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EDITORIAL

We record with a heavy heart the sad demise of Dr. L. S. Chandrakant, the Editor-in-Chief of this Journal on 26-11-1988 in Chicago after a brief illness. He was an outstanding scholar, a visionary in educational planning, an able administrator and a champion for the cause of promotion of technical and vocational education at global level. He occupied various positions in the Ministry of Education, Government of India, rising to the level of Educational Adviser (Technical). He also served with distinction as the founder Director of the Colombo Plan Staff College for Technician Education in Singapore. His rich and varied experiences in technical and vocational education have been a major source of strength for bringing out this Journal, since its inception in 1984. The Journal owes a deep debt of gratitude to him and finds it difficult to fill the void created.

Dr. Kwan Lee, who was a distinguished member of the Editorial Advisory Board of the Journal was elevated as Honourable Minister of Science and Technology of the Republic of Korea in February 1988. The Journal congratulates him for the honour conferred on him. He found it difficult to eke out adequate time to continue serving on the Board, in view of the onerous responsibilities of his new position. The Journal thanks him very much for his valuable guidance and support all these years.

This issue includes a wide range of articles on various aspects of technical and vocational education which we hope will be of interest to our readers.

Dr. Dyankov, in his article on 'Impact of New Technologies on Technical and Vocational Education' outlines the rapid changes taking place in the technologies and highlights their effect on the content of curricula of technical courses, instructional delivery systems and teacher training provisions.

Mr. Okolie T., in his article on 'Education in the Present Tense: The Science and Technology Phase in Nigeria' describes the efforts of Nigeria in modernising its system of education with emphasis on science and technology, in pursuance of the thrust provided by the country's National Science and Technology Policy, 1987.

In the article on 'Impact of Technological change on Professional Work,' Mr. Tippett and Dr. Treagust report the findings of a study on the perceived impact of technological changes on the professional work of faculty in an Australian college of technical and further education.

The findings of a study investigating the expectations of Nigerian teachers who are the participants of the Technical Teacher Training Programme (TTTP) in the colleges and universities in U.S.A. are reported in the article by Mr. Ogochukwu and Dr. Wolansky. The paper includes useful recommendations for effective planning, implementation and evaluation of TTTP.

The article by Dr. Bhola on 'Skills Development Training in the Consultancy Mode' presents the model of a new approach for project design adopted for a project in Ecuador involving training planning and training design to develop the technical skills of workers in that country.

In his article on 'Education as an Integrative Element in an Integrated Rural Development Programme' Dr. Dan O'Brien shares his insights into the East Sepik Rural Development Project in Papua New Guinea. He reports that the project was largely fruitful and beneficial to the community it served due to the integrative influence of relevant component of education as a sub-project. □

JOURNAL OF TECHNICAL AND VOCATIONAL EDUCATION: AIMS AND STRUCTURE

In recent years, many countries have concentrated upon improvement and expansion of their systems of Technical and Vocational Education to keep pace with their programmes of development. This has been achieved through several innovations, projects and programmes and there is a need for sharing such experiences among countries of the world. In this context, an important and challenging task is to provide an effective means of communication between all those involved in this system of education. The 'Journal of Technical and Vocational Education' is intended to serve this purpose. This Journal is being published from Technical Teachers' Training Institute, Madras, India. It is currently published annually and there is a proposal to have two issues in a year in due course.

Objectives

The objectives of the Journal are:

1. To share experiences in respect of national policies, norms and standards, course patterns and structures, resources and expertise, trends and issues relating to technical and vocational education in different countries.

2. To publish major advances and innovative ideas and report on current trends in the theory and practice of technical and vocational education.

3. To exchange experiences in the design, development, implementation and evaluation of all types of technical/vocational teacher education programmes.

4. To report case studies and research findings on various aspects of the system in different countries.

5. To promote the recognition and understanding of the interaction of technical and vocational education with other collaborating agencies such as industry, government and society.

6. To project and report on the emerging trends and futurological studies in the technical and vocational education system.

Main Sections

Each issue of the Journal has the following four main sections:

1. *General Articles Section:*
Dealing with articles of evaluative and/or synthetic nature in all areas of technical and vocational education.

2. *Research Reports Section:*
Dealing with research findings relating to researches in technical and vocational education system. The emphasis in this section will be on publication of applied and application-oriented research of national/international interest.

3. *Innovative Programmes and Projects Section:*

Dealing with reports on development work and innovative practices in technical and vocational education system.

4. *Notes, News and Review Section:*

Dealing with information about on-going projects and programmes, news about conferences, meetings, seminars, symposia/workshops and reviews of books and other resources in the area of technical and vocational education.

AWARD

The following article published in Issue 4 (1987) received the 'Distinguished Paper of 1987' award from the Northeastern Educational Research Association, U.S.A.

A Measurement Model for Labor Force Attachment of American Youth. (*David L. Passmore, George A. Risher and Unal Ay*)

Impact of New Technologies on Technical & Vocational Education

A. Dyankov

ABSTRACT

The paper outlines the rapid changes in the technologies such as informatics, super conductors, robotization and automatization and super computers and their implications for the future. The impact of new technologies on technical and vocational education are then highlighted. The author stresses that it involves not only changes in the curriculum content, but also introduction of innovative systems of instructional delivery and provision for suitable teacher training programmes.

Emerging New Technologies

Communication Revolution

We live in an era of rapid technological changes, based on scientific discoveries. The whole world is today in the grip of communication revolution which is creating an information society. The world now possesses the technological capability to transport rapidly people from one continent to another. Millions of people around the globe can witness the landing of man on the moon, or many world events happening simultaneously, without moving out of their rooms. Through satellites, telecommunication has reached new heights: signed copies of a letter can be on the desk of the addressee instantly through fascimile, bypassing the entire postal system. Distant telephone calls can be made by dialing numbers, without the services of the operator at the telephone exchange. People located at great distances from each other can talk with cordless phone, even computers talk to each other and do the human work efficiently. A little silicon chip, smaller than the size of a credit card can carry as much information as the bulky telephone directory of a metropolitan city.

Superconductors

When we talk of a communication revolution, we talk of a global phenomenon of the tremendous leap forward taken by the technology in the field of informatics. This recent communication revolution is related to the spectacular scientific breakthroughs in superconductors. Their discovery may be compared with the physics discoveries that led to electronics and nuclear power. Superconductors were once thought to be physically impossible. But in 1911, some metals cooled to extremely low temperatures (below 400° Fahrenheit or 205° Celsius) were found to carry electricity with zero resistance. Some ceramic materials have been found to be superconductors when at the much "warmer" temperature of liquid nitrogen. Scientists, hoping to find a ceramic that works at room temperature, are trying new formulas.

One use for the new superconductors would be to replace those that need the extreme cold of liquid helium-huge superconducting electromagnets used in nuclear magnetic resonance research, atomic particle accelerators and fusion research reactors.

Other types of electromagnets made with superconductors could be used to lower the cost of electrical generation and storage, and make faster trains economically feasible. While the aviation technology has placed the outdated conventional trains aside, new high-speed trains are coming soon. Looked from the front at a distance, it is difficult to recognize them as trains: there are no engines, no wheels, no rails.

The train is called a maglev, a contraction of magnetic levitation. The vehicle floats in the air, supported by the force of immensely powerful magnets. Instead of rolling on rails, it actually flies, using magnets for propulsion. Not exposed to any friction, except the wind resistance, the train could travel with 1000 km per an hour speed. This would resolve the problem of clogging the major travel arteries.

At present two groups of designers work on two different proto-types. One of the models, being repulsion system, uses magnets made of super-conductors which are embedded in the guideway wall. The alternation of the current in the wall magnets pushes and pulls the superconducting magnets built into the car's undercarriage and thereby moves the train which is levitated off the guideway by 11 cm.

The other model, known as attraction system, uses conventional electromagnets. A set of electromagnets in the centre of the guideway interacts with another set of magnets built in the carriage. Raising the frequency of the electric current, speeds up the electromagnetic wave, and due to the attraction between the poles, the car levitates by 2 cm. In both systems the train actually rides on an electromagnetic wave. These trains will mark a new era in land transport.

Robotization and Automatization

A new era in many industrial fields is marked by another technological change: the introduction of robotization and automatization. At present, thousands of robots perform great variety of tasks: everything — from cleaning premises, or acting as night guards, driving vans, harvesting fruits, taking care of disabled — to assembling machines, and computers.

Some researchers are developing now, a new generation of commercial automations, that would bring working robots in many offices and shopping centres. Several fast-food chains, exploiting young workers, are moving towards robot restaurants.

The rapid changes of new technology towards more practical and effective, and simultaneously — less expensive one, hastens the process of replacing the existing technology. For example, a welding robot, costing no less than US. $ 150,000 five years ago, would cost now half of this price, with increased productivity. Such a phenomenon forecasts the spreading of robotization and automatization throughout many industries.

Robots become indispensable particularly in hazardous environments. Robots have been used to clean up radioactive debris at Three Mile Island, and a number of laboratories are designing now different robots for maintenance chores in functionining nuclear power plants. The future mining industries will increase their productivity at lower cost and risks through robots. Most robots in use today are run from a control station, coupled to an operator by tether, radio or laser. While this extension of human capability, called tele-operation, keeps people out of hazardous environments, for greater versatility a robot should work on its own, with minimal human supervision.

At the same time, the new technology brought by the communication revolution, places many existing jobs in manufacturing out. For example; when a microprocessor — which is much faster than its predecessor — the computer, is coupled to existing machinery, it increases greatly the productivity. This has boosted

research and development in the field of supercomputers of the future.

Supercomputers

One group of scientists and technologists, working with the lightning-fast machines known as supercomputers, is always pushing for more raw power, more blazing speed. Another group, writing programs that show the rudiments of artificial intelligence, explores the mysteries of human thought. Each of these two grand scientific enterprises has proceeded as if the other did not exist.

But there are signs that the two broad avenues of computer research may be starting to converge, that today's most advanced machines may someday evolve into electronic brains that are not just incredibly fast but smart as well.

Speed and power are what distinguish supercomputers from their predecessors. In the early days of the industry, speed was measured in thousands of FLOPS, an acronym for floating-point operations per second, in which the decimal point is moved in very large and small numbers. Today's largest machines are measured in gigaFLOPS, or billions of operations a second. Tomorrow's will be measured in tera FLOPS, trillions of operations a second. A single supercomputer going at tera FLOPS speed will have the power of 10 million personal computers working at full throttle. At the same time, the most powerful supercomputers are surprisingly small and sleek.

In a classic case of a technology developed for a few specialized purposes finding application in all sorts of unexpected areas, supercomputing has spread from one industry to another like a benevolent virus. Semi-conductor manufacturers use supercomputers to design ways to squeeze more transistors into a squarecentimeter chip of silicon. Financial advisers use them to devise investment strategies of dizzying complexity. Biochemists need them to predict which molecules are worth testing as new medicines. Engineers rely on them to design new cars, jet engines, light bulbs, sailboats, refrigerators and artificial limbs.

Although supercomputers are dazzling in their power and engineering virtuosity, hardware alone will only partly achieve the eventual goal of computer scientists: the creation of systems that can imitate the decision-making powers of human beings. This goal is called AI, for artificial intelligence, and it has eluded computer programmers for decades. Now, however, even as supercomputers open up new worlds of possibility, researchers are taking major strides toward making their machines both smarter and more versatile.

Their work has spawned a new phase of the great computer revolution that has been going on for the past 40 years or so. Whereas the early use of computers revolutionized information handling, late developments promise to better manage raw computer power and the increasing complexity of modern information technology. For the first time in history, these systems allow computers to deal with ambiguity and questions of judgment that are too subtle for conventional data processing.

No one benefits more from supercomputing than research scientists. Supercomputers are giving scientists unprecedented access to hidden worlds both large and small.

Today's computers have been able to produce a dazzling array of colorful animations from the roiling birth of a tornado to the supersonic fountains that spew forth from black holes at the centers of galaxies. According to the Nobel Physicist Kenneth Wilson of Cornell University: "An astronomer with a telescope can observe the universe over a period of 50 years. But an astrophysicist with a supercomputer can 'see' billions of years into the past and the future".

Futuristic Trends

Some futurologists envisage future underwater cities, utilizing new technology to extract life-giving oxygen, food and water for their inhabitants from the sea.

Other futurists predict the development of new space technology — leading to colonization of the moon, mars, or other planets of our solar system.

Some scientists foresee such development in the biotechnology and genetic engineering, that the agricultural products will suffice to feed the world population, which is estimated to double by the middle of the next century.

But the great technological leap forward could also bring possible problems, stripping our planet of its resources, if the new technology is not able to control climatic changes, heavy-metal contamination, soil erosion and air and water pollution.

Impact on Technical and Vocational Education

Message for Educators

The above scenario, describing the benefits of the technology as technical roses, accompanied by ecological thorns, brings a message for all educators. Traditionally, the educational systems respond slowly to changes in technology and in society. Since it takes a long time to reconstruct education, we need to build a capacity for change, which will enable us to create new opportunities for learning. Especially in the field of technical and vocational education, we must consider the fact that those, who enter technical teacher training institutions today, will practically teach — by the time of their retirement — youth that will be active in the workforce in the second half of the next century, with all advances in biotechnology, microelectronics and information technology, and materials technology.

Starting with a proper, future-oriented vocational guidance and counselling, technical and vocational education will have to build the necessary knowledge and skills for tomorrow's advanced technological society.

Educational Developments

Introduction of Computers

The impact of the new information and communication technologies in many countries is evident by their move to introducing computers in technical and vocational education. Computers have the potential to change in a radical fashion the ways in which teaching and learning take place in schools. Computers can change the rate at which material is covered, the access of students to information, the kinds of feedback given to students, and the role of the teacher. Traditional methods of evaluation may no longer be suitable. For example, it is difficult to compare outcomes of computer-aided instructions with those of traditional teaching, since in the former case the content matter may differ for each student depending on his or her interests and rate of progress.

Curricular Changes

In a wider scope, the overall impact of all new technologies on the technical and vocational education is a growing demand for bridging the gap between the demands of industries and society for adequately competent and skilled technical manpower and the capability of the educational system to meet these demands.

This practically means that scientists and engineers should cooperate with manpower planners and technical educators to forecast the future needs for innovations in technical and vocational education. These innovations would affect curriculum content, equipment and facilities, as well as teaching — learning methods.

A basic core curriculum should build

all necessary basic knowledge and skills that would prepare a person not only for today's technology but will also lay strong foundations, and inculcate the skills for future learning, paving the road for a life-long education in pace with newer scientific and technological developments. This basic core curriculum has to develop a wholesome person, aware of all positive and negative effects of technology, depending on how it is used for the benefit of the humanity, for preserving our environment and peace.

Alternative Curriculum

Along with the new technologies, we have the emergence of an "alternative curriculum", which is the curriculum of the media, and especially of television. Since many young and adult people spend more time watching television than the time spent in school, the educational television should enhance technical knowledge and skills, both in and out of school, through television networks.

Open Systems

Another avenue would be the development of open systems and flexible curricula and structures, adaptable to needs and to changes, so that required qualifications and/or training (both in terms of knowledge and skills) may be obtained.

The impact of new technologies will bring also new changes in technical and vocational education, preparing for self-employment, for access to higher education or entering the labour market. A wider access to technical and vocational education, including ethnic groups, girls and women, coupled with the vocationalization of general education, and with the possible transferability from one to the other; and transferability between formal and non-formal system, will all contribute to the democratization of education.

Appropriate Technology

Special emphasis on agricultural education in rural areas, promotion of appropriate technology and development of home-industries in remote, isolated areas is another task for technical and vocational education, contributing to the raising of living conditions of the rural poor. The introduction of new technologies in this sector will also enhance the role of technical and vocational education.

Cooperative Education

A vital important element in bridging the gap between industrial requirement and schools' output of technical manpower is the co-operative education, i.e., education based on close co-operation between technical schools and industries. Such co-operation could improve the flexibility of education to rapid technological changes and would be of mutual benefit to industries and the educational system.

Teacher Training

The system of technical teacher training should also reflect the impact of new technologies and make provision for effective, flexible re-training of teaching personnel in pace with technological changes and scientific discoveries. Besides updating the teachers' knowledge, their teaching methods and skills need also continuous upgrading.

Education in the Present Tense: The Science and Technology Phase in Nigeria.

OKOLIE T.

ABSTRACT

The paper describes the efforts of Nigeria in modernising its system of education with emphasis on science and technology. The launching of the National Science and Technology Policy in 1987 is cited as the major thrust in this direction. The paper specifically examines the provisions of this policy as it pertains to the country's education system. Some factors inhibiting the successful implementation of its goals are also highlighted and actions initiated for overcoming the problems of implementation are described.

Background

Education has long been recognised as an instrument of change, not change for its own sake but change for a better living and future. The need for rapid change can be traced to many factors which include population growth, urbanization, industrialisation, internationalism, knowledge explosion and rising and changing aspirations of human beings. We have come to realise that education of the present and the future must not be isolated from the world of reality. It must become a real-time, continuous and life long process. A real-time approach to education is a plea for education that copes with the impact of accelerating rate of change in science, technology and society; education that closes the imaginary gap that exists between the world of "school" and the world of "work". The notion that education takes place only in schools is no longer valid.

Nigeria has indicated its readiness to step into the phase of education that emphasises science and technology — the critical factors in the network of causes of change in the world of today — by launching the National Science and Technology Policy: an attempt which is seen as a reaffirmation of our faith in the indisputable role of science and technology in transforming the country into a self-reliant and self-sustaining economy. Functional education must be the answer and emphasis has, therefore, been shifted from liberal education to science and technology-oriented education. This constitutes "education in the present tense" which forms the topic of this article.

The bid to fashion out an educational system that would relate learning experiences provided under the auspices of the school to those available outside it received an impetus with the introduction of the 6–3–3–4 system of education in the country — the system of education which became operational throughout Japan by 1948. Today, Japan is said to be at the forefront of the world economy and is an industrial giant. The contribution of the National Curriculum Conference held in Lagos in 1969 in introducing the reform is noteworthy. The first recommendation adopted at the conference was that "The content of Nigerian Education must reflect the past, the present and the future of a dynamic Nigerian society in terms of the role the individual is expected

to play in the present modernization process" (Adarelegbe 1972: 212). Of course, the past was said to be dominated by the liberal education of the British colonial masters and the Christian Missionaries and the present must be in tune with the realities of modern scientific and technological society and capable of leading us to the future which is unpredictable. However, many Nigerians of note have warned against placing undue emphasis on science and technology. Ikoku (1987), for instance, reiterated this point when he remarked that:

> "While science and technology are now correctly being given the pride of place in national development, there is need to warn against an unhealthy overemphasis of these disciplines to the detriment of a balanced overall educational programme for the nation."

Given these premises, this paper is designed to explore the need for science and technology education in Nigeria, and also to examine the provisions of the National Policy on Science and Technology as it relates to science and technology education. Lastly, the paper makes a recommendation on some of the ways to realize the goals of the policy.

Need for Science and Technology Education

It is science and technology that has catapulted countries like America and Russia to heights where they now dictate to the whole world on what to do and what not to do. The rest of the world is watching helplessly from below, though many such as India, Britain and Japan are on their way to the top, if not already there. The Soviet launching of the Sputnik into space in 1958 stirred the imagination of America in overhauling its educational system-Massive aid was unleashed by the American government to improve education. Much of this grant went into curriculum reform — the new mathematics, science, foreign languages, social studies, etc. Much money was also pumped into research and development efforts. The result was the successful launching of the first manned rocket to the moon — the Apollo.

It is noteworthy that though Russia was the first to move into space, America was the first to launch a manned rocket to the moon, a feat attributed to the application of advanced technology to a highly complex problem. Based on the above theses, Nigeria's science efforts should be geared towards achieving the following (Ango, 1984: 83):

- Scientific literacy for personal and societal health and survival;
- Societal — social life improvements like standards of living and health;
- Technological advancement towards yielding all the basic materials and tools we need for survival and economic growth;
- Balanced living, especially social, interactions and associations.

The application of science to solve human problems — problems of food, shelter, better education, improved health, increased industrial output, or more efficient transportation and communications — constitutes technology. Hence, we need technology to design and develop machines that can extract our mineral resources; to manufacture motor cars, aircrafts, ships, rockets, etc., to develop mechanical and chemical devices that can be used for industrialization; to produce military hardware; and to improve education overall. It is pertinent to note that decisions involving technology are made when appropriate knowledge and experiences are called upon. Hence, application of technology requires a multi-disciplinary team of experts who bring into focus their wisdom and expertise to resolve human problems effectively. All hope is that Nigeria's technological take-off will make a "soft-landing" in the world of our dream. The flight must, as of necessity, be regu-

lated by an appropriate educational policy that is rooted in Science and Technology.

Education in the Present Tense

Nigeria's effort to brace up with developments in science and technology has crystallized into a policy document — The National Science and Technology Policy (NSTP) — which will, for some time to come, give direction to the scientific and technological activities in this country. The highlights of the policy as outlined by President Ibrahim Babangida on 27th July 1987 while launching the 400 million Naira National Science and Technology Fund include the following (FMST News letter, 1987: 28):

(*a*) the enhancement of scientific and technological manpower development;

(*b*) the development of a local capital goods industry by initiating design, development and copy-technology activities;

(*c*) the exploitation, and utilization of the nation's material resources to maximum effect;

(*d*) the unpackaging of imported technologies;

(*e*) encouragement of local research and development activities in both private and public sector enterprises;

(*f*) the involvement of the masses in the development of science and technology; and

(*g*) the financing of the development of Science and Technology through public and private sector contributions.

The details of these highlights are contained in the policy document. It is the objective of the policy that Nigeria's educational system shall emphasize science and technology at all levels. The strategies for implementation of these broad policies by our educational system include the following (NSTP, 1986: 12–14):

(*i*) Evolving programmes for the recognition, encouragment, development and promotion of scientific and technological talents at all levels;

(*ii*) Making it possible for the average child to have early contact with the concepts of, and materials related to, science and technology even before attaining primary school age;

(*iii*) Ensuring a sound science foundation during the first six years of the 6–3–3–4 educational structure through

(*a*) Entrenchment of science teaching in the primary school curriculum.

(*b*) Provision of adequate teaching laboratory aids;

(*c*) Provision of well-trained and well-motivated science teachers; and

(*d*) Introduction of gainful practical activities such as model-making, handicrafts, gardening and farming;

(*iv*) Ensuring that admission into Universities and Polytechnics and, Colleges of Education, irrespective of the proposed area of specialization, emphasizes English and Mathematics at Senior School, Certificate or equivalent levels.

(*v*) Enforcing strictly an absolute minimum of 60:40 ratio of science-based disciplines to the humanities in annual student enrolment into the nation's Universities, with a target ratio of 70:30 by the year 1988

which will correspond with the graduating year of the first set of entrants to the new 6–3–3–4 education system;

(*vi*) Orienting science and technology curricula of Polytechnics and Colleges of Technology to be less theoretical and more practical-based;

(*vii*) Strictly enforcing admission into Polytechnics and Colleges of Technology to reflect a strong science and technology bias aiming ultimately at not less than 80%;

(*viii*) Initiating and supporting continuing education programmes aimed at specific training for top-level scientists, practising science teachers, engineers and technologists;

(*ix*) Developing special science and technology post-graduate programmes in Universities, Polytechnics and Research Institutes with the aim of forging an inroad into the area of high technology;

(*x*) Working towards establishing at least one Trade Centre/Vocational School in each Local Government area of the country as a means of giving practical training in various crafts towards improved efficiency and self-employment;

(*xi*) Ensuring that adult education includes, in addition to learning how to read and write, learning how things around us work;

(*xii*) Initiating and encouraging programmes for the training of scientific and technical personnel on a scale adequate for the fulfilment of the country's needs in education, agriculture, medicine, engineering, industry, defence, etc.;

(*xiii*) Honouring deserving scientists, engineers and technologists involved in science and technology activities with special awards, in recognition of their contributions as an important component of the strength of the nation;

(*xiv*) Encouraging Nigerian scientists, engineers and technologists working outside the country to return home and contribute to the development of science and technology in the nation;

(*xv*) Encouraging and promoting the writing of Mathematics and science books at all levels; and

(*xvi*) Encouraging individual initiative for the acquisition and dissemination of existing knowledge and for the discovery of new knowledge.

A critical analysis of the above provisions for the country's educational system leaves one in no doubt that if these policies are faithfully carried out with the co-operation of all concerned, Nigeria can hope to step into the twenty first century with an unprecedented gusto.

Factors Inhibiting Effective Implementation of the Policy

What the education in the present tense in Nigeria is supposed to be, has been stated in the immediate preceding section. A clearer picture of what the situation actually is at the moment can be deduced from the table below which shows the number of applicants indicating their preferences for various disciplines for admission through the Joint Admission and Matriculation Board (JAMB) from its inception in 1978 to 1987 — a period of ten years. The records show that out of about 1.3 million candidates who sought for admission within the ten-year period only 5% (slightly above 80,000) indicated preference for the sciences. The table is constructed from the reports of Onuoha (1987) as released by JAMB.

Students' Choice of Disciplines in the JAMB (1978—1987).

Discipline	*Number of Applicants*	*Percentage of total*
Social Sciences	211,037	15.5
Law	209,387	15.3
Education	183,338	13.4
Medical Sciences	178,811	13.1
Business Administration	167,630	12.3
Arts	155,237	11.4
Engineering and Allied Studies	138,583	10.1
* Pure Sciences	Slightly over 80,000	5.0
Agriculture	52,912	3.9
Total	1.3 million	100.0

* the exact number was not indicated.

The above data speak for themselves. Out of 1.3 million applicants, only 5% indicated preference for pure sciences, 15.5% (the highest) showed preference for the Social Sciences, while Agriculture attracted only 3.9%, making it the least-desired-for discipline. This is a clear indication that inspite of government efforts to encourage the study of science and technology, only very few students opt for it. A possible reason for the above preferences is offered by Akinbami (1987):

> "It is not enough to force students to read science through the official 60-40 per cent bias for science courses in our higher institutions. The pertinent question is to examine the reason why students have been drifting to the arts and social sciences. The incontrovertible fact is that these courses provide ready materials for the administrative cadre which makes no pretension to lording it over the scientists, who are the endangered species; their remunerations must be reviewed upwards and their career prospects must be enhanced".

The country's university dons are another source of worry. Their stance is made obvious by the communique released by the National Executive Council (NEC) of the Academic Staff Union of Universities (ASUU) after its executive meeting at the Institute of Education, Ahmadu Bello University, Zaria on 5th and 6th December, 1986:

> "NEC rejected the 60:40 science — arts admission ratio into higher institutions as both unscientific and counter-productive. This artificial discrimination is aimed at throttling the radicalis-

ing potential which the necessary mutual interaction between humanities and the sciences affords. The inequitable ratio is also a ploy to cut back on admission figures because, in most cases, places allotted to sciences which are not filled in the year are not utilized by the humanities disciplines" (ASUU, 1987:13).

Contributing his own quota to the debate on science and technology development in Nigeria, Umeh (1987:8) opines:

> "Any talk about technological advancement of the nation, whether through transfer or otherwise, will remain mere academic exercise, if due consideration is not given to the mental make-up of our people; a mental make-up which from all indications is anti-self-reliance. The truth is that the term 'self-reliance' frightens many Nigerians right out of their skin. Remember what devastating effect a mere fifteen month emergency period, for example, had on our 'sophisticated' life-styles, and on our psyche. Who would tell us-ardent consumers of imported luxury goods, that Chinese people endured a whole ten years of 'emergency period' during the late Chairman Mao's cultural revolution there?"

What we can glean from our exposition so far is that some factors are constituting a stumbling block to "education in the present tense": a general bias for the arts and social sciences by a majority of our students; the neglect of the scientists; vested interest among those at the helm of affairs, as shown by the stance of ASUU; the general attitude of Nigerians to the concept of self-reliance (through science and technology). Other factors include: shortage of qualified manpower in science, engineering, and technology; lack of funds; inadequate teaching and learning materials and equipment both within and outside our school environment; inadequate physical facilities; poor background and performance of students in science and mathematics; the abstract nature of scientific concepts, laws and theories and their remoteness to the sensibility of the students; unequitable allocation of the existing fiscal resources; government policy — a particular government in power may not emphasize science and technology etc.

Actions initiated for Implementation

A close scrutiny of the provisions of the National Policy on Science and Technology indicates that government has mapped out plans to overcome these problems. All that is required is to back words with action; otherwise all our talk about science and technology will degenerate into NATO: no action, talk only (Umeh, 1987:8). It is one thing to fashion out a policy which looks good on paper, and another to translate these policies into concrete actions for everyone to see. The era of lip-service to the issues related to science and technology should be laid to rest.

It is gratifying to note some of the government actions that have pointed the way to an honest, guided route towards putting some of the policies into visible action—the launching of the 400 million Naira Science and Technology Fund; the proposal for the introduction of computer education in the 41 "unity schools" (Federal government colleges); the sinking of 217.8 million Naira in the purchase of introductory technology equipment for the 6-3-3-4 system of education nationwide; the proposal for the allocation of 5% of the country's annual budget to development of science and technology; the plan to establish National Centre for Mathematics at Abuja to act as a resource centre for promoting post-graduate work in Mathematics; series of seminars and symposia aimed at extolling the desirability of the pursuit of science and technology education; an annual conduct of science and technology week, the first of which may take place in October this year; and so on. Another important milestone is the inauguration of the

National Council for Science and Technology, among others, by the Ministry of Science and Technology. The functions of the Council include the following:

(*a*) determination of policy issues that will allow the development of endogeneous capability to be able to absorb, adapt and develop technologies to prevent our over-dependence on technology importation;

(*b*) review of programmes, and proposals from research and development institutions to achieve the best results for this country;

(*c*) encouragement of commercialisation of research and development results for services and goods;

(*d*) formulation of policies and programmes that will popularise science and technology to create a science and technology culture in the society, thereby removing those beliefs and cultural hindrances to development;

(*e*) mobilisation of our scientists to the challenges of socio-economic development.

Conclusion

An attempt was made in this paper to highlight the need for science and technology education in Nigeria. Attempt was also made at exposing some of the factors that inhibit smooth forward progress. The provisions of the National Science and Technology Policy, as they relate to the expected contributions of the country's educational system were exhaustively reported. It is hoped that if these provisions are faithfully executed, the country will definitely be stepping into the twenty-first century as a modern nation with a clear vision. Our concern for salvation through science and technology education forms the basis for "education in the present tense" in Nigeria and this phase must be allowed to succeed.

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The Impact of Technological Change on Professional Work: Perceptions of Teaching Staff in a College of Technical and Further Education in Australia.

PAUL C. TIPPETT AND DAVID F. TREAGUST

ABSTRACT

The paper reports the findings of a study of the perceived impact of technological change on the Professional work of teaching staff in a large Australian tertiary college of technical and further education. The study has focussed on the impact of technological change on: teaching programmes, syllabus documentation, technical expertise, relationships with industry, teaching facilities and student expectations. The outcomes indicate that the effects of technological change are perceived as being experienced at varying levels in all teaching areas and some of these effects are undermining progress in technical teaching. Recommendations are provided for facilitating the incorporation of new technology into the professional work of tertiary technical college teaching staff. It is observed that the broad issues that have emerged out of this study are of general relevance to technical institutions throughout Australia.

Technical Change and Technical Education in Australia

Technological change has had a marked effect on the employment and economic structure of both industrialised and non-industrialised countries. In Australia, there have been significant changes in the occupational structure since the advent of the electronic age, highlighted by the fact that many areas of employment have been reduced or made redundant. Furthermore, new areas of employment have appeared and grown as a result of the changing use of technology in society. Dawkins (1981) noted that for the period 1947-71, professional and technical occupations increased by 233%, while the total work force grew by only 66%. According to Jones (1982), this trend appears to have accelerated in recent years.

These changes in technology and the subsequent new technical skills required within the economy and work force, impinge upon the courses offered by the various educational authorities (Sungaila, 1983; Hull & Pedrotti, 1983). Changes in technology are of particular importance to the Technical and Further Education (TAFE) sphere of tertiary technical education which is largely concerned with the preparation of technically oriented and skilled people (Tognolini, 1984; Whitehead, 1983). This is especially so in recent years when there has been an increasing awareness of the influence that new technology is having on the social and economic aspects of Australian society (Jones, 1982). As highlighted earlier by Toffler (1973), technological change introduces new knowledge and processes to society at an unprecedented rate. However, while there has been considerable

debate relating to the introduction of new technology into TAFE courses, the actual or perceived effects of new technology on technical teaching in Australia has received little attention. Since the completion of this study in 1985, a much larger study across TAFE colleges throughout Australia was conducted by Hall (1987) "to investigate ways in which experienced TAFE lecturers can regularly update their technical knowledge and skills, with special reference to the rapid technological changes occuring in industry and commerce." Many of the recommendations presented by Hall are similar to those discussed in this paper.

In the decade since the Kangan (1975) report, technical and further education in Australia has experienced a significant growth, both in student numbers and in the range and scope of courses offered. The total number of TAFE students in Australia increased by more than 300,000 during the period 1975-80, to a total of 1,014,959. The academic staff during this period increased and currently consists of the equivalent of 7,527 full-time teachers (Australian Year Book, 1984). The majority of TAFE courses in Australia are offered as part-time and are usually taken concurrently with employment. However there is also provision for full-time, and to a lesser extent, external study. Programs are classified into six "streams" of study, namely, professional, para-professional, trades, other skilled, peparatory, and adult education/non-vocational.

Issues addressed in the Study

This paper describes the perceived impact of technological change on professional work of teaching staff at a large TAFE College in the State of South Australia. Six issues concerning the introduction of new technology into TAFE were identified from a review of related literature by Tippett (1985). Data were obtained by questionnaires and interviews: A total of 180 questionnaires were distributed with a response rate of 68%, while 20 individual interviews were conducted with teaching and administrative staff. Interview transcripts were compared with questionnaire responses to improve validity and reliability of the teachers' perceptions. The six issues considered are:

Issue 1: The effect of technological change on TAFE programmes.

Issue 2: The influence of technological change on the TAFE curriculum and syllabus.

Issue 3: The effect of technological change on TAFE teachers' level of technical expertise.

Issue 4: The influence of technological change on TAFE teachers' relationship with industry.

Issue 5: The effect of technological change on the adequacy of TAFE teaching facilities.

Issue 6: The effect of technological change on students' expectations of TAFE courses.

Discussion of the Issues and Outcomes of the Study

Data relevant to the questionnaire are presented from the 18 items in Table 1 while data relevant to the interviews are presented from the 8 items in Table 2. A discussion of the issues along with outcomes of the study are now presented.

Issue 1: *The effect on TAFE programmes*

The rate of technological change was perceived to vary across the range of TAFE programmes. In some courses, especially those related to the "hospitality" industry, there was not a perceived need for radical changes in the technology associated with the courses offered. However, in many TAFE courses, especially those courses related to mechanical and

TABLE 1: Questionnaire Results from Technical College Teachers (n = 101) on Six Issues Related to the Perceived Impact of Technological Change on Professional Work.

Issues and three items to assess each	*Percentage Responses*				
	SA	*A*	*N*	*D*	*SD*
1. Effect of technological change on TAFE programmes					
(1) Recent changes in technology have had a major influence on my area of expertise	28	46	18	7	1
(2) I find it difficult to keep my teaching resources up-to-date	18	46	17	18	1
(3) I have successfully incorporated recent technological advances into my courses.	6	63	22	9	0
2. Influence of technological change on the TAFE curriculum and syllabus					
(4) Recent changes in technology have caused my syllabus to become obsolete	4	30	28	37	5
(5) My syllabus assists in my efforts to incorporate new technology into my courses	5	35	34	23	3
(6) The syllabus that I work with incorporates aspects of new technology	11	48	16	23	2
3. Effect of technological change on TAFE teachers' level of technical expertise					
(7) As a result of recent technological advances it is necessary for me to constantly upgrade my subject knowledge	33	50	10	7	0
(8) Changes in technology have affected my level of technical expertise	20	46	19	14	1
(9) I have managed to maintain my technical expertise despite technological change	2	16	27	51	4

Issues and three items to assess each	*Percentage Responses*				
	SA	*A*	*N*	*D*	*SD*
4. Influence of technological change on TAFE teachers' relationship with industry					
(10) Equipment and processes used by industry have changed dramatically since I started teaching	32	44	13	13	0
(11) I find it difficult to maintain contact with new trends in industry	9	39	24	27	1
(12) I have kept in touch with the latest technology in local industry	2	15	25	52	6
5. Effect of technological change on the adequacy of TAFE teaching facilities					
(13) Advances in technology have changed the equipment and facilities that I require to teach the subject effectively	17	55	15	12	1
(14) It is difficult for me to teach courses which are up-to-date using existing facilities	14	40	14	29	3
(15) In my area of expertise there is a continuous review of teaching facilities to ensure technoloical relevance	5	24	30	34	7
6. Effect of technological change on students' expectations of TAFE courses					
(16) Technological advances have influenced student expectations of my course	19	50	22	9	0
(17) Some of my students have more access to technological advances than I do	16	61	11	10	2
(18) I have managed to meet student expectations of technological relevance in my courses	1	12	31	56	0

Note: SA— strongly agree, A — agree, N — no opinion, D — disagree, SD — strongly disagree.

TABLE 2: Interview Results (n=20) Related to the Effect of New Technology on Teachers' Professional Work and Teachers' Evaluation of the Introduction of New Technology in a TAFE College.

	Percentage Responses							
	(a) Effect of New Technology on Teachers' Professional Work				*(b) Evaluation of the Introduction of New Technology*			
Interview Topic	*VL*	*L*	*N*	*S*	*VS*	*S*	*N*	*U*
1. Changes in area of expertise/courses as a result of new technology	20	65	10	5	5	65	30	0
2. Introduction of new technology into the syllabus	0	50	20	30	0	35	25	40
3. Degree of industrial liaison/relations with industry	15	55	20	10	5	45	20	30
4. Effect on TAFE teaching facilities to include new technology	25	55	10	10	0	25	25	50

Note: VL — very large: L — large; N — no opinion; S — small.
VS — very successful: S — successful; N — no opinion; U — unsuccessful

electronic engineering, there have been dramatic changes which reflect the scope and level of new technology being introduced and applied in industry on a continuing basis. Such courses include micro-electronics, computer aided design, computer aided manufacture, digital control, and the use of new and improved materials for manufactured products.

Questionnaire results indicated general agreement among the TAFE teachers that new technology is affecting their day to day teaching. While these changes were considered to be somewhat complex, 74% perceived the introduction of new technology to be a positive aspect of their professional activities (item 1) with 69% considering that they had successfully introduced new technology into their courses (item 3). However, 64% of these TAFE teachers had difficulty keeping their teaching resources up to date while 19% did not (item 2).

The view that new technology has a major influence on TAFE programmes was supported by 85% of interviewees who considered that new technology has had a large effect on their area of expertise over the past 5 years (item 1a). In addition, 70% of those interviewed considered that they had successfully, introduced new technology into their courses over the last 5 years (item 1 b). Courses dealing with the application of new technology include computing, plastics, micro-electronics and robotics. One interviewee considered that:

> Courses have changed dramatically in some areas in the way we teach and what we have to teach. This has really come through the use of the computer in the design and manufacture of plant and components. The impact has been fairly dramatic over the past 5 years.

OUTCOME 1: The positive finding that a large percentage of TAFE teachers are introducing new technology into their courses has important consequences since concerns have been expressed (Jones, 1982; Sekhon 1982; Stranks 1983; Whitehead, 1983) about the ability of TAFE teachers to adapt to change.

Issue 2: *The influence on the TAFE curriculum and syllabus*

The TAFE teachers appeared to be attempting to incorporate technological advances into their courses but the level and scope of syllabus documentation available to them varied from course to course. New technology has had a significant effect on the syllabus of 59% of respondents (item 6). Teachers were, however, divided in their opinions of the obsolescence of material in the syllabus, and on how well their syllabus reflected changes in technology (item 4). Responses varied for how well the syllabus reflected new technological trends; 40% considered the syllabus to be very supportive, while 26% considered that it constrained their efforts to up-date courses (item 5). Interview data confirmed the questionnaire results; 50% of interviewees said that advances in technology had affected their curriculum to a large extent, while 30% considered the changes to be small in nature (item 2a). Opinion was divided on the effectiveness of the curriculum in reflecting these changes; 35% indicated that their syllabus had successfully incorporated new technology, while 40% considered it had been unsuccessful (item 2b). Several teachers commented on the excessive time required to initiate and adopt curriculum change. This point was highlighted by one interviewee, who stated that

> The curriculum structure is not designed for a flexible response. It is designed for a rigid, accountability response. The model is that you go out to industry and find out what they want. Then you come back and design a course to meet those needs. Then you get it all written, then approved and accredited, and then you teach it... Too late!.... gone; gone long ago!

Indeed, the literature highlights the problems associated with curriculum development and syllabus documentation in TAFE and the need for constant course review (Bates, 1979). Curriculum development procedures that enable a flexible response to change are supported by Pulsford (1984) and Singh and Shannon (1980).

OUTCOME 2: The results of this study highlight the importance of a curriculum process that assists with up to date syllabus documentation. The TAFE teachers in this study expressed concern for an improvement in the responsiveness of the TAFE curriculum process.

Issue 3: *The effect on TAFE teachers' level of Technical expertise*

Questionnaire data indicated that 83% of the teachers considered it necessary to constantly up-grade their subject knowledge while only 7% did not (item 7). Sixty six per cent of respondents considered that new technology had affected their level of expertise while 15% disagreed (item 8). In fact, 55% responded that they had been unsuccessful in maintaining their level of expertise (item 9). The teachers are in general agreement on how new technology is affecting their professional work, and the need to constantly upgrade their technical expertise. One interviewee addressed this when he stated.

> Just to stay up to date with whatever field you are in requires constant work.. I find it very exciting. New technology is exciting. It requires a lot of work to get up to speed, but once you are there,

provided you concentrate on that area, it is relatively easier to stay there.

However, during several interviews, comment was made that TAFE teachers are not making full use of the technological up-dating opportunities that are currently available to them. Bates (1979), Cross (1979), Keeves (1982) and Stranks (1983) consider that many teachers in TAFE have not maintained the level of technical expertise necessary for them to effectively conduct up to date courses.

OUTCOME 3: This study confirms the necessity for TAFE teachers to maintain their level of technical expertise, and concurs with the opinion that many TAFE teachers have not maintained a sufficient level of expertise to adequately introduce new technology into their courses.

Issue 4: *The influence on TAFE teachers' relationship with industry*

TAFE teachers found it difficult to maintain contact with industry and to keep in contact with technological advances. The questionnaire data indicated that 76% of teachers perceived that there have been significant changes in the processes and equipment used in industry since they had begun their teaching career in TAFE (item 10). A large percentage (58%) of respondents considered themselves to be out of touch with the latest technology in their area (item 12). In addition, almost half of the sample (48%) considered that it was difficult for them to maintain contact with industry (item 11).

The data from interviews supported these findings, although the aspect of the teacher's responsibility in maintaining liaison was an issue of some debate. Of those interviewed, 70% considered that maintaining contact with industry was important (item 3a). The response related to the success of maintaining their industrial liaison varied, with 50% considering their activities in this area to have been successful, and 30% disagreeing (item 3b). The lack of motivation for TAFE staff to undertake professional development programmes appeared to be a factor for the apparent low level of successful industrial liaison. One interviewee highlighted the problem of motivation when he stated:

> The Department has allowed staff time off to go into industry. A look at the records shows that not many of them take it up.. Maybe it's the problem that they are not encouraged with any incentives. They are going to get their salary, irrespective of what the situation is.

In addition, the issue of part-time teachers in TAFE was a recurring comment in the interviews, since part-time staff were seen as a valuable source of information and expertise in relation to new technology. One interviewee highlighted this point when he stated:

> It is a matter of monitoring what we perceive industry needs, and trying to find staff who are competent to perform the tasks expected of them. I would still maintain some form of hourly paid instructor. It's our job to impress upon the Department that it's our life line.. I see that as another aspect or major thrust to keep our credibility.

Indeed, the literature advocates a strong liaison between TAFE teachers and industry as a method of improving the teachers' level of expertise and is an essential aspect of the TAFE teachers' professional role (Flower and Russel, 1983; Keeves, 1982; Schneider, 1984).

OUTCOME 4: The results of this study point to the need for an ongoing programme of industrial liaison for TAFE teachers; the current level of liaison between teachers and industry is considered inadequate.

Issue 5: *The effect on the adequacy of TAFE teaching facilities*

TAFE teachers were concerned at the

availability of adequate facilities for effective teaching of courses involving new technology. Most teachers (72%) considered that new technology has had a significant effect on the teaching facilities that they required (item 13). Opinion was divided as to the effect of these facilities on the teacher's professional activities, with 54% of the sample considering the facilities to be a constraint while 32% saw them as assisting (item 14). Twenty nine per cent of teachers agreed that a continuous review and up-dating of teaching facilities in their area of expertise was taking place while 42% disagreed (item 15).

The interview results supported the concerns expressed in the survey about the availability of adequate teaching facilities. Of those interviewed, 80% considered that the equipment required for their teaching activities had been influenced to a large degree by new technology (item 4a). In addition, 50% responded that the existing facilities were inadequate for their requirements (item 4b). One interviewee considered that:

> Although the Department makes a token effort to enable schools to trade in their obsolete equipment to update it, it wouldn't be able to provide enough finance to do that adequately.. It's nowhere near enough to do it justice because technology is moving so fast that we can't really keep up to date.

The literature also recognises the need for changes in up to date equipment as a result of recent technological advances (Davis and Golen, 1983; Dudley, 1982; Swain and Cappo, 1980).

OUTCOME 5: Overall, the results of this study indicate that TAFE teachers placed central importance on the role of teaching facilities in the introduction of TAFE courses based on new technology.

Issue 6: *The effect on students' expectations of TAFE courses*

Sixty nine per cent of teachers considered that students expect TAFE courses to be upgraded as a result of new technology while only 9% disagreed (item 16). In addition, only 13% considered that they had met the increased technological expectations of their students while 56% considered they had not (item 18). Seventy seven per cent of respondents considered that their students had more access to new technology than they did (item 17). Comments made on the changing nature of the students attending TAFE courses, identified the increased expectations of TAFE students. The effect that TAFE students were having on the teachers who are involved in technology-based courses was highlighted by one interviewee who stated:

> ....I would suspect that students coming into TAFE now are the new generation, they expect computing to be par for the course, and I suspect that their expectations are higher.

The literature agrees with these sentiments, including Byrne and Nagel (1980) and Dawkins (1981) who consider that students now expect a higher level of technology to be included in TAFE courses.

OUTCOME 6: The results of the study support these literature findings and show that the teachers surveyed hold the view that the changing nature of technology and processes used at the workplace have increased the technological expectations of students attending TAFE courses.

Recommendations

Recommendations derived from an analysis of the results of the questionnaire and interviews relate directly to theTAFE College which participated in the study, but the broad issues may be relevant to institutions of a similar context. The recommendations are summarised in point form:

* Areas of study within TAFE that are

subject to rapid technological change should be identified and attempts made to initiate the processes required to increase the level of technology available to the teachers and students in these areas. This may include increased resources to maintain the technological level of study in areas seen as being vital to the community and the economy.

* Technical staff development activities and staff training and retraining should be carried out on a regular and continuous basis. Such a scheme may involve the conversion of a proportion of the TAFE teacher's existing recreation leave to a fixed period of technological update time.

* A criterion for the selection and promotion of new college teaching staff should be the demonstrated ability of the candidate to have responded effectively to changes in industry. The ability to respond to technological change should be a central part in the selection of TAFE teachers. This focus may include such areas as a record of continued studies, recent industrial liaison or experience, and involvement in related professional associations.

* More incentives and opportunities should be provided for teaching staff to update their technical and technological expertise. These may take the form of regular visits or secondments to the related industry for extended periods. In addition, the level of technical expertise could be improved by encouraging teaching staff to become more involved with conferences and consulting activities. However, it was also noted that staff development is a dual responsibility between the TAFE teacher and the employer, and that this dual responsibility has increased with rapid technological change.

* The curriculum development process needs to be streamlined to allow for the rapid introduction of changes in course content as a result of advances in technology. Thus, curriculum documentation could well consist of a "core" of theoretical principles relating to an area of study. This would enable a more flexible approach to incorporating up to date applications of new technology in the curriculum. The use of elective subjects which may be easily restructured as technology changes can be an example of a flexible curriculum.

* Teaching staff require further encouragement to read the appropriate journals and manufacturer's literature related to their area. Journals were considered by several interviewees to be a prime source of information related to technological advances in their teaching areas. Such a scheme may include journal circulation and access strategies involving the TAFE college library which would enable teaching staff to become more familiar with new trends and equipment used both locally, nationally and overseas.

* There is an urgent need to upgrade the facilities in a number of teaching areas, especially those long-established teaching areas where recent rapid changes in technology have been most evident such as mechanical engineering. A form of "life-cycle" costing on major equipment should lead to the replacement of equipment at a time scale related to the rate of change in the area.

* The need for increased student access to large-scale high technology equipment may be through the co-operative efforts between TAFE and industry. The use of leased equipment, shared equipment, or organised student activities in off-campus locations where high technology equipment is available could enable a greater degree of staff and student access to state of the art facilities.

Conclusions

The results of this study have highlighted the perceived effects that tech-

nological change is having on the professional work of TAFE teachers in one TAFE college. While the findings are applicable to other TAFE colleges which offer technology-based courses, a study to examine the actual effects of new technology within TAFE would need to focus more finely on the teaching and learning processes within the classroom. A series of staff development and administrative recommendations derived from the results may assist TAFE administrators in the introduction of technological advances by focusing on the professional work and responsibilities of the TAFE teacher. It is apparent that, in the final analysis, the TAFE teacher plays a crucial role in the success, or otherwise, of the introduction of technological change within TAFE in Australia.

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Nigerian Students in Technical Teacher Training in U.S.A. — Are they Getting What they Expect?

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ABSTRACT

The paper reports the findings of a study investigating the expectations of the Technical Teacher Training Program (TTTP) participants, who are Nigerian teachers sent to United States colleges and universities to receive training under the program. The study has identified the expectations of the participants regarding the technical components of the program and found that 70% of the identified expectations are being met by the technical course offerings of the colleges and universities involved with the program. It is also observed that the participants' expectations regarding the practical aspects of the technical component are not met as adequately as theoretical aspects and the related areas. The paper concludes with useful recommendations with regard to effective planning, implementation and evaluation of the TTTP.

Introduction

One of the greatest problems facing Nigeria has been the shortage of a skilled work force. This problem is a result of the country's educational system which has placed little or no emphasis on technical education in some parts of the country. To tackle the problem of shortages in the skilled work force, the Federal Government of Nigeria (FGN) introduced a new policy on education which emphasized vocation education at the secondary school level. In order to provide enough technical teachers for the vocational programs, the FGN established the Technical Teacher Training Program (TTTP) with the cooperation of the United States Government. Since 1981, Nigeria has been sending approximately 250 students every year to be trained in United States colleges and universities.

To provide adequate and proper training for students requires, among other things, knowledge of pupils' needs and expectations. In an extensive review of the literature on foreign students in the U.S., Spaulding and Flack (1976) found that "few studies related to or involved academic departments in such a way as to acquaint academic staff with the learning needs of foreign students or to suggest solutions to difficulties stemming from personal or academic background differences..." (p. 43)

Problem of the Study

The problems addressed in this study were first, an investigation of expectations of Nigerian students (within TTTP) of the technical component of the TTTP in U.S. colleges and universities, and second, the extent to which those expectations were being met by the U.S. institutions participating in the program.

Purpose of the Study

This study was designed to make available information regarding TTTP partici-

pants' expectations of the technical component of the program in U.S. colleges and universities. It was also designed to determine whether the technical component expectations are being met by the technical course offerings of the U.S. colleges and universities participating in the jointly administered program.

Review of Literature

Students entering any educational program tend to have some expectations of what they will get from the program. Based on previous experiences and knowledge, people tend to anticipate the outcome of some situation they are about to face. Bassano (1985) found in a survey of ESL students in American English as a Second Language class that students do have expectations and preferences related to skills development. Gigliotti (1987) contended that the expectation people bring to a setting can affect their behaviour and outcomes. He went further to state:

> ...students would enter a class with expectations about what benefits they will obtain. Whether the expectations are unmet, met or surpassed will affect students' feeling about relations. Unmet expectations may produce disappointment, a sense of unfairness and anger. Expectations which are met or surpassed may produce varying emotions ranging from a sense of fairness to pleasure and even indebtedness (Gigliotti, 1987, p. 365).

Students' expectations have been found to be an important factor in their academic performance. Expectations for success are important determinants of their actual performance. Entwisle and Webster (1973) observed that either as the major independent variable or as an intervening variable, expectations have been involved as the explanation for a large number of results involving students' academic performance.

To be successful in any program, participants have to take the program offerings seriously and try to do their best. Participants' expectations about the events that will take place in the program are found to be directly related to the seriousness with which they will participate in those events (Book, Byers and Freeman, 1983).

Considering the foregoing review of literature, one can safely suggest that a thorough understanding of students' expectations is necessary for proper program planning. There is a need to consider students' expectations when data are being collected for program/curriculum planning.

Methodology

Population/Sample

The population for this study consisted of Nigerian students participating in TTTP in United States colleges and universities. The participants were formerly technical teachers and administrators in Nigerian schools and colleges. The sample for the study was made up of two hundred and fifteen Nigerian students within the TTTP who completed at least two semesters in the program.

Instrument for Data Collection

The instrument used for collecting data was a questionnaire. Questionnaire items were generated by the researchers from literature (LeBlanc and Cap, 1986; Nwoke, 1986; and Spragg, 1984) and by brainstorming with Nigerian students within the TTTP at Iowa State University. The items in the questionnaire addressed TTTP participants' expectations of the technical component of the program. There were twenty items grouped under three sections — Practical Aspects, Theoretical Aspects, and Related Areas. A nine-point scale was used for the response mode. The instrument was validated by a panel of experts comprising three professors at Iowa State University.

Data Collection and Analysis

The method used for data collection was a mailed questionnaire. Out of 215 questionnaires sent out, 137 (63.72%) were returned and provided data for the study.

The data collected were analysed using descriptive statistics (Mean, standard deviation, frequencies and percentages). Five was established as the threshold limit on a scale of 1 to 9 for deciding met expectations. *A.V* SPSSX package was used for the statistical analysis of the data.

Findings

Major findings of this study include results of descriptive analysis of (*a*) TTTP participants' expectations and (*b*) the extent TTTP participants' expectations are met.

TTTP Participants' Expectations.

The respondents were asked in the questionnaires to indicate the expectations that did not apply to them from a list of expectations as well as those that did. Table 1 shows results of analyses of the participants' responses.

TABLE 1: Frequencies and percentages of responses to listed expectations.

Expectations	*Responses*	
	Not expected (%)[a]	*Expected* (%)[a]
1. Involved in technical laboratory/shop practices in my area of specialization	0 (0)	137 (100)
2. Make use of different hand tools commonly used by technically skilled persons	2 (1.5)	135 (98.5)
3. Exposed to the use of varied portable machine tools in my area of specialization	0 (0)	137 (100)
4. Exposed to the use of varied heavy/complex machine tools in my area of specialization	3 (2.2)	134 (97.8)
5. Provided opportunities to go on field trips to industrial establishment(s) in my area of specialization	1 (0.7)	136 (99.3)
6. Provided opportunities to plan and construct practical projects	3 (2.2)	134 (97.8)
7. Given hands-on experiences on the application of new high technology in my area	2 (1.5)	135 (98.5)
8. Highly skilled in my area of specialization by the end of the program	1 (0.7)	136 (99.3)
9. Given an in-depth knowledge of the content area of my specialization	0 (0)	137 (100)

Expectations	*Responses*	
	Not expected (%)[a]	*Expected* (%)[a]
10. Introduced to new developments in my area of specialization	0 (0)	137 (100)
11. Given basic knowledge in my area of specialization	5 (3.6)	132 (96.4)
12. Given an in-depth knowledge of safety practices related to my area	2 (1.5)	135 (98.5)
13. Given opportunity to take technical courses in other areas of interest to me	3 (2.2)	134 (97.8)
14. Given practical training that is related to Nigeria's needs	4 (2.9)	133 (97.1)
15. Given an in-depth knowledge of industrial processes	3 (2.2)	134 (97.8)
16. Given an in-depth knowledge of industrial laboratory/workshop management	1 (0.7)	136 (99.3)
17. Given more exposure to technical courses as opposed to professional courses	5 (3.6)	132 (96.4)

[a]Numbers in parentheses are expressed in percentages.

Table 1 indicates that over 95% of the respondents had items 1 through 17 as their expectations of the technical components of the TTTP. All the respondents expected to be:

1. involved in laboratory/shop practices in their areas of specialization;
2. exposed to the use of varied portable machine tools in their areas of specialization;
3. given an in-depth knowledge of the content area of their areas of specialization; and
4. introduced to new developments in their areas of specialization.

Other expectations the respondents stated that were not listed in the questionnaire are:

1. Exposed to an organized internship/industrial attachment in area of specialization.
2. Exposed to student teaching practice.
3. Developed new ideas in field of specialization.
4. Exposed to modern innovations in area of specialization.
5. Exposed to the use of computer in area of specialization.

The most frequently occurring expectation was, 'involvement in a well-planned and organized internship program'.

Extent to which the expectations are met

The respondents were asked to rate on a scale of one to nine the extent to which their identified expectations are met by the technical course offerings of the TTTP in U.S. colleges and universities. Analyses of responses to the expectation statements are presented in Table 2.

TABLE 2: Mean and standard deviation of ratings of the extent expectations of TTTP participants are being met by the technical course offerings of U.S. colleges and universities.

Expectations	*No. of Responses*	*Overall mean*	*S.D.*
Practical Aspect:			
1. Involved in technical laboratory/shop practices in my area of specialization	137	5.02	2.07
2. Make use of different hand tools commonly used by technically skilled persons	134	4.88	2.15
3. Exposed to the use of varied portable machine tools in my area of specialization	135	4.81	2.15
4. Exposed to the use of varied heavy/complex machine tools in my area of specialization	134	4.58	2.16
5. Provided opportunities to go on field trips to industrial establishment(s) in my area of specialization	132	4.67	2.26
6. Provided opportunities to plan and construct practical projects	131	5.18	2.06
7. Given hands-on experience on the application of new high technology in my area	135	4.62	2.25
8. Highly skilled in my area of specialization by the end of the program	135	5.19	2.21
Theoretical Aspect:			
9. Given an in-depth knowledge of the content area of specialization	137	5.30	1.84

Expectations	*No. of Responses*	*Overall mean*	*S.D.*
10. Introduced to new developments in my area of specialization	136	5.48	1.94
11. Given basic knowledge in my area of specialization	131	5.36	1.83
Related Area:			
12. Given an in-depth knowledge of safety practices related to my area	135	5.73	1.81
13. Given opportunity to take technical courses in other areas of interest to me	134	6.08	1.95
14. Given practical training that is related to Nigeria's needs	130	5.01	2.22
15. Given an in-depth knowledge of industrial processes	133	5.26	2.04
16. Given an in-depth knowledge of industrial laboratory/workshop management	135	5.56	1.96
17. Given more exposure to technical courses as opposed to professional courses	128	5.38	1.97

Table 2 shows that 12 (70.6%) of the 17 listed expectations recorded mean ratings above 5. Item 13, "Given opportunity to take technical courses in other areas of interest to me," has the highest mean rating of 6.08, followed by item 12, "Given an in-depth knowledge of safety practices related to my area," with a mean rating of 5.73. A close examination of the results in Table 2 shows that 5 of the 8 expectations relating to the "Practical Aspects" section have mean ratings lower than 5.

Discussion

The findings reported in Table 1 indicate that over 95% of the respondents identified the 17 statements of expectations as being among their expectations of the technical component of the TTTP in U.S. colleges and universities. The high percentage of the respondents who identified the statements in the "Practical Aspects" section suggests that TTTP participants are fully aware of the importance of practical work in contemporary Nigeria's economy. This awareness is in line with the demands of the New National Policy on Education regarding vocational courses.

Table 2 shows that the technical course offerings of the TTTP in U.S. colleges and universities met 70% of the expectations of the TTTP participants. How-

ever, the findings also show that the expectations regarding the "Practical Aspects" of the technical component had ratings slightly below 5 on a scale of 1 to 9. This suggests that TTTP participants' expectations regarding the practical aspects of the technical component were not met as adequately as the other two components.

Conclusions

All the expectation statements reported in Table 1 emerged as the expectations of TTTP participants of the technical component of TTTP in United States colleges and universities. The participants also expected to be involved in a well organized internship program.

Based on the research findings presented in Table 2, 70% of the expectations of TTTP participants were met by the technical course offerings at the U.S. colleges and universities involved with the program.

Recommendations

Based on the findings of this study, the following recommendations are made by the researchers:

1. The expectations of TTTP participants identified in this study should be considered in the screening and selection process of prospective participants.

2. The Agency for International Development (AID) should take into consideration the identified expectations when placing TTTP participants in institutions.

3. Universities involved in TTTP should, among other things, consider the expectations of the participants when planning their programs.

4. Efforts should be made to provide TTTP participants with hands-on experience in the use of heavy/complex modern machine tools in their respective specialities.

5. A follow-up of graduates from TTTP to identify their progress and impact on technical education in Nigeria should be made.

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Skills Development Training in the Consultancy Mode—An Experience in Ecuador*

H. S. Bhola

ABSTRACT

In this paper, the author presents the Case Study of a new approach for project design, which he adopted for a project in Ecuador involving training planning and training design for development of technical skills of workers. Following the dialectical mode, he analyses the planner system, the initial set of objectives and the adopter system and lists the determinants of training planning that would guide training design. He then develops a 'model of training in the consultancy mode' consisting of five stages—demand, diagnosis, definition, design and delivery. He concludes by pointing out the anticipated problems as well as prospects in adopting this new approach.

Introduction

Training design is an exercise in instructional "systems" technology and should, therefore, involve systems thinking and systems practice. The current theory and practice of instructional systems technology, however, is less systemic and more systematic. Its creative ideology is that of logical positivism. The basic design theme is to "program" the teaching-learning process. Most practioners of instructional systems technology look inward to instructional systems components rather than outward to the social system that surrounds the total instructional enterprise. The "system" in instructional systems technology is narrowly defined as the setting in which instructional messages are received (1).

The purpose of this paper is two-fold: First, it will be suggested that the practitioners of instructional systems technology should let go of the ideology of logical-positivism and should adopt instead the creative ideology of logico-dialectics, thereby covering both the logical and the dialectical in educational change. This new ideology will enable them to take a broader view of systems and give them the ability to put a "frame on the flux" of social reality. As a corollary, it will be proposed that the process of "training planning" should always precede the process of "training design" so that the larger socio-political and economic issues as well as some purely technical considerations can be taken into account. The issues to be faced in a training design exercise may include recruitment pools,

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class basis of occupations, institutional settings of training and of work, incentive structures and distribution of rewards of productivity between employers and employees, and, finally, the political economy of development in the country.

Second, the promise of what is called the model of "training in the consultancy mode" will be described and briefly discussed. It will be demonstrated that the contextually-correct approach to training design is indeed embedded in its own context. The process of training planning simply uncovers conditions that compel the choice of a particular training design to fulfil specific training needs in a given context.

Two cautions must be offered before the case study of training planning and training design for the development of technical skills of workers in Ecuador is presented.

The case study need not be considered premature simply because there has been no implementation; and, therefore, there are no findings to report on the effectiveness of the training design. Indeed, the project has not even been approved yet; and must go through a long cycle of development and reviews before it is even submitted for approval to the donor and the recipient governments. What is presented here, then, is a study of the *processes* of training planning and training design in an *initial stage* (2). It is done so in the hope that the case study has something to teach to educational planners in general, and to planners and designers of instructional technology systems in particular.

The second caution is about the generalizability of the models presented. The two models of training planning and training design should not be viewed as being either culture-bound, or sector-bound. Each model will apply equally well to societies other than Ecuador — societies both developed and developing. Each model, again, will be found relevant to instructional situations both in-school and out-of-school, from formal schooling, through distance education, to family planning and agricultural extension.

The Case

In June 1985, the author was invited to join a group of consultants in the preparation of a Project Identification Document (PID) for USAID/Ecuador for a possible vocational skills development project to be implement in Ecuador (3). The initial communication identified a serious lack of adequately trained workers in the small and medium sized enterprises (SME's) in the industrial, service, commercial and agricultural sectors of the Ecuadorian economy, resulting in serious constraints on production, productivity and employment. The USAID/Ecuador wished to examine the feasibility of providing technical assistance to improve the quality of vocational skills training in Ecuador, especially focussed on the needs of the SME's which were already contributing the largest share to the growth of total employment in Ecuador; and were seen to have an even greater potential if their productivity could be increased. In the context of the project to be proposed, USAID/Ecuador envisaged the transfer of the best of the training technology, from the U.S. to Ecuador, incorporating competency-based training methodology; the establishment of learning resources centers to undergird the new training technology; and the institutionalization of linkages between the training system to be proposed and the private sector to ensure increased influence of employers on the training curriculum (4).

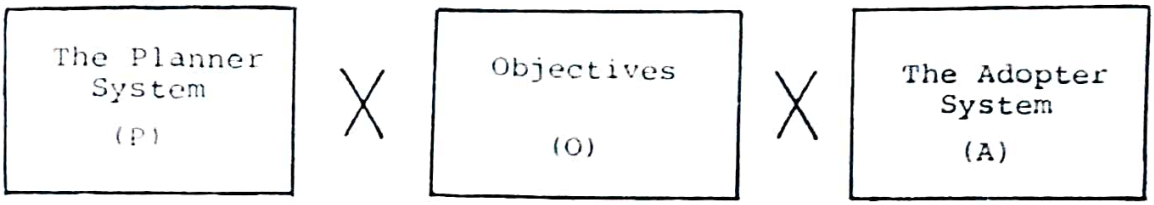
The Model Used for Conceptualization

The assignment given to the present author was to conceptualize the training project within the particular political and social framework of Ecuador; to relate training dynamically to employment generation and economic development; and

to design an evaluation system that will effectively evaluate the process and results of the project.

The CLER model of innovation diffusion, planned change and development was used in the conceptualization of the project (5). The CLER model states simply that the probability of a change event occurring depends on the synergetic optimization of C (Configurational relationships between and among the social configurations involved in the change event); L (Linkages, both formal and informal between and among social configurations); R (Resources available, singly and jointly, to the social configurations in the planner system to promote change, and to the social configurations in the adopter system to adopt change); and E (Environment or environments to which the various social configurations involved in the change event might be responding).

The CLER model is a logico-dialectical model. It is systematic and systemic; and it is dialectical. In the dialectical mode, the CLER model can be presented as follows:



The entities in the "$P \times O \times A$" ensemble above should be viewed to exist in a set of mutually defining relationships, each defining the others. This means that the Objective (O) of a change project are not firm and final for all times, but keep on changing in both subtle and significant ways, as they enter into dialectical relationships with P and A in the "$P \times O \times A$" ensemble. Again, the Planner System (P) and the Adopter System (A) are also not systems with tight and unchangeable boundaries. The boundaries of these systems are indeed both elastic and permeable. The CLER model suggests that the P and A in the "$P \times O \times A$" ensemble should be described in terms of CLER; and then the ensemble should be looked at as one to develop planning-related statements and strategies.

Objectives of the Ecuador Project

Even though objectives do change in the process of design and implementation, training planners and training designers must start with a primitive formulation of objectives to be able to initiate the logico-dialectical processes of planning and implementation. The objectives in the case of the Ecuador project were initially stated as follows:

* To introduce and institutionalize a new and more effective technology of training design and delivery to serve, with greater efficiency and effectiveness, the existing as well as the evolving human resource needs of the SME's; and

* To improve and expand, as appropriate, the existing institutional capacity of training institutions in Ecuador.

The achievement of these two objectives, it was assumed, would ultimately improve the human resource base of the SME's, both within the formal and the informal sectors of the economy; and would contribute to improved production, productivity and employment in the SME sector and in the informal sector of the economy.

Planner System in the Project

The planner system was, in itself emergent, but could be seen, initially, to consist of USAID/Washington, USAID/Ecuador, and the consultants employed to work on the project. There were a large number of "sleeping stakeholders" both within and outside the Government of Ecuador that would, later, become active participants in the planning process. The World Bank, even though not directly involved in this particular project, was a most important influence.

Adopter System in the Project

The adopter system was not yet too well-defined either, and was, again, in the process of emerging. To begin with, it was not clear whether all of the four sectors of industry, service, commerce and agriculture would be covered by the project or whether some would be given priority over the others, and agriculture, perhaps, left out altogether to be covered by other programs already in force. Priorities within geographical regions were also to be established. The adopter system would perhaps include both employers and employees; and would thus encompass both local chambers of commerce and trade union shops.

Planner System Characteristics and Policy Environment

It is not enough for the planner of change to merely identify what social configurations, that is, what individuals, groups, institutions and communities are part of the planner system (or what social configurations constitute the adopter system). The planner of change must acquire substantive *knowledge* of all the social configurations involved in the change event. The planner must have knowledge of their behavioural patterns and propensities, about existing and possible linkages between and among them, of their resources, and of the environments to which they do and might respond (6).

The context of training planning and training design in Ecuador was found to have many layers: the development ideology of the US with its emphasis on private enterprise; the World Bank development assistance policy based on "conditionality"; the USAID policy on economic development and on skills training in Ecuador; and the Government of Ecuador's policies in regard to foreign trade, industrialization and employment. The more immediate institutional environment of the existing training institutions in Ecuador had to be considered as well both in regard to their institutional culture and their institutional capacity.

Ecuador in the International Context

Until (7) the late 1960s, Ecuador, an Andean country of some 283,600 square kilometers — and some 8.3 million people in 1983 — situated in the North-West of the South American continent, was one of the poorest countries of South America and showed all of the typical symptoms of underdevelopment. In 1967, oil was discovered in the Oriente; and by 1970 a pipeline had been completed so that oil could now be sold to the outside world. In 1973, with the coming of the OPEC, Ecuador was making windfall gains from petrochemical exports. During 1973-80, GDP grew at the rate of 8 per cent. From one of the poorest countries of South America, Ecuador became a middle income country in barely ten years.

In 1980, with the worldwide glut of oil and fall in oil prices, a different scenario began to develop. There was a drastic fall in oil revenues and the country entered a period of severe recession. On the one hand, there was a considerable reduction in employment in the oil-related industries; and, on the other hand, the economy was unable to generate any new employment in the medium term future. Thus, there were serious constraints in generating savings at home and in earning foreign exchange. As a result, the balance of payment problems became severe. In 1982, there was an actual

reduction in per capita income of wage earners.

World Bank in Ecuador: Conditionality

In 1983, the World Bank proposed an austerity program which was accepted by Ecuador, fearing economic collapse and with nowhere else to turn to. The World Bank's current economic development ideology is that of promoting partnership of the private and the public sectors in achieving development. A large part of resources in the Third World, the Bank points out, are privately owned, hence they must be manipulated privately (8). The Bank, at the same time, is taking an aggressive stand in regard to its lending to the Third World. It offers help conditionally: loans are provided only if the country seeking help promises to implement economic reforms suggested by the Bank. Under this so-called conditionality, Ecuador was asked to reduce local consumption, offer more attractive interest rates for savings, introduce a better pricing structure for public utilities, undertake a tax reform, achieve greater efficiency in public programs, assure better investment allocation of public funds, rethink some of the present investment plans and increase exports to earn foreign exchange.

US Ideology and USAID Policy

The US economic ideology under the present administration matches that of the World Bank. Developing countries are encouraged to make the policy shift from import substitution to export promotion and give greater role to private enterprise. The President's Task Force on Private Enterprise (9), for instance, saw the world in a "global struggle between free enterprise and statism" and recommended strongly that the U.S. Government should establish a link between trade and aid. The Task Force opined: "We can open new markets, increase trade, create new jobs, spread hope, and build the sort of climate in which freedom can flourish in future generations". Naturally, the key theme of the Task Force was the growth of private sector activity and its key tool was the market mechanism. As a corollary, the Task Force had suggested that "To the maximum extent possible, the US Government should not channel its foreign assistance resources to governments, but to private sector in developing nations."

The Task Force understood the need for appropriate training for the implementation of the new policy initiatives. In the area of training as well there was to be a special emphasis on "private sector participation and needs" and there was to be "training for and by private enterprise" as far as possible. The Task Force took note of the need for "lower level, practical, hands-on training" which would include "managerial, vocational, and technical training." Special emphasis was to be put on "small and rural enterprises, the source of most economic activity in developing countries." The USAID policy in Ecuador sought to make this ideology concrete in local settings.

Culture and Capacity of Training Institutions in Ecuador

As in most other countries of the Third World, the existing training capacity in Ecuador (10) is far less than the development needs of the country; and the culture of the training institutions that do exist is riddled with formalism. It is important to note that the training of teachers for the formal school system itself leaves much to be desired. Training of teachers to serve the special needs of students such as the vocationally oriented or the handicapped gets little attention.

Vocational training in out-of-school settings has a long and rather impressive history in South America. Early in the 1940s, Brazil trained manpower needed for its fast-expanding industry by establishing training arrangements in out-of-school settings and maintained on revenues

collected from the industry itself. This experiment has since been repeated in many other countries of South America and elsewhere in the Third World.

Servicio Ecuatoriano de Capacitacion Profesional (SECAP) follows the pattern of SENAI in Brazil and SENA in Colombia. It was created in 1966 with the objective of providing "intensive professional training for the labor force and mid-level technicians for industrial, commercial and service activities." The legal mandate of SECAP includes service to small enterprises *excluding* artisans and micro sector. In practice, however, SME's remain unserved. Things may change under a SENAI-World Bank Project that proposes to build 10 to 12 skills centers and will provide some mobile training units. These skills centers and mobile training units could perhaps serve the training needs of adults who are interested in training leading to a job.

Centro Nacional para la Promocion de la Industria y Artesania (CENAPIA) was another institutional entity of interest to the planning and design exercise described here. CENAPIA was created in 1975 with the legal mandate to provide technical assistance to the small industry and artisan sectors as well as to help these sectors with credits and other preferences. It has ambitious plans but concrete actions are yet to be taken. In the meantime, there are already signs of conflict between CENAPIA and other institutions in the sector. This does not augur well for the future work of CENAPIA.

Another institution has been established to serve the small enterprises, namely, the Associaciones and Nucleos de Pequenos Industriales, but it has yet to establish a track record. To sum up, the needs of agri-businesses have been least considered and least served. In the other three sectors of industry, commerce and services, available training programs seem to gravitate towards formal training delivered in pre-packaged courses of long and short duration.

Adopter System: Who are the Actors?

The CLER model in the dialectical mode invites due attention to the adopter system: A in the "$P \times O \times A$" ensemble. If planning has to be more than blueprint planning, enough should be known about the adopter system. If planning is for implementation, then we must have knowledge of all the actors in the adopter system and of relationships among and between them.

In the case of this particular project, the core of our adopter system consisted of the SME's. But as we pointed out, earlier in the paper, many questions remained unanswered: What SME's will be covered, in what economic sectors, and in what geographical regions of the country? Shall we target the employers or shall we reach the employees? Shall we cover also workers not employed but actively on the job market? Shall we consider the chambers of commerce as well as the trade unions as parts of the adopter system? What do we know about all these various actors within the adopter system?

As was indicated earlier, most of our knowledge about the present condition and potential of SME's came from three studies conducted by Partnership for Productivity, Washington, D.C. for the Private Sector Office of the USAID Mission in Ecuador; and an additional study also conducted for USAID/Ecuador by Professor Albert Berry on "intermediate cities" — secondary cities that in terms of size stood between large cities and small townships. It is not possible to review in any great detail the findings of these studies in the space available. Only the most general conclusions can be presented.

The studies took note of the extreme politicization of the labor movement in Ecuador and found the labor and capital animosities to be severe. The labor market was thus in turmoil. On the one hand,

there were unsatisfied aspirations; and, on the other hand, there were obvious inefficiencies crying for attention.

During the last 10 to 15 years, the Ecuadorian economy had moved towards the modernity end, but with all the progress, it still remained a substantially informal economy. In 1982, 42.5 per cent of the labor was employed in agriculture; 21.9 per cent in services; 10.4 per cent in management; 9.6 per cent in commerce; and 5.7 per cent in construction.

The economy needed to create employment for reasons both economic and political; and clearly must promote labor-intensive enterprises. The SME's were, therefore, central to the strategy of economic growth. Simply because of their size, informal and rural sectors of the economy held great promise. Agro-industries were clearly most important if the policy shift from import substitution to export promotion had to be implemented. Within the SME's in the more formal sectors of industry, commerce and services, employment potential lay in new enterprises rather than in existing ones.

In view of the preceding, the intermediate cities would play a most important role in the economic growth of Ecuador. Intermediate cities were dyanamic and not averse to using labor-intensive production processes. Also, they were using very little import components. They already were focussed on agro-industries, artisanery and small industry.

These studies also brought up the need for the training of workers and managers if the development potential of SME's had to be fulfilled. Contrary to common belief, however, these enterprises did not seem to need training in the technology of production. They seemed to do all right on this score. What they did need was training in management, cost analysis, market research, credit assistance management, production management, inventory control, and information about export opportunities and regulations.

Generating Planning Statements

The CLER model suggests that after initial, but sufficient descriptions of *P*, *O*, and *A* have been established, the ensemble should be looked at as one and planning-related statements should be developed. No facile formulas can be offered for generating these planning-related statements. One has to look hard and think of what is amenable to change, choose the strategic from among the possible alternatives, do mental experiments to test the relative goodness of the choices made, and make sure that the choices made are congruent with one's values. We will, later, in the paper list the statements derived from the "$P \times O \times A$" ensemble in this project, but first we must discuss the three overlapping thought processes involved in the planning of change whatever its size and scope.

From the Theoretical to the Existential

The CLER model highlights three different but interacting processes involved in planning. In our first encounter with the situation of change, we begin by *ordering and relating* what we see. We impose a structure on that slice of the world that concerns us, placing boundaries around the planner system and the adopter system in relation to the objectives we may have in view. We look for the actors (individuals, groups, institutions and communities and subcultures) within the planner system and the adopter system and make sense of their relationships. Some temporal order is imposed as purposes and causes are assigned. Both facts and values are involved in this process.

Ordering and relating is both accompanied with and followed by the process of *typifying and expecting*. The various social entities, social processes and environments involved in the change episode just ordered, are now typified and expectations about their behavior and performance are built.

The third process involved is that of *experiencing and correcting*. The planner is now immersed in the reality that is the object of manipulation. Theoretical knowledge which is most useful in the first two levels is not usable here. Now the theoretically designed strategies must be tested in the context of existential reality.

Thus, before an operational strategy for planned change can be developed., the "$P \times O \times A$" ensemble must go through these three processes. It is implicit in the model that the implementation of S1 (Strategy One) will generate further knowledge which will make another multi-layered review of the "$P \times O \times A$" ensemble possible and, thereby, generate S2 (Strategy Two) for use in the change episode. The final objectives will be achieved, in some form, through a process of successive approximations.

In the case described here, most of the planning effort was spent in ordering/relating. Some typifying/expecting was also done, but this was at a general level. For example, we found out a lot about intermediate cities generally, but not much about the particular cities where we might want to locate the project. Again, we found lot of useful information about SME's in general but not much about particular SME's in particular sectors, in particular cities where we might work.

Determinants of Training Design

Looking at the descriptions of the planner system, the initial set of objectives and the adopter system in a dialectical mode, we were able to list the following statements that would guide training design:

1. The project was to benefit productivity and employment in the private sector.

2. Within the private sector, SME's were to be targeted. (Which of the four sectors of industry, commerce, service and agriculture would be given priority was not yet clear.)

3. The project had to be a *training* project.

4. If at all possible, training had to be delivered through the private sector to the private sector. Linkages had to be established with the private sector in such a way that the private sector had influence on the type of training delivered.

5. Training was to be basically training in management and entrepreneurship and not technical training.

6. Training design had to include the components of competency-based training design, learning resource centers and employers' advisory boards all of which had proved to be useful in recent projects implemented by USAID/Ecuador in the country.

7. Special attention had to be given to the economic promotion of women and the poor.

The Environment of Uncertainty

The most important fact in the planning environment, however, was the current level of uncertainty. The choices of the intermediate cities where the project might be located and of the economic sectors it might serve were not made. Questions about training curricula were left unanswered as was the question of institutional location. Little was known about the trainees, their training needs and incentives to which they would respond. The only thing that could be said with certainty was the fact that the project will have to respond to multiple contexts, and multiple needs which will, in turn, be constantly changing.

The training design, therefore, had to include a continuous design function in itself. The training system had to be

designed as an intelligent system which would collect information in the course of performance and on the basis of that information make proper means and ends calculations. Only a few essential decisions would be made at the front end. These decisions had to be either fail safe or reversible or low risk. Thus, only those components of instructional technology could be brought in that would be needed under all circumstances.

Training in the Consultancy Mode

Using the determinants of training planning listed above, the following technological decisions were made which gave us a model of training in the consultancy mode (11):

1. A number of Regional Training Support Systems (RTSS's) will be developed that will use the latest training technology including competency-based skills training and learning resource centers. In its fully functional final form, the project, on the one hand will have a national coordination mechanism; and on the other hand, will have a number of local level cells for effective outreach. A beginning will be made with three regional centers, one each in Quito, Guayaquil and Cuenca. The first center will be opened in Cuenca, a region of greater relative need. What is learned from this experience will be fed into the establishment of the other two RTSS's in Quito and Guayaquil.

2. Each of the RTSS's will have two major components: a program development component that, in consultation with client groups, will clarify training needs and establish training priorities; and a training design component that, on the basis of task analysis, learner analysis and environment analysis, will design and produce training courses, and instructional materials. Each of the RTSS's will be able to perform the following functions: learning needs assessments, liaison with small enterprises, training consultancies, training design and delivery, production and testing of courses, packages and materials, information and documentation, outreach through mobile units and evaluation. In collaboration with existing training institutions, the RTSS's will engage in both (*i*) supplementation of existing training and (*ii*) complementation of existing training. In other words, each RTSS will complement existing training through technical assistance and thereby improve training quality. Each RTSS will also supplement current training effort by offering new training courses to satisfy newly emerging needs.

3. The question of institutional location of the RTSS's will be decided later as more data become available about the cultures and capacities of the various possible institutional locations. The institutional arrangements to be established will reflect the policy orientations established by USAID. To ensure that the RTSS's are able to take affirmative actions in regard to the economic promotion of women, one of the two co-directors of each of the RTSS's will always be a woman. The other may be a male or a female.

4. Each of the RTSS's will also have an advisory board to help it develop both long and short-term training policy.

5. In the development of local training capacity as well as in the delivery of training to client groups in the local setting, a multiplier model will be used which can be represented graphically as follows:

T1→T2→T3→T4→ Groups of Trainees.

Trainers from universities in North America (T1's), provided by USAID/ Ecuador, will train their counterpart trainers (T2's)— the latter will be working whole-time within the RTSS's. Most of T2's would have visited institutions of higher education and training in the United States and would have received formal and/or internship training in the area of instructional systems technology and training design. T2's will train T3's, trainers already working within the train-

ing centers and institutions of Ecuador, especially those serving the particular needs of SME's. T3's will train T4 trainers — those who might be functioning within individual economic enterprises or groups of enterprises to fulfil the immediate local needs of those establishments. T4's, of course, will be at the firing line in regard to the delivery of training. Where no T3's or T4's exist, T2's will work directly with T4's or the client groups as the case might be.

It is important to point out that trainers T1, T2, and T3 and perhaps even trainers T4, will be trained as *instructional technologists* and not in the various technologies of the SME's. They will, of course, have a general orientation to the substantive content of training. But they will be basically specialists in training design rather than specialists in technical content. In the actual process of training design, training designers and technical specialists will work together in teams, each participant making his or her own special contribution to the task in hand.

6. The process of training design and delivery will be "demand-driven". It does not mean, of course, that the training specialists will sit in their laboratories and offices and wait for people to come to make their training needs known and demand that they be trained. We know now quite well that neither individuals nor institutions can always define and diagnose their problems. The definition of the problem may indeed be the stage at which potential clients may most need the help of a specialist. What we propose, then, is a mating of ideas between the training specialists at the RTSS's and the SME's.

7. The model of training in the consultancy mode will consist of five stages: Demand—Diagnosis—Definition—Design —Delivery. In the first stage, the model will involve establishing a mode for the encounter between the SME's and the RTSS's and the development of demand for its services. In the second stage, there will be a more concrete diagnosis of the situation. The question asked will be: What is the problem? The question will not be: What is the *training* problem? In many cases, the problem may not turn out to be a training problem but another, such as, lack of credit, lack of marketing information, or need for legal services. The RTSS's should, in such cases, have the necessary information and the organizational capacity to make referals to appropriate agencies.

If the problem is defined as a training problem, then the design process should begin. Here is where one of the typical *instructional development* models will be used (12). In the final stage, instruction will be delivered, that is, trainees will be trained for effective performance.

8. The model of training in the consultancy mode requires that the process of training design should be conducted anew for each and every training episode. This does not mean that prepackaged training programs will have no part in this training model. What it does mean, however, is that the training approach will always be problem-centered and not course-centered; and that in each case, the training team will start with the problem definition, and diagnosis, before coming to the definition of the learning needs and undertaking the task of training design. If someone has already designed training for a very similar group with very similar objectives, and has produced instructional materials to go with this training, it would be absurd to waste resources for re-inventing the wheel. But even in such cases, the instructional package should be unpackaged and then repackaged so that the special ethos of the culture, the immediate organizational climate of training and economic institutions, the special needs of the group, and the local peculiarities of the technology and the materials in use can be duly projected in the design and delivery of training.

9. The model of training in the con-

sultancy mode should not be used to make an overkill. There will still be need for relatively standardised programs such as accounting, taxation and import and export procedures.

Not without institutionalization!

As indicated earlier, the question of institutional location of the RTSS's had been postponed until a list of possible candidates could be developed; information about each of them could be collected and, consequently, well-informed choices could be made. However, there are some problems with the concept of institution building (I-B) itself that have serious practical consequences. These problems need to be clarified to ensure that the decisions in regard to the institutional structure and institutional location of the project when made are appropriate.

First, we need to understand that whatever needs to be done systematically and with some expectation of continuity, needs a system — in other words, some institutional arrangement is required to be established. Unavoidably, the RTSS's proposed above will have to be institutionalized. I-B, defined as the process of building new institutions to perform new social functions, or rebuilding existing institutions to help them to acquire new capacities and new objectives, has had a checkered history. The 1960s and the 1970s were the heydays of I-B (13). USAID was in the forefront of the movement of institution building as part of their technical assistance effort. Since that time there has been a backlash against I-B. However, the critics of I-B seem intent on throwing the baby out with the bath water. What was wrong with I-B was never the idea of I-B, but wrong decisions in the choice of strategies and impatience in the implementation process. Practitioners of I-B were in too much of a hurry to get their job done. In place of facing the more difficult task of renewing existing institutions or managing the politics of building new institutions in competition with existing institutional arrangements, they chose to build brand new institutions isolated from local politics and under their own control — out on the periphery and not in the mainstream. No wonder these institutions died as soon as the artificial life support systems provided by foreign technical assistance were withdrawn.

In the present project as well, the purpose should not be to avoid I-B. Indeed, the avoidance of institution building is not possible. What we need to do is to do a good job of institution building: to dare to renew existing institutions, and, if need be, to build new institutions *within* the existing institutional networks, whatever the cost in dollars and ulcers.

Evaluation of the Project

Since the project is in a very preliminary planning stage, "evaluation planning" (14) in regard to this project must be more in the nature of a statement of evaluation principles rather than in terms of concrete evaluation proposals. First, the project will have a built-in evaluation system; in other words, evaluation will be an activity that permeates the whole implementation process. At the core of this built-in evaluation will be a management information system (MIS) which will record data as it is generated by the program and will, thereby, promote within the RTSS's, an organizational culture where information is valued, and is systematically developed and used to make informed decisions from day to day. This should not be difficult to do within a project dealing with training design in the competency-based mode. The design process has to be based on data on learner characteristics and on teaching effects. Evaluation cycles are an integral part of such a process of training design.

The second important principle applied to evaluation in the project will be methodological pragmatism. Both formalized and naturalistic methods of evalua-

tion will be used depending on the information needs. There will be competency tests and tracer studies in the formal mode. Naturalistic methods such as suggestion boxes, visitors' remarks, letters from workers, and employers, conversations, and observations will all be used to generate feedback on the effectiveness of training.

Problems and Prospects

The training planning process through which we went and the training design that we came up with is by no means problem-free. It is important to anticipate some of the problems.

First and foremost, there is the problem arising from the project design being somewhat unusual. It is unusual in the sense that it proposes the initiation of open-ended processes rather than giving a list of concrete activities to be conducted or providing an inventory of definite tasks to be performed. The design is able to reduce very little uncertainty, and postpones many important decisions. It is honest in refusing to offer the readers a false sense of security to which we have all become so accustomed. But the problem is that the proposal may not even make through the initial cycle of approval.

Second, the proposal will require a staff of very high quality both from universities in the US and from inside Ecuador. Hiring the merely second-rate and giving them impressive-sounding professional designations will not suffice.

Third, the project will have unusually high training needs of itself. Even the best qualified local staff will have to be sent to the US for training in instructional technology. At the local level, the training problem may be confounded by the fact that staff trained at the cost of the project may be stolen by competing institutions through the promise of better rewards.

Fourth, training in the consultancy mode takes time to design and time to deliver. This will mean a slow start and higher project costs at the front end.

Fifth, the SME's may not use the services of the RTSS's. They may consider the training process to be too formal and too sophisticated. The experience of the SME's with the government has been such that small entrepreneurs like to operate outside the institutional and legal framework designated to support their operations. They may avoid training help as well for fear of being trapped in something they do not understand. Those who do use training opportunities may use training for the greater exploitation of labor rather than to increase employment or to promote the welfare of those now in employment. As the *Partnership for Productivity* studies point out, SME's after all have self-interest, not community interest at heart. On the other hand, if training is really effective, other larger economic enterprises may siphon off training resources. This is quite possible when they themselves serve on the advisory boards of these RTSS's.

Sixth, unless overall economic and political structures change, training may make no difference at all. Productivity may not change without change in incentive structures. The advantages of increased productivity may be kept by the employer and may not be shared with labor. Employment may not increase because of the geographical and class basis of employment.

Seventh, long-term funding may not develop and the project may fade away as soon as USAID funding is terminated.

Yet, if this bold initiative is accepted and implemented, real training needs of SME's may be fulfilled. Local training materials may be developed where none exist now. A new training culture may develop within the skills development training sector in Ecuador that may spillover into other sectors of education and development in Ecuador.

NOTES AND REFERENCES

1. See *The Definition of Educational Technology*. Washington, D.C.: Association for Educational Communication and Technology, 1977 for a delineation of the dominant paradigm in instructional systems technology. A popular textbook, representative of the field uses the word systematic in the title: Walter Dick and Lou Carey, *The Systematic Design of Instruction*. Glenview, Ill.: Scott, Foresman and Co., 1978.

2. This paper should be read as an individual contribution to the understanding of the process of training planning and training design. The paper has no official status whatsoever; and commits no one, official or non-official, in the US or in Ecuador, to the contents of the paper. Documentation used for writing the paper is all in the public domain.

3. The three-week invitation to the author came from Professor Gene Lamb of San Jose State University, currently, Distinguished Research Fellow in International Education with the United Schools of America Incorporated, Miami, Florida. Dr. Lamb, in addition to writing several parts of the project, has the overall responsibility for final editing and submission of the project proposal. This author's debts to Dr. Lamb are many and, in the writing of this paper, it has not always been possible for me to separate his ideas from my own.

4. These three components have been well-tested and had indeed proved their worth in projects designed and implemented in Ecuador under Professor Gene Lamb, e.g.: the project of institutional development of the Centro Juvenil San Patricio; the project dealing with the development of an urban technical school, namely, Escuela Anzoatequi under Filantropica, in Guayaquil; and the creation of the Instituto de Desarrollo Professional (IDEPRO) under Camara de Comercio, Guayaquil.

5. See H. S. Bhola (ed.), *Planned Educational Change: A Model and Critiques Thereof*, a special issue of *Viewpoints in Teaching and Learning*, Vol. 58,No. 4, Fall 1982 for a detailed elaboration of the CLER model and its tests and applications. The methodology of the CLER model in the logico-dialectical mode is presented in H.S. Bhola (with Joginder K. Bhola), *Planning and Organization of Literacy Campaigns, Programs and Projects*. Bonn, FRG: German Foundation for International Development (DSE), 1984. ERIC Document No. ED 240 302. See also a more recent paper by H. S. Bhola, "Tailor Made Strategies of Dissemination: The Story and Theory Connection," paper presented to the Seventh Nationwide Vocational Education Dissemination Conference of the National Center for Research in Vocational Education, The Ohio State University, Columbus, Ohio, November 13-15, 1984. (ERIC Document No. ED 253 728). It must be pointed out also that USAID has a model of its own that is required to be used in the design and evaluation of its projects, *The Logical Framework — Modifications Based on Experience*. Washington, D.C.: Agency for International Development, November 1973. In the document that I prepared I thought with the CLER model and wrote with the logical framework. The logical framework is not incompatible with the logico-dialectical CLER model, but it does not go far enough in dealing with what can be called frame factors. The logico dialectical nature of the CLER model enables one to put logical frames on social reality that is in perpetual flux.

6. Acquiring knowledge about configurations, linkages, resources and environments in the context of a change event is never a one-shot affair. Knowledge constantly grows as more and more is read and discussed; and as research findings are comple-

mented with firsthand experience. Knowledge is also continuously being tested as it is put to work to make sense of the reality, to design strategies of change, and to learn about effects. The experience of this author in Ecuador was no different. Some knowledge was acquired on campus, more was learned in interaction with colleagues in Ecuador, and even more through an immersion in the local reality.

7. This section and the one following is based on World Bank documents on Ecuador and, particularly, *Ecuador — An Agenda for Recovery and Sustained Growth* (A World Bank Country Study). Washington, D.C.: The Bank, 1984.

8. *Economic Development and the Private Sector*. Washington, D.C.: The World Bank, 1983.

9. *The President's Task Force on International Private Enterprise: Report to the President*. Washington, D.C.: USAID, December 1984. Also *Private Enterprise Development*. (A.I.D. Policy Paper: Revised). Washington, D.C.: U.S. Agency for International Development, March 1985. The USAID training policy is included in their *Basic Education and Technical Training*. (A.I.D. Policy Paper). Washington, D.C.: U.S. Agency for International Development, December 1982.

10. This section and the one dealing with the adopter system is developed on the basis of personal notes made by the author during his visit to Ecuador and on the following documents: *Employment and the Role of Intermediate Cities in Ecuador During the Coming Years*, prepared by Albert Berry for USAID/Ecuador, July 1984. The three studies prepared by the Partnership for Productivity/International for the Private Sector Office, U.S. AID Mission, Quito, Ecuador are: *A Small Enterprise Development Program for Ecuador: Economic Background Paper* by Jorge Sanguinetty, Albert Berry and Augusto de la Torre, June 1985; *A Small Enterprise Development Program for Ecuador: Institutions Background Paper* by Gino Lofredo, Liza Valenzuela and Miguel Maldonado, June 1985; and *A Small Enterprise Development Program for Ecuador: Strategy Paper* by Albert Berry, Gino Lofredo, James Hochschwender and Liza Valenzuela, June 1985.

11. Many of the ideas that finally entered the model of training in the consultancy mode came from Professor Gene Lamb of United Schools of America, Miami, USA; Mr. Patricio Maldonado of USAID/Ecuador, Quito; and many others with whom the author had the opportunity of interacting and discussing.

12. See Robert M. Gagne and Leslie J. Briggs, *Principles of Instructional Design*. New York: Holt, Rinehart and Winston, 1979. Also the Dick and Carey book referred to in Note 1 above.

13. Melvin G. Blase, *Institution-Building: A Source Book*. Washington. D.C.: USAID, 1973.

14. See H. S. Bhola, *Evaluating Development Training Programs*. Bonn, FRG: German Foundation for International Development (DSE), 1982. ERIC Document No. ED 238 651. Also, H. S. Bhola, *Evaluation Planning, Evaluation Management and Utilization of Evaluation Results within Adult Literacy Campaigns, Programs and Projects*. Bonn, FRG: German Foundation for International Development (DSE), 1982. ERIC Document No. ED 221 759.

Education as an Integrative Element in an Integrated Rural Development Programme

DAN O'BRIEN

ABSTRACT

The concept of Integrated Rural Development Projects has been debated vigorously. Some have claimed that it is little more than a new name for previously unsuccessful rural development projects. The author shows how, in at least one, the concept of integration was largely fruitful and lead to widespread benefits to the area in which the project was carried out. Through the example of the East Sepik Integrated Rural Development Project (Papua New Guinea), the author describes how the project had far greater effect than would have been expected, had not the education sub-project been an integrative factor.

Introduction

The concept of Integrated Rural Development Programs grew out of dissatisfaction with rural projects as they had been conceived and executed during the 1950s, '60s and early '70s. For example, despite the Green Revolution, rate of growth in food production fell between 1962 and 1974 (Leupolt, 1977: 7). In planning massive, single crop interventions such as the introduction of miracle rice, little attention had been paid to the attendant social changes (Murai Yoshenori, 1980; Richard W. Franke, 1982). To counter such deleterious effects programs were developed concentrating not on single crops but on the development of the potentialities of a region and its people. The aim was no longer to produce one large export crop but to involve the people in a concentrated effort to develop the overall potential both of themselves and of their region. Through government and aid organizations, plans were drawn up whereby a series of related interventions would be carried out in a particular region (cf. Cohen, 1980: 199). The ultimate aim of such coordinated activity was the balanced growth both in societal and economic terms of a region or district. The name, Integrated Rural Development Program, was coined for such interrelated activities in a specific rural area.

However, the idea of Integrated Rural Development Program (henceforth I.R.D.P.) has itself come in for severe criticism. Perhaps the most damning and most frequently quoted phrase is that of Ruttan who said in his article that I.R.D. is an 'ideology in search of a methodology or technology' (Ruttan, 1975). Another criticism levelled at the concept of integrated rural programs was that it became a catch-all phrase for any effort to improve rural conditions through government or aid-organization intervention and that the concept had no definition or clarity as a result (cf. Sweet, quoted in Cohen, 1980:198). It is even sometimes referred to as a "Buzz word". A number of articles have been published with the aim of clarifying the concept and helping to refine the operation of IRDPs.

Concept of IRDP

Leopolt sees IRDPs as increasing the

involvement and absorption of the rural poor in an expanding rural economy (1977:33). In this view an IRDP would increase the yield of subsistence farmers without incurring the destruction of the environment, improving food consumption patterns and basic conditions of living (1977:14). Two main strategies would be used to achieve these objectives. Firstly, improve access to productive sources and employment; secondly, mobilize and motivate the people at local level (1977:15). Leopolt, according to Cohen, is interested in integrated aims i.e. increased production and distribution, with which he agrees. For his own part, however, he is more concerned with 'tying together those mutually reinforcing components that are essential to a program or project's success' (Cohen, 1980:203). He calls his model of an IRDP a "mutually reinforcing" one. He wishes at the conceptual level to 'narrow the concept so that it can be distinguished from the larger notions of rural development and be applicable to set situations so that it be a viable devlopment approach' (1980: 209).

Armor et al are chiefly concerned with the administration and organization of an IRDP. They accept a broad description of 'Integrated' using the words 'multisectoral' and 'total systems' to typify such an approach. Their interest therefore is in seeing how different sub-systems within a project may be related to one another and to the total operation. In this way they accept the validity of Cohen. In looking at the administration of a project they comment: "To promote integration, project designers draw up organization charts with boxes designating spheres of activity and lines between the boxes indicating either chains of command or areas of 'coordination'. What is too often missing, however, is any indication that boxes higher up have the authority or the resources to direct the boxes lower done; or whether parallel boxes have any incentives to coordinate their activities." (Armor, Honadle, Olson and Weisel, 1979:277).

They also ask the question, "Why should the member staff of different subsystems of a project co-operate with one another?" (Armor et al 1979:277). It is not infrequently true that one part of a project may be seen to be almost in competition with other parts.

A further problem that they detail is that of co-operation and communication with the local farmers — 'Empirical research has shown that the probability of project success is significantly raised by such factors as effective two-way communication between project staff and farmers' (Armor et al 1979:282). This problem may be joined to another that they mention when trying to involve local people, namely, that unless there is some input from the beneficiaries that the project is supposed, then the project is likely to remain active only as long as the project personnel are present. They suggest that the solution to this problem be sought in 'process consultation' (1979: 283) whereby the project ceases to be a cast-iron, unchangeable operation handed down by one group of people to another but that room is left for continuing input by those for whom the project is designed and who will be expected to carry it on in the future.

In his article in the PNG journal Yagl Ambu David Lea points to the difficulties associated with IRDPs and with the conceptualisation of the idea. His view is that the meaning of the term depends on which author is using it. He traces the history of the term through U.N. and World Bank sources and shows that the use of terms such as 'comprehensive approach' or 'total development' to explain 'integrated' do little to clarify the concept. Having examined various approaches to IRDPs Lea concludes that there is little reason for hope. He details problems such as the administrative ones mentioned by Armor et al and the practical difficulties attached to trying to link rural and urban areas and those encountered when trying to modernise methods of agriculture. He points specifically to

the difficulties to be found in trying to 'integrate the best of traditional and modern society'. While one must acknowledge the validity of much of Lea's criticism, it can be shown that operationalising of the integration of traditional and modern methods is not impossible and that this can lead to other forms of integration.

IRDP Model

To fulfil the model of integration set out above, an IRDP would need to have the following characteristics. The administration should be clear, both vertically and horizontally, i.e. to fulfil Armor's requirements the chains of command from top to bottom should be clear and the duty to co-operate between those at equal levels be patent. In fulfilling Armor's requirements administratively, Cohen's 'mutually reinforcing' model comes into play, but does not stop at clarity of organization. Genuine co-operation is required to make components reinforce one another. The objectives of the model are set out by Leupolt in the demand for an expanding rural economy in which the rural poor are involved. This final integration of the locals into the program fulfils Armor's model but must at the operational level be a combination of traditional and modern methods for the program to continue after funding ends. If this last integration has not taken place, then the particular IRDP will not be part of local life but just another piece of outside temporary benevolence or interference.

A model IRDP would be one in which there was an overall goal for the region or area. After consultation with the local authorities the project would be set up so as to be coherent with local developmental objectives. Local in this case could be regional, district, or in the case of Papua New Guinea, provincial. An overall Manager should be appointed, one who is acceptable both to the authorities and to the experts and locals responsible for specific areas. It is vital that the Manager be able to communicate not only with his own technical staff, but also with local influential figures and through them with specific people, the villagers, who would carry out the project. This guarantees a vertical flow of communication, not only downwards from the Manager but upwards from those who are expected to benefit and who will carry on the project when Manager and experts have departed.

Each of the sub-projects should be run under the general direction of the Manager. At sub-project level, co-operation between sub-project Managers should take place so that the maximum benefit accrues to the people. Each sub-project would be open to suggestions and feedback from the people in an endeavour to find in what way the sub-project meets their needs. The lack of communication between sub-project Managers, the local authorities and the people they serve leads to individualistic practices. The integration planned for the Project fails, and small separate empires result. Consequently, one part of an IRDP may be in competition with another. One part may fail through lack of help or even positive hindrance by one or more of the other sub-projects.

The ideal world does not of course exist, and IRDPs suffer from many problems. It would be unrealistic to expect that a total IRDP would work out. However, this does not mean that the idea should be abandoned. This paper deals with one IRDP which achieved some of the aims of the model set out above. The model helps point out some of the bottlenecks and failures encountered in the operation of the project and may help point to some structural faults in the model.

The East Sepik Rural Development Project

The IRDP in question is the East Sepik Rural Development Project, the first Integrated Rural Development Program in PNG. The paper shows how

co-operation occurred fruitfully between two of the sub-projects though this was not originally envisaged in the Plans for the Project. It also shows how integration of the two sub-projects into the lives of the people was carried out. What is particularly interesting is that the horizontal integration examined occurred between a project of the D.P.I. and the Education Department. As five of the six projects were from the D.P.I., the Education's sub-project was regarded by some as an unwanted extra. Some people wrongly said that it had been tacked on as an afterthought. Examination of the original documents shows that the Education sub-project was always part of the overall scheme.

The East Sepik is one of the largest of PNG's provinces. It has some 210,000 people out of a total population of 2.9 m and ranks sixth most populated province. The major geographical feature of the region is the Sepik River which flows into the sea east of Wewak, the major town. The province is recognized as being one of the poorest in New Guinea. Jackson rated it eighteenth out of twenty-one on a composite index of five indicators: Health status, Education status, Land transport, Smallholder income and Government staffing (Jackson, 1979:176). A similar study carried out by Kent Wilson but using districts as the unit, found that the four districts of the East Sepik, Wewak, Maprik, Ambunti and Angoram, rated 10th, 37th, 58th and 62nd of 79 districts. The indicators used were Indigenous Cash Crops per head, Hospital and Health Care beds per 1000, Administrative staff per 1000, School enrolments per 1000, Index of accessibility and Local Government council grade. Since Wewak is a large administrative centre and is rated the fifth town of PNG, the positions of Ambunti and Angoram as 58th and 62nd of 79 districts are indicative of the general lack of input into the area and qualifies the province as one of the poorer in PNG.

The economic benefits of the project to the Papua New Guinea people were seen as increased agricultural and fisheries production, resulting in enhanced export earnings and a reduction of imports (Vol. 1 Appraisal, 1976). The immediate beneficiaries were to be 25,000 farmers and 3,000 fishermen, together with their families, making up about 150,000 people out of a total province population of 226,000 in 1975 (Appraisal, Vol. 1, p. 15).

Since over fifty per cent of the population of PNG in general and of the East Sepik in particular, is under fifteen years of age, and most would be going back to the land after schooling, then investment in their education and training as related to their future existence on the land was seen as important. In addition, such investment in agriculture and nutrition education would cut down the high rate of malnutrition prevalent in the province (Appraisal Vol. 1).

Prior to Independence in 1974, it was suggested that a loan might be obtained from the Asian Development Bank for a project in the East Sepik. A team from the Bank examined the province with a view to granting a loan for a rural development project. As a result of their work a document called 'Appraisal of the East Sepik Rural Development Project in PNG', Volumes 1 and 2, was produced. This document suggested that an integrated rural development project consisting of six sub-projects could usefully be implemented. The PNG government requested a loan from the Bank. A total sum of 10.4 million kina was advanced for the scheme, 7.6 million kina coming from the ADB and the remainder from the Government.

The general aims of the project are contained in the 'Appraisal of East Sepik Rural Development Project in Papua New Guinea Volume 1 Main Report, November 1976' (henceforth Appraisal Vol. 1 or 2). The work for this document was carried out by a team from the Bank. It was suggested that an integrated rural project consisting of six sub-projects be implemented in the East Sepik Province. The

Papua New Guinea Government requested assistance from the Bank, and on the basis of the appraisal the Bank agreed to give a grant in the form of a long-term low interest loan.

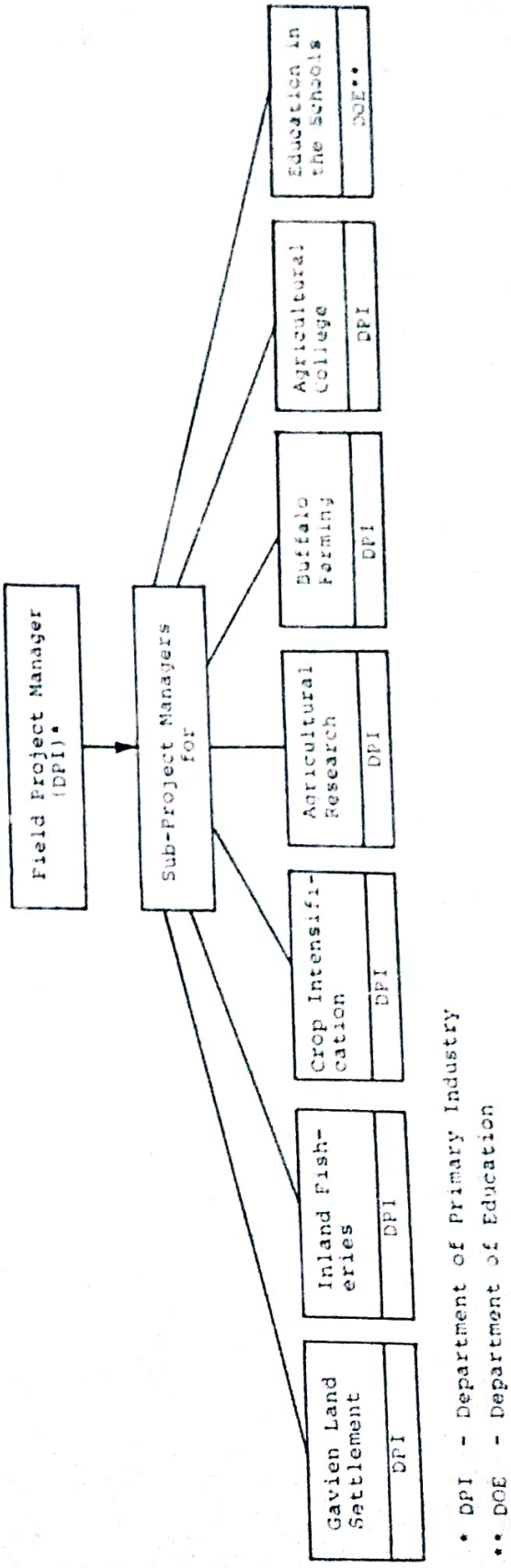
The team recognized that there was real potential for developing PNG's agricultural exports and in reducing her imports through such a project. As this was one of the major aims of the new government, agreement on the overall strategy was easily reached. The ambience in which the project was to take place was said to be one where PNG was passing through a transitional stage from subsistence to market and cash cropping. The project was seen as helping in this transition. (Appraisal Vol. 1).

The East Sepik Rural Development Project is thus an areal project as defined by Armor (1979:279). It also attempts to take into account criticisms of single commodity projects criticised by Leupolt and others. The aims of the E.S.R.D.P. are to help not just one section of the community, but the community as a whole with particular reference to those who are poorer.

The project is to be divided into six sub-projects:

1. Gavien Land Settlement (planting of rubber bearing trees)
2. Buffalo Farming
3. Inland Fisheries
4. Crop Intensification
5. Agriculture Research
6. Agriculture and Nutrition Education.

The chart for the organisation of the Project is laid out on p. 69 of the first Volume of the Appraisal, and a diagram of the lower two sets of boxes is given here.



The organization of the Project may be seen from this chart. The Project Manager lived in Wewak (the provincial capital) and had an office at the provincial headquarters. Sub-project managers lived at their sub-projects and had constant contact with the Project Manager.[1] However, as Armor notes in connection with other projects, little attention is paid to delimiting chains of command (Armor et al, 1979). Each sub-project is connected by a line to the Project Manager, but there is little indication of degree of control exercised by the latter, and there is no indication of any horizontal links between the sub-project managers who were the operational agents of the project.

Though the document uses the word integrated on several occasions (Appraisal, Vol. 1), the meaning given is not very precise. On page 1 of the Introduction, the word integrated is not used; the document simply states that the 'proposed Project consists of six sub-projects'. On page 29 however, in the description of the project, it is noted that 'the project strategy ..is based on an integrated area development approach with benefits for all sections of the population' (Vol. 1, 29). An internal review in January 1980 by J. Cairns, D. Takendu and G. Sadler was concerned that the project 'be fully integrated into the overall development programme for the Province' (p. 3). The description of what each sub-project is intended to do does not include any reference to integration either with the provincial authorities or with the other sub-projects. Appraisal documents and reviewers, as far as one can judge, used the word 'integrated' as a descriptive term. It meant that the project was confined to a certain area, that it had a series of sub-projects, and that overall it was tied to other provincial operations. What this article shows is that achievement of the aims of one sub-project is inextricably linked with the achievement of another. This linking is shown to be essential to the definition of an IRDP and fulfils the model as sketched by Armor et al administratively, and by Cohen and Leupolt from an operational point of view. Secondly, it is shown that a sub-project has little chance of success unless it is involved in the ongoing life of the people and changes with their reactions to the program's inputs. Thus it fulfils Armor's need for vertical integration with the people it is meant to help. Thirdly, it is shown that the aims of a sub-project cannot be realised without involvement in province plans and structures. This new dimension is one which is not mentioned by the authors quoted, but is not in contradiction with their views. It does however add an element to the definition.

The author, in company with Mr. K. de Lacy, was an external evaluator of the Agriculture and Nutrition Education sub-project in July 1981. This is the one sub-project outside the D.P.I. umbrella. Because of its somewhat invidious position as odd man out, it is a useful one to look at in the examination of an integrated project and to examine the concept of 'integrated'.

The Agriculture and Nutrition Education Sub-Project

The aim of the sub-project was to 'promote agriculture and nutrition education in the school system, including community schools, high schools, vocational centers and the teacher training college and to establish a college to provide certificate level training in agriculture.' (Appraisal Vol. 1, p. 56). It was decided to carry out the aims by training one teacher for 20 schools for each year of the project. The teachers were to undergo an inservice course of three months and at the end return to their school. It was later decided that all 120 schools were to be included in the scheme. The inservice

[1] Qurba and Walter incorrectly state that the education sub-project had two managers (p. 35)

courses were carried out largely at Gavien, near Angoram, the site of the Research Station, rubber plantation and the Fishery sub-project. At the inservice courses the teachers were instructed in and carried out the curriculum which they were to use in the Community Schools.

Curriculum of the Sub-Project Education

The curriculum base of the sub-project consisted of a series of practices entitled Improved Subsistence Agriculture (henceforth I.S.A.). In a paper given at Goroka and printed by the Educational Research Unit, eighteen steps were said to constitute Improved Subsistence Agriculture. However, the nutrition consultant who wrote the paper, in conjunction with the agriculture consultant, agreed that the essentials were contained in the following five practices: Mulching, Composting, Crop Rotation, Variety of Crops and Fruit Trees. The explanation of these practices has been detailed in booklets, papers and teachers' class notes prepared by the staff of the sub-project.

These five practices were finally chosen because they are sound agriculturally and work in the East Sepik. Mulching, the covering of the ground with cut grass stalks or leaves, protects the soil from the sun so that it is not leached and also mitigates the forces of heavy rain which could otherwise wash away the topsoil. Composting, the heaping of grass, leaves, food waste in pits or covered mounds, and the subsequent spreading of the manure gained, revitalises the soil weakened after a crop. Rotation allows part of the garden to lie fallow and recover. Variety of Crops is important since, in common with most of Papua New Guinea, the East Sepik grows adequate supplies of the stable, be it sago, sweet potato or taro. As far as this is concerned, the project had little to offer; in the East Sepik no one sends his son or daughter to school to learn how to grow taro, sago or sweet potato. Project school gardens did not grow staples. What was taught was the growth and appreciation of the large number of different vegetables and fruit available for use and indigenous to the area. The nutrition consultant said that one criterion for variety was the reappearance of the wing bean. This extremely nutritious plant had formerly been in common use in the East Sepik, but had fallen into disrepute with the introduction of newcomers such as tomatoes and store goods. As a result of I.S.A. a considerable number of indigenous plants, easily grown and adapted to the region, are planted as a crop instead of relying on haphazard cropping in the bush. The final practice was that of encouraging the planting of fruit trees for which young trees are readily available from the D.P.I.

Teaching The Curriculum

The curriculum was taught in two different ways: by lessons and by setting up school gardens. Originally the inservice course was to last three months, but it was found that a month was adequate for such an intensive course. This procedure was adopted with the proviso that the agriculture and nutrition consultants carry out extension work visiting the schools where there were project gardens. By July 1981 some 110 teachers had been trained. This did not mean that there were 110 schools with project teachers, there are some schools with three project teachers and many with none.

Between the external consultants, the agriculture and nutrition consultants, the Principal of the Treachers' Training College (T.T.C.) and Port Moresby nutrition coordinator, about 52 schools with project gardens were visited between November 1980 and July 1981. Since then the Educational Research Unit has visited some more (Weeks '83). Of the 24 schools visited by the agriculture consultant and the principal of the T.T.C., the gardens in six were rated excellent, in a further four they were rated good, and in five more fair. Thus 62.5% of the schools had benefited considerably from the project. The external consultants (O'Brien and de

Lacy) found similar proportions of excellent, good and poor gardens. We also concurred with the judgements of the previous survey where the visits overlapped.

The other way in which the methods of ISA were taught was as part of the preservice course at the T.T.C. The students spend some four hours per week during the second year of training doing both the curriculum of ISA and working on the garden at the College.

The second curricular base of the subproject is contained in instruction on nutrition. While the school children are not undernourished in the sense of being hungry, an unrelieved diet of sweet potato, taro or sago leads to dietary imbalances which are equivalent to malnourishment, and has the same effect. Teachers on preservice and inservice courses are helped to make pictures and charts showing the need for energy, body building and protective foods. In planning the school garden the teacher in training is shown how to include some of all three varieties. Since, as was pointed out above, the children can get plenty of energy food at home, school gardens concentrate on body building and protective foods.

As a record of growth and health, each school is given a 'nutrition record book' for each child. Four times in each grade the child is weighed and his or her height measured. In addition, the number of days each child is absent and the cause — malaria, worms, sores, death in family, mother sick, etc. noted. Finally, each teacher who has been appointed project teacher for the school is expected to organize a nutritious lunch one or more times a week. Since this part of the nutrition program is so related to the agriculture education part, it is difficult to apportion the scheme to one or other. What happens at the nutritious lunches is as follows: Each child is expected to bring some staple with him to school for his lunch. Groups of children get together at lunch on the day appointed and cook what they have brought from home, as well as the body building and protective foods that they have grown in the garden. Where the project was going well, the teachers would supervise the groups of children to make sure that they had some of each type of food. This method of growing, eating and teaching was probably one of the most effective ways of showing the children and their parents the interdependence of agriculture and nutrition. Parents were encouraged to join in the cooking and in many instances the mothers came along and cooked for the younger children. These nutritious lunches also served as an informal meeting time for teachers, parents and Boards of Management (Weeks '83).

Where such lunches do occur regularly there has been a notable improvement in the children's health and school attendance as measured by the record book. The co-operation between two parts of the sub-project might justifiably be expected given their place of operation, the school. Nonetheless, it may reasonably be called integration since co-operation did occur where both might have gone their own way. However, integration is less to be expected between the Agriculture/Nutrition Education sub-project and the Gavien Land Settlement Scheme. Such integration did in fact occur, and the next section is devoted to its consideration.

Gavien Land Settlement Sub-Project

The project document envisaged that the settlers would plant gardens in the first few months before planting the rubber trees and so after an initial period of being funded for food by the project they (the settlers) would be able to feed themselves and their families. Since the settlers were unfamiliar with the type of gardening appropriate for a site such as Gavien, which is hilly as compared with the flood plain of the river from which they came, they needed help. They also needed instruction in what to eat to make up for the lack of fish protein which they had

been accustomed to when living near the river.

A further constraint on the acquisition of a balanced diet was the fact that the settlers had to plant the rubber trees after the initial period of gardening preparation. Rubber trees take eight years to develop to maturity so obviously the sooner the farmer plants his quota of trees the sooner will he have a cash crop. Through no fault of the settlement scheme a cash crop, that is the rubber trees, was in virtual competition with food crops. The IASER assessment refers to this on the personal level where it says that "the great importance attached to the cash crop orientation of the project gave rise to criticism of the nutrition programs and to personality clashes between the first manager and a nutritional expert not of the project[1] (Qurba & Walter, 1981:36). In an effort to plant what would bring in cash to help raise their standard of living, the fundamental for an improved life-style, namely health for themselves and their children was being endangered.

The conflict occurred because the plan envisaged that the heads of families were to arrive first at the settlement, be given their land to plant rubber trees and also land for a garden. Six months later the remaining members of the families arrived on the site. However, unforeseen difficulties arose: as the families arrived so did the rubber trees for planting, and as yet the gardens were far from fully established. Since rubber trees take up to eight years to mature, the settlers were anxious to get the plantings in as soon as possible. There was then a conflict between future cash crop and present food crop. The tendency of the gardeners was to plant merely staples which, though rich in energy protein, lacked other necessities for a balanced diet. The situation was ripe for what Leupolt had pointed out had happened in other circumstances in other projects; development in one sense was going hand in hand with worsening conditions and a drop in food production (Leupolt, 1977:7).

That food crops and cash crops developed together was due to the efforts of the consultants on the spot. A potentially divisive situation was resolved by the consultants of both sub-projects, talking with each other and finding a solution. Here, in action, there was what Armor had said was necessary, namely local involvement in the decision-making process (Armor, 1979:282). This consultation did not stop once decisions were made but became an ongoing, if informal, procedure meriting the title 'process consultation' (c.f. Armor, 1979:283).

There are two aspects of the Gavien part of the sub-project which might detract from its value as a model. There is no doubt that the dynamism of the nutrition consultant has had a great deal to do with the healthy state of the project. The fact that she worked with the men and women in showing them what to do has had great impact. Does the project depend on her continued presence? There are a number of reasons that give promise that the scheme will continue after her departure. Firstly, a national worked with her for nearly a year on a fellowship program and is currently on a course in the Philippines to obtain formal qualifications in nutrition. To judge by the booklets and papers produced by this trainee nutritionist before she left, there is little doubt that she has grasped the principles of ISA and nutrition and is able to teach them.[2] Secondly, the curriculum of ISA and the corresponding nutrition instruc-

[1]They do not mention that the nutritionist in question had been the project nutritionist for several years by 1931. They also state (p. 35) that the education sub-project had two managers. This was not the case in July 1981 nor is there any evidence that there ever were two.

[2] cf. Basic Nutrition by Hannah Papi.

tion has been concisely and clearly worked out so that there is not a complicated body of knowledge to transmit. Thirdly, there is a national on fellowship training in agriculture education corresponding to the nutrition fellowship, and thus the extension work in this area and the teaching of the methods can be carried on when the expatriate consultants leave. Fourthly, the VLEW's success in Gavien working independently, and their acceptability to parents and teachers as well as to the groups in Gavien, would point to the probability of continuance. Fifthly, since there is no need for financial inputs in the shape of tools or buildings beyond that which the school would be able to acquire easily and the villagers have anyway, dependence on outside help is not a factor.[1] Finally, the administrative structure is minimal and depends on the Gavien Inservice Centre being run along the guidelines already set down and practised, and on VLEWs being able to help.

The second aspect which might detract from the Gavien as an example of the success of the sub-project and its possible replicability is the fact that the settlers had severed their ties with the customs and prejudices of their home district. They would thus be more open to accepting new ideas and methods.

However, the following incident shows that the Gavien settlers were not the only ones who saw the value of ISA. In July of 1981 a request was received from the Boards of Management of three riverside schools for the services of the VLEWs. Two young men spent some weeks with each of the schools; they were enthusiastically received and both teachers and BOMs helped them set out the gardens. Their reception was such that the VLEWs themselves were very keen to go to other places. The importance of this event from the sub-project point of view was twofold. Firstly, it was the BOM made up of parents who were gardeners which had requested the introduction of the system. Secondly, the VLEWs who were not trained teachers were nonetheless accepted as instructors by both teachers and B.O.M. This indicates the beginning of how the project is being integrated into the lives of people.

Project Aims and their Realisation

On comparing the aims set forth in the Project Document and what has actually happened, the use of a check list does not give a full view of the situation. The document puts forward what are necessarily a set of ideals. The realisation in practice may be only similar on the surface. The sub-project does in fact teach agriculture and nutrition in community and secondary schools. The reasons for teaching these are given as the importance of agriculture and nutrition education being introduced in a systematic way so as to help improve gardening practices in the villages and to alleviate malnutrition through the dissemination of knowledge (A.D.B. Appraisal of ESRDP Vol. 1, p. 63). These aims are accomplished in many instances and are not achieved in others. What is important for our purposes here are the ways in which these ideals have been aimed at the philosophy which is being gradually worked out as the project progresses. The word philosophy is used advisedly for though the agriculture and nutrition consultants denied that they have a philosophy, their attitudes to the relationship between what they are doing and the schools and community do amount to an inchoate philosophy of action. In conversations with the consultants and the sub-project manager, the following gradually emerged.

ISA and Integration into Village Life

The school has been seen by members of the community as removing the children from the environment in which village

[1] The original plan envisaged nutrition sheds for each project schools but, as pointed out above, this idea was abandoned.

subsistence and social skills are taught and assimilated. Many children will, however, return to their village on completion of Grade 6. By that time it is feared by the community that they (the children) have become unable to learn and appreciate the skills they might have acquired had they not gone to school. The sub-project is envisaged as a means whereby village skills are gained in a non-village environment, namely that of the school. At the same time the school child is receiving the skills and social training which will enable him or her to fit their village life into the wider national context. For example, because a child goes to school he or she does not have the time to learn what forest greens to eat, nor does he/she have time to roam freely to supplement his/her diet. It has been found that in many instances children are relying on staples only, a carbohydrate diet. The project aims to provide the school student with the ability to know what growth and protective as well as energy foods should be eaten, and the skills to grow them. In this way deficiencies in diet will be redressed without requiring store food purchases. The child is also learning in school the skills necessary to cope with changing extra-village life. Even if, as with the case with the majority of students, they live their lives in the village, this is not a life out of contact with changes in the rest of the world. Structures and functions of village life are being affected by external and internal influences. One of the most obvious influences is pressure on land which necessitates new methods of cultivation. Another is the age old pressure exerted by the flooding of the Sepik which is no longer tolerable to many and so they have moved to settlements such as Gavien.

The Community School is a necessary part of Community Life. The degree to which the project manages to help integrate community and school will be the major indicator of its success. The aim of the monitoring over the next eighteen months and the final evaluation will be to measure integration through the effects of the project. The sub-project is attempting to redress imbalances created in diet and village skills by school going and other outside influences, while at the same time co-operating with the school in enabling the student to cope with the inevitable changes wrought by such external influences.

This philosophy, as applied to the Community Schools, the Gavien and to riverine villages, means that without breach of former practices improvement is made to diet and gardening. The methods used allow for a continuation of a former life-style while making room for the changes which have come in recent years.

Interrelation of Parts of Sub-project

How the parts of the sub-project are interrelated and how they relate to the other sub-projects will now be considered. The final section will consider what has been done and how it matches up with the concepts of integration used by various writers.

It has been pointed out above that the agriculture and nutrition education parts are interrelated to such an extent that it would be impossible to divide them into separate exercises. The gardens are planned and planted in such a way as to provide a good crop and a balanced diet.

A continuing effort is made to involve parents in the school gardens. In fact, the school depends on local parental goodwill for the provision of land. A fertile plot of land is a genuine indication of parental interest in the school project in an area where parting with land is unusual. The parents are also involved in other ways, by giving seeds and plants for the garden and by joining in the school lunches (see Weeks 1983; 7).

At Gavien, the educational work of the project is spread beyond the confines of the school with the groups of women. Here a real start had been made on

solving the vexed question of the relationship of cash crop to food crop. The danger to traditional food growing and community collecting practices has been noted by Fisk, who points out that while the indigenous agriculture in the Pacific is particularly well adapted to its environment.. it has been neglected by the process of transition from a series of small, closed subsistence economies to larger open commercial economies taking part in world trade (Fisk, 1975, p. 149).

At the Gavien, even though people had been moved to a new area with an unfamiliar ecology, they were able to learn and use a productive method, the ISA with the help of the consultants and VIEWs. At the same time, they were planting and learning about a cash crop. Thus a modern and traditional set of practices were being used together, showing that an adapted form of the traditional can co-exist with the modern.

Comparison of Sub-project with Concepts of Integration

It is now necessary to compare the practice of integration of the sub-project with those concepts of integration put forward by various authors.

A major aim of the project was to have an impact on home gardening, and in the long run, on dietary habits in the villages (Vol. 1:57). Were this achieved, one could say that integration was occurring between the project and the villages. It can be argued that the project has begun to achieve this aim. The villagers have not changed gardening habits nor are their dietary habits different to before. However, the request for VLEWs among riverine schools, the increased willingness to give land for school gardens, the giving of plants for the school gardens, and the involvement of parents in school lunches, show in embryo that the parents see the value and purpose of the project. Parents and Boards of Management have seen that the school garden is not a joke in which the children grow nothing and learn nothing from teachers who, whatever else they might know, certainly know nothing about growing food.

A theoretical point of integration with local gardeners is that ISA follows the same reasoning and practices as their own gardening. ISA does not rely on expensive equipment or fertilisers, nor does it pose a threat by introducing totally new ideas or methods. The project was thus integrated with the villagers at both a practical and theoretical level. It can be hoped that the integration will lead to the development which is the aim of the project.

Integration with Inspectors

Integration in practice has already begun to take place between the sub-project and the provincial education system, through the agency of the inspectors and the sub-project personnel. At a meeting of inspectors in Agoram in July 1981, the sub-project personnel spent a day explaining the aims of the sub-project and showing the inspectors through the inservice-facility garden at Angoram. The Chief Inspector proposed, and others agreed, that they would (*a*) take part in an inservice course on ISA methods, and (*b*) that they would include inspection of the garden in the routine school inspections. Weeks (1983:7) does not mention this taking place however. The sub-project is thus becoming integrated into the provincial school system. This integration has come about not from an administrative order but from the co-operation of inspectors and sub-project personnel for mutual benefit. The sub-project benefits the school through improved gardens and diet, while the inspectors who visit the school frequently can keep sub-project personnel up to date with the needs of teachers and children.

The integration between the Provincial System of Education and the sub-project occurred because their operatives met at a common work place — the school, and both were involved in the improvement of that school. Looked at administratively,

integration was not required by either system — it occurred because of a seen need. What is suggested, then, is that integration be considered as a necessity of the work being carried out rather than as part of a system.

Integration should also occur between the various sub-projects. One must take into account such statements as those of Qurba & Walter: "The project cannot in any way be classed as an 'integrated' project since, in the first place, the social and economic components were not designed to interlock" (1981:4). What has been shown, however, is that despite the lack of design of horizontal linkages between sub-projects that such cross sub-project co-operation did occur in at least one instance. That such co-operation took place only after bitterness and misunderstanding, as noted by Weeks (1983:3) is true; nonetheless such disagreements refine the issues and do lead to a clearer understanding of the aims of both parties. I have not here dwelt on the many disagreements between members of the staff of the education sub-project or on the disagreements with the staff of the DPI projects. What I have done is examine the positive achievements and seen how these could be built upon.

Conclusion

The first suggestion that this paper makes therefore with regard to the concept of integration is that the project which is fitted into the ongoing provincial or national plans should be integrated from the ground upwards, as well as from the top down. The corollary of this position is that room be left for changes and reinterpretation during the execution of the plan.

The second suggestion is that the Program be integrated vertically into the community so that the project activities depend to a degree on local knowledge and practices. Inevitably this will mean that a somewhat tentative approach will be needed for the beginning, and a somewhat slower start than would be obtained by the immediate implementation of a well planned operation. However, the need for such integration of the community and the plan is necessary as may be testified by the innumerable schemes which failed because when the experts left, the locals either did not know how to carry on the project or did not care to.

The third suggestion is that integration of school and community be carried out by the genuine involvement of the parents in the running of the school. Too often parents are relegated to the position of builders of classrooms and providers of children and money. In the case under consideration parents were the ones who gave the base of the agriculture curriculum. Moreover, local practices of nutrition were not treated as if they did no good for the nourishment of the child. The crops planted in the school were not esoteric fruits or vegetables, but those which might have been found by the child in the bush were he or she not in school and so unable to learn the bush-lore of the parents. The development of these plants and fruits and the improved methods of cooking them made great strides towards balancing the children's diet. Thus, integration should be able to cope with the fact that while at school the child will be learning how to cope with the extra-village life, but at the same time he or she will not be losing out on the many things that might have been learned had they stayed at home and developed in the village setting. Finally, the education of the students in school and the parents in the Gavien was carried out in such a way as to enable food and cash crops to be cultivated together and fulfil the need for balanced development.

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ABOUT OF OUR CONTRIBUTORS

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CALL FOR CONTRIBUTIONS

Contributions are invited to the NEXT issue of the Journal on any theme relevant to its objectives. These may be sent to the Managing Editor to reach him by JUNE 1989 for this issue.