower to help develop the Philippines into a newly industrialized country. The authors of the bill are confident that this proposal will speed up the entry of the Philippine community into the "information society" that discards the walls of the conventional classrooms in favor of mass education by electronic media.

Rep. Victor Ortega (La Union), chairman of the public works committee, said that, "The information society, remarkably envisioned by futurists such as Alvin Toffler, is virtually here and now, and unless the educational system, whose modes have long become archaic, is not changed, the Philippines is bound to be left in the olden days." The enactment of the bill will boost the country's push toward the Information Age.

- Teacher Education Testing and Upgrading

A program to test teachers for certification purposes may be established using the new technologies. The Commission on Higher Education can set up and oversee such computer-assisted testing or use the adaptive testing approach to determine the strengths and weaknesses of teachers. Once these are determined, training programs can be developed to enhance teacher competencies.

- Training of Instructional Designers

  The Commission on Higher Education can develop college and post-graduate programs that will produce instructional designers who will develop learning approaches and materials to meet our education and training needs in the different sectors. These instructional designers will be equipped with the knowledge and skills to make learning and not just teaching more effective.

- Accreditation of Scholastic Achievement

  The CHED and DECS can collaborate on a program for accrediting students who have gained mastery of subject content areas through a system of equivalency testing and accreditation using computer technologies. This will be consistent with the UNESCO program of Education For All (EFA) which is being implemented by DECS.

- Skills Certification

  The TESDA, likewise, can establish a skills certification program through a system of computer-assisted testing and accreditation.

- Professional Testing
  - *Financial Management Practitioners.* The Financial Executives Institute of the Philippines (FINEX) may lead in the effort to establish professional standards and certification of financial management practitioners in the country. A person seeking professional status can take a computer-assisted test to establish his competency in financial management.
  - *Insurance Practitioners.* In the same manner, insurance professionals can be certified through a testing and accreditation program that will be facilitated by computer technology and advanced testing methods.

- Networked School Information System

  One of the projects discussed during the 11th Asia-Pacific Economic Cooperation-Human Resources Development Working Group (APEC-HRD-WG) meeting in Manila in January 1995 was the development of a networked school information system (NETsis) for all APEC member economies. This system will facilitate informational and educational exchanges and cooperation among APEC member countries. It will also enable school administrators, teachers, and students to interact with educational sources across schools, regions, and nations, eliminating the physical constraints of their environment and expanding the scope of their educational experiences and practices. This will be an additional resource similar to Philnet/Internet which is already available in several educational institutions and government agencies.

- High-Tech Courses of the Software Development Institute (SDI)

  SDI was formed through a grant from the Japanese Government to the Department of Trade and Industry and the National Computer Center. Its objective is to train trainors of software developers. This can be met through the use of interactive multimedia tools under an apprenticeship type of learning model.

III. PREREQUISITES

The action plans hold the promise of a brave new world in education. Yet, this is not so easily reached as cyberspace is for a computer buff. The groundwork -- what President Clinton of the United States refers to as the Information Infrastructure -- needs to be laid out. This has many components:

A. Policy Issues

Many organizations will be involved in such a broad and far-ranging undertaking as the computerization of the educational system. These are some of the major requirements:

- Financing of hardware and software acquisition and physical facilities; setting up of hardware and software standards where they are needed
- Training of teachers and trainors in new training technologies
- Hiring and training of instructional designers and courseware developers
- Software development/customization including establishment of software and documentation standards (also courseware)
- Curricular reform in schools to integrate new training technologies

B. Legislative Agenda

Government support is urgently needed not only in terms of funding but in enabling legislation both to accelerate response from organizations and to provide incentives and protection for those that will take the lead in this evolution. Some of the areas for government support are as follows:

- Setting up of LEET Foundation with seed money from the government
- Inclusion of LEET in NITP 2000
- Provision of tariff exemption for hardware/software imports for educational/training purposes
- Adoption of legislation that would require companies to allocate a certain percentage of their payroll for training of employees similar to Australian and French models

- Installation of safeguards for software and intellectual property rights
- Designation of Information Technology Month to promote public awareness of IT and encourage support from government, industry, and the academic community.

C. Resource Requirements

The resources that need to be mobilized to accelerate the adoption of leading-edge educational technologies may seem massive and impractical for a struggling country like the Philippines. Yet those resources, in fact, already exist. These are mainly:

- Funds for physical infrastructure, equipment, software and training, research and development programs of the Center
- People (IT professionals, instructional designers, courseware developers, graphic artists, educators, trainers, administrators, and others)
- Funds for hardware and software maintenance and upgrading
- Telecommunications infrastructure

A FINAL ARGUMENT

The debate on whether or not the Philippines is ready to move into the Information Age will most probably end up with the issue of economics. Will the government set aside large sums of money for hardware and software when funds are equally, if not more urgently, needed to provide employment, housing, health, and all the other things people need to survive? They must be given priority, indeed. But so must the acquisition of new technologies because they are the key to present-day economic movements.

What may be forgotten in the heat of the argument is the fact that information technology, like all other human creations, are just means to an end. The ultimate goal is and will always be a better quality of life for the people. We say, if leading-edge educational technologies will enable Filipinos to find better jobs, engage in more businesses, obtain basic services faster and at less cost, then they will have served their purpose.

The other major consideration is that, like it or not, our country is now part of the world economy. The other nations of the world will not wait until we reach a national consensus on the wisdom of getting into the information highway. And if the next generation of our country's leaders do not learn the parameters and potentials of this realm, we shall surely be left behind.

Certainly, this is not a life-and-death concern for education practitioners. But at the rate technologies are being introduced in daily life, our educational and training institutions may soon find themselves "spaced-out," with computers and media taking over their responsibilities. Do we wait for their existence to be threatened before we adapt?

So we say again. The time to modify our educational system is now. Tomorrow, literally, may be too late.

APPENDICES

A. Text of House Bill No. 12328: An Act Creating the Leading-Edge Educational Technologies Foundation

Republic of the Philippines
HOUSE OF REPRESENTATIVES
Quezon City

Second Regular Session

House Bill No. 12328

Introduced by Honorable Escudero III, Ecleo, Jaafar, Paredes, Jr., and Tupas

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EXPLANATORY NOTE

Among the main problems confronting the educational system in the country today, aside from lack of adequate funds and low teacher salaries, are staffing problems in remote school sites, educational inequities in terms of access and quality of education, and inadequate in-service training of teachers.

These problems are found in other parts of the world and they have found that adopting emerging educational technologies in the education marketplace are effective in addressing these problems. Thus, Holler (1990) talks about the application of telecommunications technology to distance learning which is live video teleconferencing in the business environment. Another innovative delivery approach is the use of mobile automated learning labs or MALLS found in pilot areas of the U.S.A. Brooks and Perl (1990), on the other hand, underscore the increasing availability of interactive training systems and the development of multi-media/hyper-media equipment that combines sound, pictures, and full motion video into computer software systems.

There is no doubt that the effective adoption of these technologies will also revolutionize Philippine education as in developed countries in the world. However, our country has limited resources in developing indigenous leading-edge educational technologies. We also need to be judicious in adopting these technologies, i.e., when they become more affordable. This will take place either because the costs would have dropped significantly or because of the recognition that benefits have expanded exponentially or both. However, we should take care that we do not end up with obsolete, hand-me-down educational technologies just because they are inexpensive or donated to us.

This Bill seeks the establishment of a Leading-Edge Educational Technologies (LEET) Foundation which will support a national center designed to bring together the academic, technological, and economic forces that, only in consort, can advance the educational promise of affordable technologies. It will be dedicated to the develop-

ment of the appropriate educational materials for use in these emerging technologies. To be able to do this, we need to train people to be LEET experts and acquire the critical mass of equipment and software, centrally located in a high-technology facility.

The LEET Foundation will be a private sector and government partnership with more of the private sector initiative into it. Its thrust would be education and information technology combined, but its operations should have a heavier emphasis on the information technology aspects.

The Board of Trustees will be representatives from computer software developers, hardware manufacturers, educational institutions, government agencies, and private business. The LEET Foundation will be headed by an Executive Director who will be working with the Bureau of Trustees and an Advisory Committee in determining the Center's agenda and future directions.

The LEET Foundation will be created to focus the collective resources of government and the private sector into a national force for innovation in education. It will be a government-recognized foundation with initial capital endowment from the national government. The project could be submitted to the Philippine Aid Program (PAP) for funding. Alternatively, it could be sponsored by UNDP, playing a role similar to what it did in the formative years of the National Computer Center.

Private sector support for the LEET Center can be enlisted through membership by companies or organizations for a specific period of time. Their contribution to the LEET Center will come in the form of funds, personnel, and equipment particularly at the initial stage. Program expenses can be raised from gifts, grants, endowments, and funds raised from donors and the company memberships.

The LEET Center will train educators, trainors, and practitioners from across the nation to influence the directions of educational technology. The premise is that educational priorities should lead, rather than react to, the development of affordable educational technologies. The goal is to assemble a high-technology facility for accessing leading-edge hardware, software, and materials and a core

of leadership to determine these priorities and to bring technology to bear on them as appropriate. First priorities will be areas of manpower development and the educational curricula that are of broad importance and that are amenable to the educational promise of technology.

In view of the foregoing, approval of this Bill is earnestly requested.

(SGD) SALVADOR H. ESCUDERO, III

(SGD) GLENDA B. ECLEO
(SGD) CEFERINO S. PAREDES, JR.
(SGD) NUR G. JAAFAR
(SGD) NIEL D. TUPAS

Republic of the Philippines
HOUSE OF REPRESENTATIVES
Quezon City

Second Regular Session

House Bill No. 12328

Introduced by Honorable Escudero III, Ecleo, Jaafar, Paredes, Jr., and Tupas

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AN ACT
CREATING THE LEADING-EDGE EDUCATIONAL TECHNOLOGIES FOUNDATION, PROVIDING FOR ITS ORGANIZATIONAL STRUCTURE, POWERS AND FUNCTIONS, AUTHORIZING THE APPROPRIATION OF FUNDS THEREFOR, AND FOR OTHER PURPOSES

Be it enacted by the Senate and House of Representatives of the Philippines in Congress assembled:

SECTION 1. *Title.* - This Act shall be known as the "Charter of the Leading-Edge Educational Technologies Foundation."

SECTION 2. *Declaration of Policy and Objectives.* - It is hereby declared the policy of the State to rationalize and integrate a comprehensive approach in bringing together the academic, technological and economic forces which will initiate, promote, sponsor, assist, pursue, support and conduct programs, projects and studies geared towards training, research, development of the educational promise of affordable technologies and other related sciences or fields of endeavor.

SECTION 3. *Leading-Edge Educational Technologies Foundation: Creation and Principal Place of Business.* - To implement the state policy and pursue the objectives of this Act, there is hereby

created a non-stock, non-profit, non-sectoral and non-political body corporate to be known as the Leading-Edge Educational Technologies Foundation, hereinafter referred to as the Foundation, which shall be organized and created in the public interest.

The Foundation shall have its principal place of business in Metro Manila, Philippines: *Provided, however:* That the Foundation may, from time to time, establish and maintain branches in or outside of the Philippines whenever such action is necessary or requisite in the furtherance of the purposes and objectives of the Foundation.

SECTION 4. *Corporate Powers.* - Aside from the general powers, rights, privileges and attributes allowed or permitted by law, the Foundation shall have the following powers and functions:

(1) To design and develop training programs using leading-edge educational technologies for knowledge transfer and skills training;

(2) To develop training programs using strategies and media appropriate to identified target audiences;

(3) To prepare and implement an accreditation and equivalency program using leading-edge educational technologies for students from the informal and non-formal sectors to enter the mainstream of formal education or the world of work in business and industry;

(4) To initiate and conduct seminars, publications, reports, workshops, educational campaigns, conferences, conventions, fora, and symposia on matters, subjects, and topics pertaining to or involving leading-edge educational technologies significant to practitioners, teachers, students, and private and public entities;

(5) To collect, compile, collate, evaluate, analyze, and study activities, data, and materials pertaining to or involving leading-edge educational technologies and to this end to publish or disseminate information through researches, studies, workshops, conferences, symposia, or fora and other activities of the Foundation;

(6) To review general and specific/disciplinary hardware/courseware tools from educational perspectives;

(7) To develop functional requirements for new educational/training tools;

(8) To study the implications of technology for the areas of the curriculum;

(9) To legitimize the role of instructional technology in the educational community;

(10) To develop prototype tools, software, and educational materials in response to identified needs;

(11) To facilitate collection and serve as clearing house of literature on leading-edge educational technologies;

(12) To aid, assist, or coordinate with any individual, corporation, association, organization, or entity, public or private, in the achievement, pursuit, and conduct of any or all of the foregoing activities and objectives;

(13) To acquire, secure, or obtain by purchase, lease, barter, or any other legal means of acquisition such real and personal properties as may be necessary and proper to maintain its offices or facilities, or to carry out the programs or projects initiated, sponsored, or assisted by the Foundation;

(14) To raise and maintain a fund with which to compensate its operating management and staff and to finance the programs, projects, or undertakings which the Foundation has initiated, promoted or conducted;

(15) To receive and accept funds, real or personal properties, in the form of donations and/or grants in the furtherance of the purposes and objectives of the Foundation;

(16) To invest the funds of the Foundation in such securities or investments as may be deemed advisable in the furtherance of the objectives and the purposes of the Foundation, and in connection thereto, to enter into any and all kinds of contracts, arrangements and undertaking, not contrary to or prohibited by law, with any person, corporation, or entity;

(17) To borrow money or funds or obtain and/or arrange such credit or credit accommodation as may be required or necessary for its operations, programs, and projects and in connection thereto to secure the same by pledge, mortgage, or other lawful arrangements; and

(18) To perform and engage in any and all acts, matters, and things which may be necessary, proper, and convenient for the accomplishment or achievement of the objectives and purposes of the Foundation.

SECTION 5. *Board of Trustees.* - The Foundation shall be governed and its activities shall be directed, controlled, and managed by a Board of Trustees that shall be composed of nine (9) Trustees. The members of the Board of Trustees of the Foundation, who are to serve until their successors are elected and qualified as provided by the by-laws of the Foundation, shall be as follows:

(1) Secretary, Department of Education, Culture and Sports;
(2) Secretary, Department of Labor and Employment;
(3) Secretary, Department of Science and Technology;
(4) President, National Public Broadcasting System;
(5) President, National Inter-University Forum on Education;
(6) Representative, Philippine Chamber of Commerce and Industry;
(7) Representative, Employers Confederation of the Philippines;
(8) Representative, Trade Union;
(9) Representative, Information Technology and Coordinating Council.

For the purpose of the composition of the first Board of Trustees, the President of the Philippines shall appoint the local and international organizations and donor governments, and enlist companies or organizations to raise gifts, grants, endowments, and funds from donors and company memberships.

SECTION 6. *Tax Exemptions.* - The provisions of existing laws to the contrary notwithstanding, all gifts, grants, endowments, funds, and such other donations, personal or real, from donors and company memberships shall be exempt from the donor's or transfer tax.

SECTION 7. *Applicable Law.* - The provision of Batas Pambansa Bilang Animnapu't Walo (B.P. Blg. 68), as amended, otherwise known as the Corporation Code of the Philippines, not otherwise in conflict with this Act, shall apply in a suppletory manner.

SECTION 8. *Effectivity.* - This Act shall take effect upon its approval.

Approved.

B1. Survey on the Use of Computer Technology in Voc-Tech Education and Training in the Philippines

FINDINGS

Technological Development

A general picture of the level of technological development attained by the schools can be seen through the changes that have taken place in the tools, processes, and resources that the schools and educational institutions (EI) have acquired, introduced, or adapted over time.

The extent of use or accessibility to users of these tools, processes, or resources has revealed the usefulness of these technologies to the schools' own end-users and others who availed of the services and facilities of the responding schools.

Changes in the Field of Educational Tools, Processes, and Resources (People)

Many traditional ways of teaching have been changed with the introduction of computer technology:

a. Things that used to be complicated and tiring to do by hand have become easier to handle with the use of computers. Tasks such as typing, filing, calculating, and communicating by letters have become faster and more accurate.

b. Computer video has allowed information to be displayed on screens in a variety of ways, facilitating projection (highlighting) of information in more ways than one. Video recording and replay technology with the use of video cassettes and video discs have been useful for applications where it is important for students to see how things look or are being done.

c. Audio tapes played on special tape recorders have facilitated storage and recall of certain computer programs or instructions.

d. The graphic ability of computers has also improved presentation of information or data in graphic form. Graphic communication via graphic images, letters, symbols, screen process printing, and xerography has evolved into very potent production processes in technical illustration and advertising. Computer graphics have allowed users to function more independently through use of joysticks, paddles, or pads.

Many information processing methods have also been adopted in education:

a. Processing, storage, and retrieval of information have become the least of the problems of computer users.
b. Documentation has been made easy and ready for re-use.
c. Special work-saving programs have cut most of the editing work required in documentation and report writing.

Many methods of teaching have been adopted in the development of training materials:

a. Courseware have allowed teachers to enrich and extend many classroom activities.
b. Courseware have allowed students to concentrate on creative thinking rather than on meaningless or irrelevant classwork.

Simulations through computers have brought new experiences into the classrooms:

a. Computers as demonstration devices have simulated events that are too expensive, dangerous, or difficult to bring into the classroom.
b. Introduction of computer simulations into the classroom has presented opportunities to develop skills.

Many architecture operations and engineering works have been automated or enhanced through the use of computers:

a. Product and tool designs have been instrumental in increasing the schools' competitiveness.
b. Students are now using computer numerical control panels (such as to program machines to drill holes exactly where needed) in their classrooms.
c. Drafting work and facilities have evolved from traditional to modern through the use of computer-aided designs (and drafting).

Systems and devices for communicating across distances have improved communication (by radio, television, satellites, and other telecommunications media) and interdependent conferences, meetings, and coordination work

With the advent of more support services, tools, and equipment in more affluent, more equipped institutions, students of engineer-

ing, technical schools, and related disciplines have been able to get hands-on experience.

Like the teachers, some students/trainees have been known to have gone into training in specialized institutions (in CMDF for example) here and abroad (such as in Japan under the JICA program) or travel to Korea under certain scholarship or exchange programs.

Assessment of the Extent of Use of Technological Changes in Tools, Processes, and Resources

Knowledge of the use of technologies in the voc-tech system has raised questions of the usefulness of the technologies to the schools/EIs, the teachers/trainors, and the students/trainees.

It appears that it is not enough to know that the technologies exist; what matters is the knowledge of their accessibility to the people it purports to serve.

The study made inquiries in that direction.

INTRODUCTION AND DEVELOPMENT OF COURSEWARE

Introduction and Development of Courseware

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	0.61	1.84	1.84	1.84	1.84	7.98
None	14.11	15.95	25.77	19.63	15.34	90.80
Very Limited	0.61	0.00	0.00	0.00	0.00	0.61
Limited	0.00	0.00	0.00	0.61	0.00	0.61
Extensive	0.00	0.00	0.00	0.00	0.00	0.00

USE OF VIDEO IN TRAINING

Use of Video in Training

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	2.45	1.23	2.45	1.23	2.45	9.82
None	3.68	6.13	9.20	14.11	8.59	41.72
Very Limited	5.52	6.75	7.98	3.07	2.45	25.77
Limited	0.61	2.45	7.98	3.07	3.68	17.79
Extensive	3.07	1.23	0.00	0.61	0.00	4.91

USE OF AUDIO IN TRAINING

Use of Audio in Training

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	1.84	1.84	1.84	0.61	3.07	9.20
None	5.52	6.75	9.20	11.66	6.75	39.88
Very Limited	3.07	6.13	6.75	3.68	3.07	22.70
Limited	1.23	3.07	9.20	2.45	3.07	19.02
Extensive	3.68	0.00	0.61	3.68	1.23	9.20

USE OF GRAPHICS IN TRAINING

Use of Graphics in Training

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	2.45	1.23	2.45	0.61	3.68	10.43
None	3.68	6.75	9.82	14.11	5.52	39.88
Very Limited	2.45	3.68	7.36	3.07	2.45	19.02
Limited	4.29	4.91	7.36	3.07	4.29	23.93
Extensive	2.45	1.23	0.61	1.23	1.23	6.75

USE OF TELECOMMUNICATIONS IN NETWORKING

Use of Telecommunications in Networking

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	3.68	2.45	1.84	4.29	14.11	
None	7.36	9.82	16.56	14.72	6.13	54.60
Very Limited	1.84	5.52	4.29	1.23	4.29	17.18
Limited	0.61	0.00	4.29	2.45	1.84	9.20
Extensive	1.84	0.00	0.61	1.84	0.61	4.91

USE OF COMPUTER-BASED INFORMATION SYSTEM

Use of Computer-based Information System

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	3.07	2.45	3.07	1.23	3.07	12.88
None	2.45	4.29	6.75	11.66	6.13	31.29
Very Limited	4.29	4.29	6.13	4.29	1.23	20.25
Limited	3.07	3.68	7.36	3.07	4.29	21.47
Extensive	2.45	3.07	4.29	1.84	2 45	14.11

TELECONFERENCE

Teleconference

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	3.07	1.84	4.29	1.23	3.07	13.50
None	9.82	12.27	20.86	17.79	10.43	71.17
Very Limited	0.61	2.45	1.23	2.45	3.07	9.82
Limited	1.23	1.23	1.23	0.00	0.61	4.29
Extensive	0.61	0.00	0.00	0.61	0.00	1.23

SIMULATION/MODELING

Simulation/Modeling

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	3.68	3.07	2.45	1.84	3.68	14.72
None	4.29	9.20	14.11	14.11	7.98	49.69
Very Limited	3.07	1.84	3.07	2.45	2.45	12.88
Limited	1.23	3.07	6.13	1.23	1.84	13.50
Extensive	3.07	0.61	1.84	2.45	1.23	9.20

CAD - CAM

CAD - CAM

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	1.84	3.07	2.45	1.84	3.68	12.88
None	8.59	9.20	16.56	17.18	10.43	61.96
Very Limited	3.07	1.84	3.07	1.84	2.45	12.27
Limited	0.61	3.07	4.29	1.23	0.61	9.82
Extensive	1.23	0.61	1.23	0.00	0.00	3.07

UPGRADING/TRAINING OF TEACHERS, TRAINORS, AND STAFF

Proportions of Extensive Users by Regions

Item	NCR	IV	VII	X	XI	Total
			(in percentage)			
Intro/Dev't. of Courseware	0.00	0.00	0.00	0.00	0.00	
Use of Video in Training	3.07	1.23	0.00	0.61	0.00	
Use of Audio	3.68	0.00	0.61	3.68	1.23	
Use of Graphics	2.45	1.23	0.61	1.23	1.23	
Use of Telecommunications	1.84	0.00	0.61	1.84	0.61	
Computer-based Info. Sys.	2.45	3.07	4.29	1.84	2.45	
Teleconference	0.61	0.00	0.00	0.61	0.00	
Simulation/Modeling	3.07	0.61	1.84	2.45	1.23	
CAD - CAM	1.23	0.61	1.23	0.00	0.00	
Upgrading/Trng of Teach.	5.52	6.93	5.52	3.68	4.29	
Internship Trng for Eng'g.	2.45	2.45	1.23	0.61	0.00	

Upgrading/Training of Teachers

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	1.84	1.84	2.45	1.23	3.68	11.04
None	0.00	2.45	6.75	4.29	1.23	14.72
Very Limited	3.07	2.45	4.91	8.59	1.84	20.86
Limited	4.91	4.91	7.98	4.29	6.13	28.22
Extensive	5.52	6.13	5.52	3.68	4.29	25.15

INTERNSHIP TRAINING OF ENGINEERING STUDENTS IN VOC-TECH SCHOOLS

Internship Training

Extent of Use	NCR	IV	VII	X	XI	Total
			(in percentage)			
Not Rep/No Resp	3.07	4.91	2.45	1.84	3.07	15.34
None	7.36	8.59	15.95	12.27	8.59	52.76
Very Limited	0.61	0.00	4.91	4.91	1.84	12.27
Limited	1.84	1.84	3.07	2.45	3.68	12.88
Extensive	2.45	2.45	1.23	0.61	0.00	6.75

INVENTORY AND ANALYSIS OF COMPUTER SYSTEMS

HARDWARE CONFIGURATION ANALYSIS

a. Hardware

No. of Computers by Model and Region

Models	NCR	IV	VII	X	XI	Total
XT/8086						
a*	150	124	75	26	30	405
b*	10	10	9	4	7	40
XT/8088						
a	50	21	144	52	70	337
b	1	2	7	3	3	16
AT/286						
a	120	216	260	85	86	767
b	13	17	20	8	8	66
AT/386						
a	381	297	316	97	203	1294
b	17	20	18	10	11	76
AT/486						
a	34	16	32	11	11	104
b	7	4	7	3	3	24
Others						
a	1	-	2	34	8	45
b	1	-	1	4	1	7

*a no. of computer units
*b no. of schools

b. Hard Disks

Region VII emerged as the region popularly using for its XTs and ATs 20-40 MB hard disks, followed by Region IV and NCR, in that order.

Region IV, along with Region VII, appears to be more inclined to using 80-120 MB hard disks.

c. Memory

The data here show that NCR and Region VII were the show windows of XTs and ATs with memories of 512 Ks - 640 Ks.

On the other hand, Region VII led those using 1MB - 2MBs memory; NCR, those with 4 MBs - 8 MBs memory; and, Region X (with NCR also), those with much bigger capacities, the 16 MBs -18 MBs.

Schools by Region by Memory

	NCR	IV	VII	X	XI
			(in percentage)		
250 K - 360 K	0	0	2	nil	0
512 K - 640 K	5	4	5	4	4
1024 K	2	2	3	2	0
1 MB - 2 MB	8	13	9	5	7
4 MB - 8 MB	6	4	5	2	4
16 MB - 32 MB	1	nil	0	1	nil

d. Monitors

Although colors of monitors are not as important as memory to users of computers, colors are legitimate factors that hold the interests of computer users.

Schools by Region by Color of Monitors

Color	NCR	IV	VII	X	XI
			(in percentage)		
Green	17	2	2	0	0
Paperwhite	0	28	17	12	3
Color VGA	0	10	3	0	2
Color EGA	0	0	0	0	0
Color CGA	0	0	0	0	0
Color SVGA	2	0	0	3	0

SOFTWARE ANALYSIS

a. Operating System

Schools by Region by Operating System

	NCR	IV	VII	X	XI
			(in percentage)		
DOS	20	28	26	15	15
UNIX	0	nil	0	2	nil
NOVELL	nil	2	nil	0	nil
Banyan Vines	0	0	nil	0	0
Multimedia	nil	0	0	0	0
O.S./2	0	0	0	nil	0

b. Word Processors

Schools by Region by Word Processors

	NCR	IV	VII	X	XI
			(in percentage)		
Wordstar	13	11	15	11	9
MS Word	3	4	6	3	2
Word Perfect	4	3	8	3	3
MS Works	0	nil	0	0	0

c. Spreadsheets

Schools by Region by Spreadsheets

Spreadsheets	NCR	IV	VII	X	XI
			(in percentage)		
Lotus 123	22	20	27	17	15
Quattro Pro	5	1	10	2	4
Excel	7	5	11	5	2
Symphony	2	1	1	2	0
Paradox	0	2	0	1	0
Framework	2	2	0	0	0
Sideways	0	0	1	0	1

d. Graphics

Schools by Region by Graphics

Graphics	NCR	IV	VII	X	XI
			(in percentage)		
Harvard	0	4	0	1	1
Pagemaker	0	2	3	1	1
Designer	0	1	0	2	1
Corel Draw	1	2	2	1	2
Newsmaster	1	5	2	2	1
Printshop	0	1	1	1	1
Printmaster	2	1	3	2	1
Storyboard	1	0	1	0	2
Paintbrush	1	0	3	2	1
Flowchart	0	0	1	1	0
Banner Mania	0	1	1	2	1
Desktop Publish	1	0	0	0	0
Ventura	1	0	1	0	0
Others*	0	0	1	1	6

* Publish II (VII); Fontasy (XI); Fast Graphics (XI); Logo (XI); AMIPro (XI); Pro Image (XI); Auto Disk Animation (XI); Instant Artist (X)

e. Development Software

Schools by Region by Development Software

Dev't. Software	NCR	IV	VII	X	XI	Total
			(in percentage)			
Dbase III, IV	6	6	9	5	4	30
Foxbase	0	nil	3	nil	1	5
Foxpro	nil	1	nil	2	1	6
Cobol	1	nil	3	2	1	7
Pascal, Turbo	3	3	3	1	4	15
C, Turbo, C++	2	nil	3	0	2	8
Basic, Turbo	3	nil	5	1	5	15
Clipper	1	nil	3	1	1	7
Micro Assemb.	nil	0	2	nil	0	3
Others	nil	nil	2	0	0	4

f. CAD

Schools by Region by CAD

CAD	NCR	IV	VII	X	XI	Total
			(in percentage)			
AutoCAD	13	13	19	13	6	64
OrCAD	6	0	6	0	0	12
CAD/CAE	0	0	6	13	6	25
Total Respondents (in absolute number)						16

EVALUATION OF COURSEWARE

Assessment of Courseware

Criteria	Rating of Quality of Descriptors 1	2	3	4	5
Clear course objectives	-	-	-	-	xx
Logically organized content	-	-	-	x	x
Clear graphics	-	-	x	-	x
Color not disturbing	-	-	xx	-	-
Adequate exercises for learners	-	-	-	x	x
Difficulty level suitable to learners	-	-	-	xx	-
Pleasing texts	-	-	x	x	-
Course length just right	-	-	-	-	xx
No typographical errors	-	-	x	x	-
Allows follow-up action for teachers	x	-	-	-	x

RECOMMENDATIONS OF RESPONDENTS FOR PILOT COURSEWARE DEVELOPMENT AND END-USER TRAINING

a. For Pilot Courseware Development

Various examples of skills areas were recommended for courseware development by respondents. They are:

- automotive and motor vehicle repair
- electronics
- driving
- maintenance of gas turbine
- welding and fabrication
- RAC
- electricity - housewiring
- radar simulation

- numerical control
- automated office/factor system operation (robotics)

b. For Other End-user Training

For the use of other end-users in administrative, financial, and other specific functions, the following were recommended:

1. Introduction to computers
   - o use of word processors, spreadsheets
   - o use of database
   - o use in budget allocation
   - o data encoding
   - o virus protection and control
   - o hands-on experience with computers
2. Construction of MIS
3. Use of certain software, e.g. CAD-CAM
4. Use in job placement programs, probably in matching student qualification with job openings.
5. Training of trainors and CBT managers.

MANAGEMENT PROBLEMS WITH CBT/COURSEWARE DEVELOPMENT

Problems associated with CBT or courseware development appear to be in four areas:

a. Financing for hardware and software acquisition
Here the main problem cited is lack of financing for hardware and software. Even the more affluent schools are not spared from the twin problems of allocating funds for priority areas and administration of teacher load and physical support facilities for special purposes, among them the siting of computer hardware.

b. High cost of repairing and maintaining equipment
The chief problem here appears to be the prohibitive cost of maintenance of equipment and the recurrent costs for repair and replacement of parts;

c. **Lack of training of teachers**
Not the least of their problems is the lack of training of teachers along the new mode of instructing, not to speak of the schools' prospective problem of time-slotting faculty for courseware development. It appears that it would be difficult for the school management to justify the deloading of a faculty member to develop courseware; and,

d. **Absence or lack of standard guidelines for courseware preparation**
This problems is aggravated by the lack of references for courseware development.

Perhaps it is but fitting for this study to point out some overriding principles to consider in the introduction of CBT or courseware development in schools. Some of these are:

1. Whatever the nature of the institutions, people who would be directly involved with CBT or courseware development should be involved all the way, from the design phase, to development, to validation, to production of the package.
2. Given individual strengths (or weaknesses), work in this regard should be of complementation. As can be seen, going into CBT or courseware development may be feasible for some but may be harder for many schools in the Voc-Tech system, both on the part of the schools' management (deloading faculty) and the procurement of hardware; and,
3. The NMYC should play an important role in this work, preferably with the support of COCED and educational institutions that have the structure that may be transformed or adapted to accommodate this new mode of instructing.

PERSPECTIVES OF KEY INFORMANTS

1. Visions for Future Directions

A look into the future of Voc-Tech education, as one authority puts it, points to two directions: one is wider use of technology in classrooms and another is the use of computer-assisted, computer-managed instruction or computer-based training.

In the first direction, the point made is for the management of education and training and even industries to exploit the advantages of more advanced technologies in improving education, instructing, and manufacturing; in the second, for management to exploit the advantages of computer-assisted, computer-managed instructions or computer-based training in enhancing student grasp of subject matter and upgrading teacher or employee capabilities in productive activities.

2. Views and Proposed Plan of Action

It appears that all views converge in one central idea -- that technical education will change as a result of technology.

This, they say, is inevitable because the indications are already present:

- People in authority in education, while insisting on the non-replaceability of hands-on experience, are not exactly comfortable with the traditional modes of delivery of instructions.
- There are opportunities for new directions in Voc-Tech education and training. Several forms of technology can be adopted to enhance skills formation, one of which is computer technology. In addition, more and more students appear to be going into computer engineering and computer science courses, diminishing enrollment in other disciplines.
- There are complaints about the quality of the schools' turnout. They say that while there appear to be overruns in certain disciplines, there are shortages in others, particularly those that are congruent with the needs of industries.

- There are complaints about the quality of teachers who, they say, because of overwork in classroom activities, have no opportunities to do research or further studies to improve their lot, at the expense of the students and productivity. In addition and of equal importance, there is the inability of the school system to maintain high-caliber or highly competent teachers because of poor pay.
- Requests for computer equipment and computer-related staff are increasing (from those who appear to be ready with the physical infrastructure for computing and are open to techniques of computer-based training or CAI in selected government and private schools). There are software that are suitable to the level of mental growth of learners and the needs of economic growth, that is, software that have considerable flexibility in developing courseware that can be useful in certain trade areas.
- Most importantly, there is the political will to catch up with other Asian countries, especially those who used to lag behind the Philippines.

A number of the respondents were also one in saying that there is a need for a plan to situate the efforts at going into newer or alternative instructional methodology. In this regard, they have hinted at a structure (perhaps a committee) to see that the plan really works and that there is adequate input from prospective users, if ever. How to go about this appears to be an issue requiring further consideration.

Since it is not the place of this study to conjecture, suffice it to say that the best forum for the exposition of the finer details is where policy makers, educators, practitioners, and even dealers of relevant equipment are represented, with implications on current education/ training structures, costs of acquisition, pilot testing of trade area(s), policies, leadership, and other issues as talking points.

At this point, it can only be stated that however the plan would turn out to be, the efforts of its supporters should be one of complementation (considering claims of inadequate finances, infrastructure,

equipment, and so on) and one that could give more responsibilities to its prospective supporters to design their own management system for wider acceptance of their newly installed instructional modes.

It should be emphasized here however that most of the respondents and interviewees are of the opinion that the government should take the lead in this new initiative either in the form of equipment support to those with strong internal scientific and engineering communities or in the training of teachers who would introduce the new methodology of instruction.

CONCLUSIONS AND RECOMMENDATIONS

Voc-tech education has come of age. It has transcended years of slow-moving reactions to changing student needs and economic development. With barely a handful of schools in 1940, it has grown into a number worthy of the highest consideration of policy makers and educators alike.

In terms of educational thrust, the voc-tech system has adopted one that has not only taught life skills and capabilities, congruent with current technological changes. The goodies brought about by computer technology has not only been appreciated in the area of administrative functions but has made some inroads in engineering, architecture, and construction departments of the educational system.

While it would be rash to claim that the state of the art of the technology in Region VII and Region X is more advanced than those of NCR, Region IV, and Region XI, it can be said that innovative applications of certain software by Region VII and Region X have enhanced their competitiveness compared to the other regions. Besides, as one would remember, there was an operating system that was found in NCR (Multimedia O.S.) and not in Region VII or Region X and development software that have as many users in Region IV as there were in Region X, not to speak of the number of Region IV's ATs which far surpassed the number found in Region X.

It should be recalled also that while Region VII and Region X appear to exceed the other regions in regard to extent of use of these technologies, they too suffered from the limited number of their hardware and software. Not only were all five regions saddled with the lack of hardware and software, but they were also beset with the lack of teachers/trainors for their specialized tool of teaching and instructing.

But the fact that majority of the schools are open to the introduction of CAI and CBT in schools, it is well to think of this as a gesture of good faith and support for this move. What seems to be needed to be done as a consequence of this knowledge is to define the team (which may include a steering committee) and the processes that the team will use.

Since a project of this kind usually gets lost in the flurry of activities, it may be useful to design whatever development work that may be implemented with the following considerations:

- Designers (computer experts) should work closely with objective (subject matter) workers, graphic experts, audiovisual technicians, human-factors experts (perhaps psychologists), and documentation specialists. In essence, the team should contain the right people necessary to design, develop, and produce the total product.
- After the design team is organized, there is a need to define the tools. Such questions as the following need to be answered:
  - o What are the existing levels of automation in the school or center?
  - o Can we increase this level or can we retain the schools'/ centers' competitive leverage with existing tools?
  - o Is additional training required to change the process?
- The third set of considerations to make concerns the pragmatics of the environment. Questions like the following need to be asked:
  - o Is there a need to bring the team together in a place?
  - o Are there equipment changes that would be made?
  - o Should additional computer resources be purchased or leased?

- The penultimate set of considerations to remember is the design criteria or standards.
- The last and perhaps the most important is the acceptance of the product by management and the end-users. In other words, is the product acceptable to the management and users?

Each school has its goals and ideas concerning its financial system and regulations as well as sovereignty over them which should be respected.

At this stage, what is clear is the schools' openness to some changes in the delivery of instructing and it is up to the concerned authorities to pursue this and lend the support that the schools said they could not do without.

APPENDIX B-2

B2. Survey on Leading-Edge Educational Technology for Formal Education

SCHOOL PROGRAMS INVOLVING COMPUTER TECHNOLOGY

A. School Programs Requiring Computer Subjects

	Program	No. of Schools Offering
* BS	Computer Science	12
** BS	Business Administration/Commerce	18
BS	Accountancy	15
BS	Education/Elementary Education	9
	Bachelor of Arts	7
BS	Computer Engineering	6

BS	Nursing	6
BS	Secretarial Administration	4
BS	Civil Engineering	3
BS	Hotel & Restaurant Management	3
MBA		2
BS	Biology	2
BS	Medical Technology	2
	Computer Secretarial	5
	Junior Secretarial	5

* There were variations in program names such as BS Computer and Information Science; BS Information and Computer Science; Bachelor in Computer Science.

** Three of these schools offered majors in: MIS and Office Management, Office Management, and Computer and Information Science and Management Information Systems, respectively.

B. Specific Computer Subjects Offered by the Schools

These subjects were classified under three categories, those involving general concepts and applications, those that were more professional and technical in nature, and those that are applications to specific disciplines.

1. GENERAL COMPUTER SUBJECTS AND APPLICATION COURSES

Subject	No. of Schools Offering*
Computer Fundamentals	17
Word Processing	12
Spreadsheets (some w/2 semesters)	9
Programming	23
Other Software Applications	5
Computer Information Systems	5
Input Preparation/Data Encoding	4

* 8 schools just indicated course numbers without giving course titles.

2. PROFESSIONAL/TECHNICAL COMPUTER COURSES

This enumeration is based on course titles actually indicated by the respondents, as such there seem to be some duplications of coverages.

Subject

Operating Systems
Structure of Programming Languages
Systems Analysis and Design
Logic Design and Switching
Applied Systems Design and Development
Computer Files and Data Base Management
Computer Architecture with Assembly
Computer Hardware Fundamentals
Computer Organization
Computer Resource Management
Computer System Performance and Evaluation
Computer Audit and EDP Controls
Data Base Concepts and Programming
Data Bases
Data Management
Data Base Systems
Data Structures
Data Structures and File Organization
Data Base Design and Managemernt
Fundamental Data Structures
Data Communication
Interfacing and Communication
Compu:er Files and Data Base Management
File Organization
Digital Design
Computer Networks
Distributed Systems
Computer Design
Software Engineering

Integrated Software
Systems Software
Hardware and Software Systems
Systems Project Management and Operations Research
Structured COBOL
Automata
Introduction to Artificial Intelligence and Expert Systems
Scientific Computing with FORTRAN
Computer Simulation
Trouble Shooting
Mathematical Algorithms
Fundamental Algorithms
Computer Project/Practicum/Independent Project

3. OTHER SUBJECTS INVOLVING SPECIFIC COMPUTER APPLICATIONS

Subject

Computer Applications in Business
Finance Systems
Applications for Grading and Evaluation
Computer Aided Design (CAD)

C. Extent of Technological Developments in Schools

Area of Development	Extent of Use		
	V. Limited	Limited	Extensive
Introduction of Computer-Based Courses	1	6	22
Development of Computer-Based Materials	7	11	9
Use of Video Equipment in Teaching	8	11	9
Use of Audio Equipment in Teaching	11	9	6
Use of Computer Graphics in Teaching	11	12	3
Use of Telecommunications in Networking	9	5	5
Computer-Based Information System	7	9	8

Area of Development	Extent of Use		
	V. Limited	Limited	Extensive
Computer-Based Data Processing System in Administration	9	10	7
Electronic Mail/Teleconferencing	9	3	3
Consistent Updating for Teachers	5	9	11
Computer Internship for Students	8	5	10
Support for Computer-Based Course Materials	6	9	9
Software Development	10	3	9

COMPUTER SYSTEMS USED IN SCHOOLS

A. Hardware Available

1. SCHOOLS WITH XTs

Schools Using XTs (640 KB) without hard disk

No. of Units Used	No. of Schools
Less than 10	5
11 - 20	11
21 - 30	1
above 50	4

Three schools (5, 20, and 38 units respectively) had XTs with hard disks of 21-41 MB.

One school indicated using XTs but did not give any configuration.

All the above schools were also using other computers of varying capacities.

2. SCHOOLS WITH 286s

Schools with 286s (1MB RAM capacity, no hard disk).

No. of Units Used	No. of Schools
10 and below	8
11 - 20	4
21 - 30	3
80	1

Schools with 286s of 1MB RAM and 40MB hard disk

No. of Units Used	No. of Schools
10 and below	3
11 - 20	1
40 and above	2

One school had two units of 286s with 1 MB RAM and 130 MB hard disk capacity. Another school had 35 units of 286s with 2 MB RAM capacity and 130 MB hard disk capacity.

3. SCHOOLS WITH 386s

Five schools said they had 4, 10, 25, 42, and 206 units of 386s, respectively, but did not indicate the capacities. One school just checked the existence of 386s but did not give any other details.

4. SCHOOLS WITH 486s

	No.			Hard Disk Capacity			
RAM	Hard Disk	125-500MB	130MB	210M	350MB	1GB	1-2GB/130MB
4MB	(20)	(80)		(26)			
8MB	(1)		(1)	(3)	(2)		(15)*
					(1)		
16MB	(10)					(1)	
32MB	(1)						
Total No. of Schools	4	1	1	2	2	1	1

*The school did not make a distinction as to how many there were for each of the hard disk capacities.
Two schools said they had 1 and 15 units of 486s respectively but failed to indicate the configuration of the units.

5. PRINTERS

Dot Matrix Printers

No. of Units	No. of Schools
Less than 10	11
10 -19	9
20 - 30	4
65	1
Total No. of Schools	25

Letter Quality Printers

No. of Units	No. of Schools*
Less than 5	4
6 - 10	4
17	1
Total No. of Schools	9

*Most of these printers were over and above the dot matrix printers.

Laser Printers

No. of Units	No. of Schools
1	10
3	1
4	2
Total No. of Schools	13

Inkjet Printers

No. of Printers	No. of Schools
1	2
4	1
Total No. of Schools	3

6. OTHER COMPUTER EQUIPMENT

Scanners

No. of Units	No. of Schools
1	5
3	2
Total No. of Schools	7

Fax Machines

No. of Units	No. of Schools
1	5
2	1
3 (Fax Modem)	1
5	1
Total No. of Schools	8

Modems

No. of Units	No. of Schools
1	1
2	3
9	1
Total No. of Schools	4

Multi-Media Facilities

Four schools (two in Manila, one in Cebu and another in Zamboanga) were using CD ROM auxiliary drives.

Cad/Cam Work Stations

No. of Stations	No. of Schools
2	1
6	1
10	2
17	1
Total No. of Schools	5

Lan Work Stations

No. of Stations	No. of Schools
20	1
40	1
15 LANARCNET	1
16 ETHERNET	1
Total No. of Schools	4

One school indicated using NOVELL for a local area network but did not indicate the number of workstations.

Other Computing Units Used

School #1 16 units APPLE II E's (64 kb) and
55 units MACINTOSH (8MB/ 160MB)
School #2 2 units MACINTOSH

Other Special Computing Equipment Available

School #1 IBM S/34, IBM AS/400, electronic filing system
School #2 RS6000, 8LCD computer projection panels
School #3 RS6000, Club PC-AT acting as Novell server
School #4 VGA to NSTCA and NSTC to digital converters

B. Software Used

1. OPERATING SYSTEMS

System Used	No. of Schools
DOS	30
WINDOWS	19
NOVELL	13
UNIX	5
OS/2	2

Other Operating Systems mentioned:

WINDOWS NT	Apple Talk
AMICA-DOS	AIX
SYSTEM 7	SSP
OS/400	DOS/VSE

2. COMPILERS

Name of Compiler	No. of Schools
BASIC	24
C	17
PASCAL	21
COBOL	19
FORTRAN	12
ASSEMBLY	3
C++	2

Other compilers mentioned:

Clipper	RT Link
Clarson	PROLOG
LISP	TURBO C++
MASM	TURBO PASCAL

3. WORDPROCESSING SOFTWARE

Wordprocessing Brand	No. of Schools
Wordstar (4.0 - 7.0)	27
WordPerfect	20
WORD	8
MS WORD	9
WORD for WINDOWS	3
AMIPRO	2
PAGEMAKER	2

Other brands mentioned were:

WRITE	NEWSMASTER
CHIWRITE	SIDEKICK
PCWRITE	WRITE for WINDOWS

4. SPREADSHEET SOFTWARE

Spreadsheet Brand	No. of Schools
LOTUS 1-2-3	26
QUATTRO	14
EXCEL	10

Other brands of spreadsheets mentioned:

SYMPHONY	SIDEWAYS
FRAMEWORK	ORCAD
AMIPRO	LOTUS Smartsuite
LOTUS 3-4	

5. DATABASE MANAGEMENT SYSTEM

System Brand	No. of Schools
DBASE III+ and IV	25
FOXPRO	14
FOXBASE	9
CLIPPER	5
INFORMIX	2

Other brands of database managerment system mentioned:

FOXPLUS	IBM DB/400
PARADOX	UNIFY
ORACLE	LOTUS Smartsuite

6. PROJECT MANAGEMENT SYSTEM

Brand Used	No. of Schools
Harvard Graphics	2
POWER POINT	2

Other brands mentioned:

FLOWCHART	P.S.
FLOW	W/S
PAGEMAKER	TIMEBASE
LOTUS	

7. GRAPHICS

Brand	No. of Schools
COREL Draw	8
Harvard Graphics	6
Pagemaker	6
Storyboard	5
Paintbrush	5
Printmaster	3
Desktop Publishing	3
Printshop	3
Banner Mania	2
Fontasy	2
Power Point for WINDOWS	2
Printmagic	2
Ventura	2
Newsmaster	2

Other brands mentioned:

ATS/CAD-CAM	Instant Artist
ACAD	MS Draw
First Graphics	MS Publishing
Flow	PCPaint
Image	Powerpoint
PRO Design	Supervision
Turbo Pascal	VISUAL Basic
Newsmaster	CAD Supervisor

8. COMMUNICATIONS

Brand	No. of Schools
Novell	5
Procomm	2

Other brands mentioned:

AST 5251	LA Plink
BITCOMM	MAIC
DEJAVU	TELIX
IDEACOM	TLP/IP

9. OTHER SOFTWARE USED BY SCHOOL

4GL	GURU
DACEASY	Dr. Shrink
DERIVE	

10. UTILITIES

Brand	No. of Schools
Norton	9
PC Tools	8
SCAN	5
VIR-X	4
CPAV	4
NDD2	2

Other brands mentioned:

Anti-Virus	PC Shell
Clarion	TE
Genifer	Virus-Scan
MAGIC	Virus-Remover

11. SOFTWARE USED FOR ADMINISTRATION PURPOSES

Application	No. of Schools		
	Internally Dev.	Commercial	Combination
Enrolment	17	3	-
Grading	17	2	-
Accounting	13	7	7
Library	5	7	-
Office Automation	6	6	1
Personnel	8	5	-
Students' Academic Records	2	-	-
Other Uses:			
Instructional Applications	1	1	1
Internal Examinations	1	-	-
Mailing List	1	-	-

MANAGEMENT PROBLEMS RELATED TO COMPUTER-BASED TRAINING

The respondents were asked to identify the problems they meet in the use of computer systems and computer-based training. The responses given below were grouped into areas of commonality. Overlaps may be observed in some of the responses given.

A. Fast Development of Technology

- Rapid changes in technology
- Lack of skills; overwhelming innovations and developments in computer technology make it difficult for faculty to keep pace because of heavy teaching workloads which serve as deterrent to their desire to attend training programs.
- Difficulty of coping with the call of the time (updating curricula, software, hardware, and instructions).

B. Personnel

- Fast turnover of personnel (teaching).
- Lack of qualified personnel in required field of specification.
- Lack of CPAs who are IT professionals to serve as faculty members.
- Lack of personnel, only a handful of faculty members are handling computer-based courses.
- Lack of qualified personnel. (9)
- Lack of skills. (3)
- Lack of training for trainors.
- Lack of trained teachers who can incorporate computer-based subject matter into courses.
- Lack of skills, training, and know-how.
- Lack of skilled personnel for maintenance. (3)
- Salary base not competitive.

C. Software/Budget Difficulties

- Expensive software. (3)
- Rare availability of affordable software which are business related to simulate accounting processes.
- Lack of business software.
- Limited budget for acquisition of software. (3)

- Budgetary constraints; very minimal number of units available for use by both students and faculty.
- High maintenance/operating cost.
- Budget - lack of hardware support.
- Maintenance - due to budgetary constraints, computer units cannot be upgraded.
- Expensive computer-based materials (books, software, and hardware).
- Limited budget. (7)
- Budget - especially for licensed copy of software.
- Lack of budget to get new technology.

D. Other Problems

- Maintenance. (5)
- Text references and computer assisted learning materials.
- Difficulty in avoiding viruses; no effective virus remover.
- Training in Statistics/Economics/Marketing/Management/Advertising.
- Applications in other areas, e.g., testing and grading.

APPENDIX B-3

B3. PSTD-COCED Computer-Based Training Survey

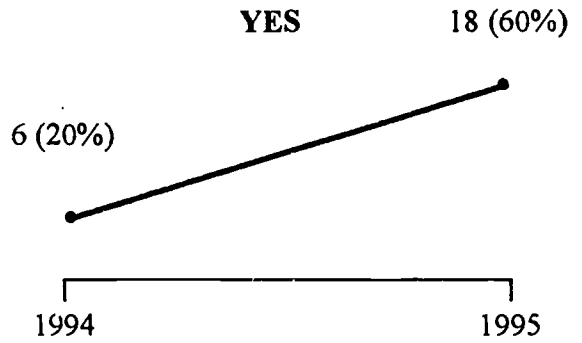
SURVEY COVERAGE

- 150 Service Organizations
- 41 Responded
  - 33 Not users
  - 8 Users
    - Phinma
    - Pagcor
    - Ayala Land
    - Caltex Philippines
    - Anchor Insurance
    - De La Salle University
    - Selecta Dairy Products
    - International Container

What were the reasons why your organization did not consider CBT as an alternative training method? 61

		% of Total
1.	Lack of knowledge about CBT	28%
2.	Not a priority in our training plan	26%
3.	The initial investment is too high	18%
4.	Lack of management understanding	8%
5.	Lack of success stories	6%
6.	Not acceptable to potential trainees	3%
7.	Too advanced for our needs	3%
8.	Too cumbersome to develop	2%
9.	Still preparing CBT materials	2%
10.	Not suited to our needs/training program	2%
11.	Lack of available CBT materials	2%

Do you plan to conduct a feasibility study to implement CBT in your organization? 30



Who initiated the concept of implementing CBT in your organization? 7

		% of Total
1.	Top Management	44%
2.	Training Department	28%
3.	Parent Company	14%
4.	EDP Department	14%
5.	Local Training Consultant	0%
6.	Foreign Training Consultant	0%

What are the principal applications of your CBT? **15**

		% of Total
1.	Use of computer-based application systems	40%
2.	Develop technical skills	27%
3.	Develop managerial skills	20%
4.	Orienting new employees	13%

What approach did you use to develop your CBT lessons? **14**

		% of Total
1.	Purchased generic CBT lessons	43%
2.	Developed in-house	29%
3.	Contracted a training firm	14%
4.	Acquired from parent company	7%
5.	Developed in-house with outside consultant	7%

How many trainees have used CBT in your organization? **7**

	1990	1991	1992	1993	1994
Top Management				15	16
Middle Management				5	7
Lower Management			4		9
Supervisors	3	2	21	13	105
Rank and File	20	16	13	48	146
	23	18	38	81	283

What type of computers do you use for CBT? **7**

	Brand	Model	No. Units	Dedicated?	Network?
Mainframe	IBM	4831	1	no	no
Midrange	IBM	AS/400	1	no	no
Microcomputer	IBM C	486	58	8 dedicated	combination

What type of auxiliary storage devices did you use to deliver your CBT lessons? **23**

		% of Total
1.	Hard Disk	35%
2.	3.5" Diskette	26%
3.	Floppy Diskette	9%
4.	Removable Cartridge	9%
5.	CD-ROM	9%
6.	Analogue audio tape	4%
7.	Digital audio tape	4%
8.	Video Disc	4%

What benefits did your company gain in implementing CBT? **17**

		% of Total
1.	Flexible training schedule	22%
2.	Consistency of CBT lessons	18%
3.	Ability to transfer to other sites	18%
4.	Less needs for highly paid trainers	12%
5.	Self-paced method of learning	12%
6.	Ease of updating CBT lessons	6%
7.	Ability to customize to trainees	6%
8.	Reduced training time	6%

What problems did your organization encounter in implementing CBT? **13**

		% of Total
1.	High cost of hardware	31%
2.	Lack of off-the-shelf lessons	23%
3.	Limited trainee-computer interaction	15%
4.	Lack of staff with technical skills	15%
5.	High cost of CBT lessons development	8%
6.	Rejection from trainees (boring)	8%
7.	Slow response time	0%
8.	Lack of support from vendors	0%

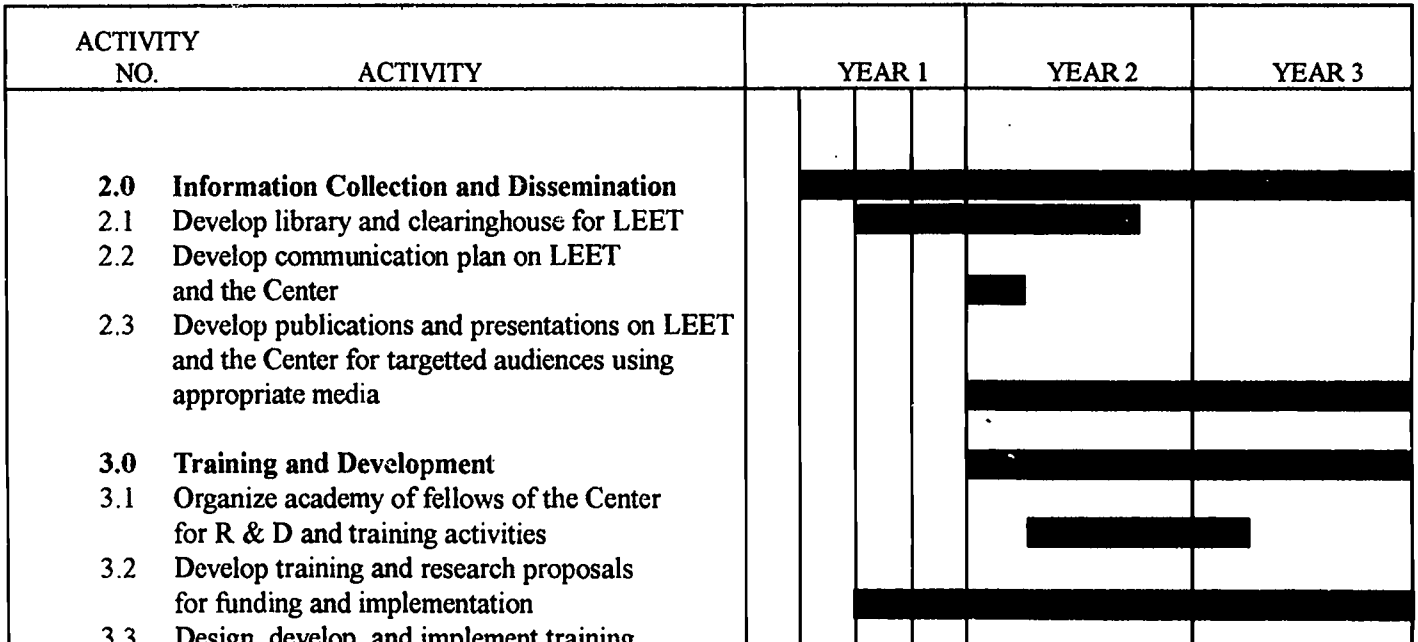
What is your personal evaluation of the effectiveness of CBT in your organization? **5**

		% of Total
1.	Excellent	0%
2.	Very Good	20%
3.	Good	40%
4.	Fair	40%
5.	Poor	0%

ANNEX C

LEADING-EDGE EDUCATIONAL TECHNOLOGIES FOR EDUCATION AND TRAINING
PROPOSED ACTION PLAN

ACTIVITY NO.	ACTIVITY	YEAR 1	YEAR 2	YEAR 3
1.0	**Establishment of LEET Center**			
1.1	Organize government and private sector support for the LEET Foundation			
1.2	Solicit grant funds for equipment, software, physical infrastructure, and research and development			
1.3	Plan three-year work program of the LEET Center			
1.4	Link with national and international organizations and IT networks			
1.5	Staff LEET Center with professional staff and fellows from the academe, government, and industry			


ACTIVITY NO.
ACTIVITY
YEAR 1
YEAR 2
YEAR 3
2.0 Information Collection and Dissemination
2.1 Develop library and clearinghouse for LEET
2.2 Develop communication plan on LEET and the Center
2.3 Develop publications and presentations on LEET and the Center for targetted audiences using appropriate media
3.0 Training and Development
3.1 Organize academy of fellows of the Center for R & D and training activities
3.2 Develop training and research proposals for funding and implementation
3.3 Design, develop, and implement training programs for target audiences in:
• formal education
• vocational-technical education
• business-corporate education
• nonformal education

ACTIVITY NO.	ACTIVITY	YEAR 1	YEAR 2	YEAR 3
3.4	Implement research and development programs in selected areas including: • instructional design and development • interactive multimedia • electronic performance support • testing and accreditation • distance education • special education • nonformal education			
4.0	**Materials Development**			
4.1	Train instructional designers and developers in LEET			
4.2	Develop instructional materials for: • formal education • vocational-technical education • business-corporate education • teacher training • distance education • special education • others			
5.0	**Telecommunications and Networking**			
5.1	Develop programs for using telecommunications in education and training (satellite broadcasts, internet, videoconferencing, and others)			

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