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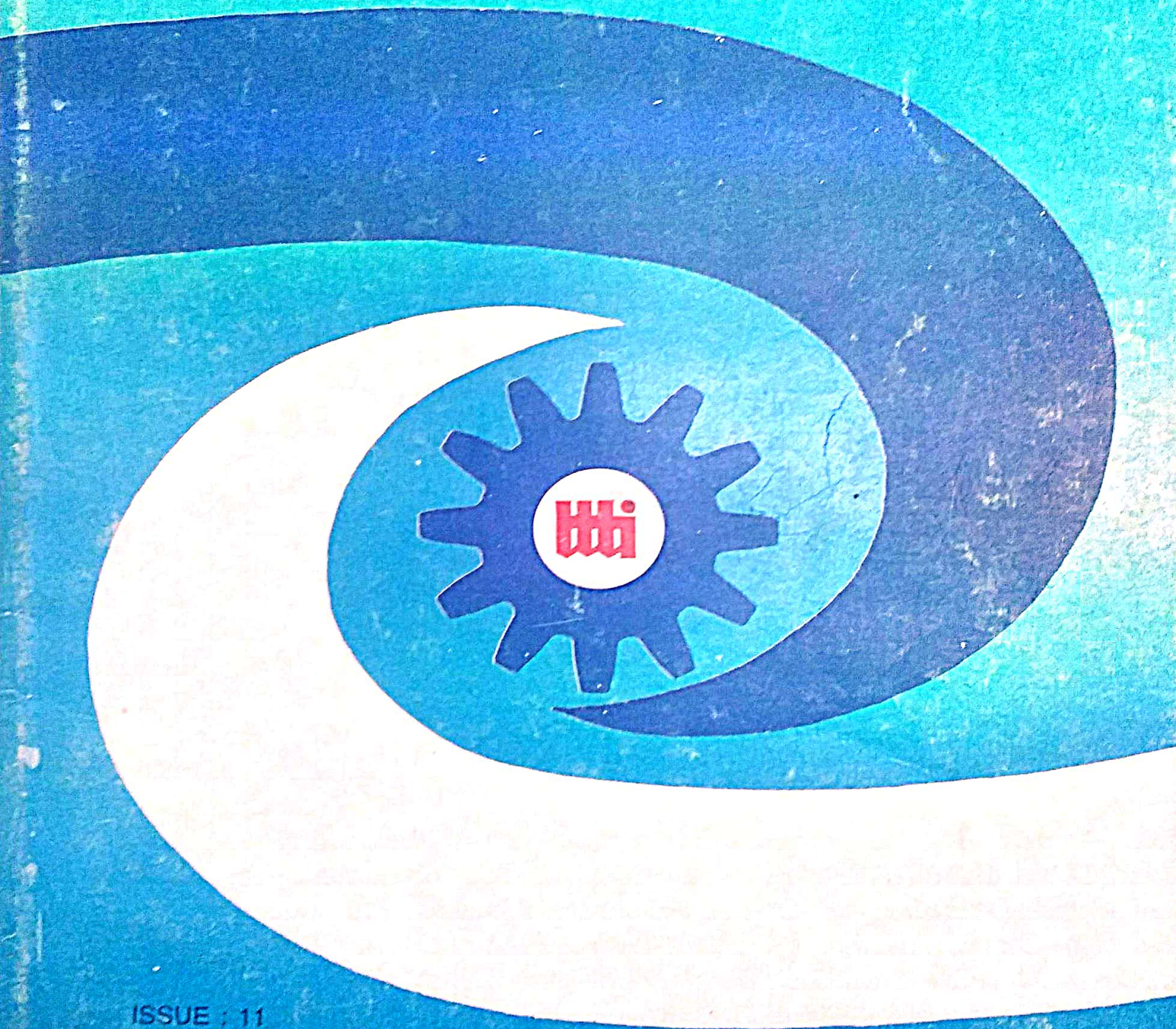

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Editorial

Encouraged by the wide reception to this journal dedicated to the development of technical vocational education in developing countries the management finds it useful to extend copies to all parts of the world. In view of the cost involved in bringing out each copy year after year it has been decided to collect a nominal subscription from the receivers of this journal. Effective from the issue No.12 to be released before December 1995 copies will be sent to those organisations, individuals and others who send an annual subscription or preferably a long-term (10 year) subscription as appealed on the last page of this issue. It is hoped that the encouragement will continue further and further in the cause of the technical vocational education.

In this issue two new sections are added. The section on developmental schemes is meant to make known the various schemes of development in practice in several countries. It would be worthwhile to adopt or adapt these schemes in countries other than those which operate them. The section on inter-disciplinary concepts begins with elaboration of an educational concept for application in various branches of study.

The five articles are in effect based on research findings through survey or documents on conceptual framework as represented by Dyankov, Srinivasan and Afugbuom and Ghani and Okeke. In fact Okeke mediates between the two sections pointing to development. The two schemes presented by Molokwu and Natarajan in the two developing countries of Nigeria and India could greatly benefit and even motivate other countries to launch similar schemes for their improvement. The three research papers by Uche Afugbuom, Benjamin and Yao and Chen-Jung focus on women, Number Mathematics and Educational Economics. The concept of remediation by Uma Sivaraman although emerges from her discipline of English Language Teaching is very useful for extension to teaching of other subjects too, especially in skill-oriented technical vocational education. The research abstract by Mukhopadhyay and Dhanapal is a pointer to futuristic planning of technical vocational education in the context of emergence of hi-tech industries and their impact on social, economic and educational aspects of national development.

More and more such contributions from diverse countries would fulfil the avowed objective of this journal intended to function as a bridge between developing and developed statuses of the world's countries.

— EDITOR

Co-operation between technical and vocational education institutions and industrial and other enterprises

A.DYANKOV

ABSTRACT

This article presents some of the countries' current experiences in linking education to the world of work - through co-operation between technical educational and training institutions and various industrial and other enterprises. The article reflects the responses of fifty countries to a questionnaire, distributed by UNESCO to the Member States, with the aim to obtain some information on various forms of collaboration between educational institutions and industries.

In many countries the preparation of skilled technical manpower is provided by various categories of technical and vocational education institutions, in close co-operation with some industrial, business, agricultural and other enterprises. Usually their collaboration is mutually beneficial for both. On the one side, the educational and training institutions benefit from the physical facilities, machine park and equipment offered by various enterprises for the so-called 'on the job' training at their premises; or - alternatively - the industries equip the educational institutions with most of the required equipment, tools and machinery, along with providing the expertise of their specialists - for technical advice on the curriculum contents, or for the design of training programmes, development of software and other instructional materials. Some specialists are involved also in part-time teaching and assist in vocational guidance, counselling, testing and evaluation. On the other side, various enterprises benefitted from the training facilities offered by vocational and technical training institutions - for further education and upgrading of their employees - through full-time short courses, part - time evening courses or weekend classes, as well as correspondence courses, instructional television programmes or other instructional materials developed by teaching personnel at technical and vocational education institutions. Some technical teachers and instructors are offered opportunities to participate in the research work of industrial enterprises, using their high -tech laboratories; or work on industrial machinery in the production process, so as to upgrade their knowledge and skills and keep abreast with new technological developments.

UNESCO has distributed a special questionnaire to the Member States, seeking information on the additional measures which they have undertaken for the implementation of the Revised Recommendation concerning Technical and Vocational Education with focus

on the special measures taken to promote the co-operation between technical and vocational institutions and industries.

Question (1): Please describe briefly how various enterprises (in industry, agriculture and commerce), have contributed to the development of technical and vocational education programmes and their implementation.

In each county, there is a Vocational Training Committee, the majority of whose members also come from the working life.

The industries sponsor the introduction of information technology in schools, especially in the field of technical and vocational eduction, through some new subjects, like electronics and computer studies.

Both basic training and upgrading of adults through training/refresher courses take place at the working place on full - time or part - time basis.

In Austria, employers' and employees' organizations often provide the idea for new curricula. Training opportunities in industry exist both for apprentices under the dual system and for summer practice for students of technical and vocational institutes.

In Botswana, permanent joint consultation exists through advisory committees at government and local levels. In Benin, technical commissions are responsible for the development of training programmes. Argentina reports on extensive inter-change of specialists between industry and technical education/vocational training. These are made between vocational training centres and institutions and employers and can take the form of on-the-job training, supervised practice or acquisition of work experience. Mexico has established within the Technical/Vocational Education Directorate, a subdirectorate responsible for liaison with industry and employers.

In Norway, the Advisory Council for Vocational Education at the Ministry consists of 13 Members, 10 out of whom represent work organizations and industries.

Besides the correspondence schools, the Norwegian State Institute of Distance Education is also involved in various T.V/video projects for vocational education, in collaboration with the national broadcasting system.

In the Republic of Korea, co-operative education has been initiated by the government and according to the Education - Industry Promotion Law, all vocational and technical students should have practical experience in industry as part of their regular courses. In Mauritius, personnel from industry are becoming increasingly involved in training programmes and also serve on the examination board.

In Zimbabwe, industry and commerce contribute significantly to the development of technical and vocational education through the following endeavours:

- Each employer contributes 1% of the total wage bill towards training levy (Zimbabwe Manpower Development Fund). The funds are used to finance various training programmes.
- The industry provides on-the-job training to complement institutional training (e.g. 20% of the practical training is carried out in the institutes and 80% at work places).
- Employers release their qualified staff to participate in institutional training on part - time basis for teaching in subject areas, suffering from some shortage of qualified teachers.

- Employers contribute generously to technical and vocational education institutions, offering awards to successful students.
- Technical and vocational education curriculum is developed jointly with the active participation of industries.
- Industries offer facilities for apprenticeship training; and for upgrading the skills of workers or training personnel and ministry officials - through seminars.

In Spain, there is close collaboration with Ministry of Labour in respect of skill training within the framework of a national manpower training programme.

Question (2) Please describe to what extent technical and vocational education institutions, in co-operation with industrial enterprises, have met the training requirements of new technologies.

In most of the industrialized countries, the training in new technologies is provided within the work place, by large-scale enterprises, or at the premises of some technical and vocational training institutions, which are well equipped with the necessary tools to deliver such training. In cases where technical and vocational education institutions lack sufficient equipment, machinery, hardware and software to provide such training, in order to introduce new technologies, some big enterprises and corporations provide the necessary funds, or equipment and facilities that are needed for co-operative industry/institutional training in the use of new technologies.

In Canada, technical and vocational education institutions work in close co-operation with business and industry. This is materialized through industry - education partnerships, private sector training and special labour adjustment measures. Some computer companies contribute largely to the introduction of computers in education by offering expertise and equipment.

Continuing education opportunities are offered in the work place, through part-time training and upgrading in post-secondary technical institutions, or through evening or week-end courses, distance education, educational television and special seminars for introducing new technologies.

Questions (3) Please describe various organizational patterns of technical and vocational education, providing training opportunities through full-time or part-time programmes for employees of industrial, agricultural or commercial enterprises.

Many responding States answered this questions. The answers show that facilities vary from a well organized framework of institutions and financial aid for learners to a few evening courses leading to no recognized qualification. Enrolment figures show, however, that there has been an increase in all training facilities.

Recent technological developments have made increased demands for mobility and skill diversification on the work - force.

In Bulgaria, Cuba, Finland, Mexico, Nicaragua, Norway, Poland the whole of the technical and vocational education system is open to persons who are in employment and are entitled to paid study leave.

Various organizational patterns of technical and vocational training offered by technical and vocational education institutions to employees of industrial, commercial and other enterprises are described in the countries responses to this question.

In Austria, for example, as well as in Germany, the dual apprenticeship system with

compulsory part-time education has a long tradition. The length of the courses is extended in case of part-time schooling and shortened for those who have successfully completed some lower stage. Full-time vocational education is organized in courses of one to four year's duration. In Norway, technical and vocational education is based upon two items of legislation: the Act on Upper Secondary Schools and on the Act on Systematic Training within the World of Work (apprenticeship training).

New Zealand reports on their community Interest Classes established in line with the government policy of encouraging adults to take up apprenticeships. Credit units are given in respect to suitable previous employment experience in these classes, and even university entrance may be obtained by this means for persons over 20 years of age without the need for other academic qualifications. Nicaragua mentions the establishment of a sub-system in education for the upgrading and retraining of semi-qualified staff.

Spain also reports that their Adult Education Service is making use of modules for vocational training, enabling adults of over 25 years of age to sit for university entrance examinations without any prior qualifications in formal education. Tchad indicates that their lifelong education programmes are limited to evening classes.

In Italy, under law 845/78, a modular system of an alternating study-work programme is being experimented. In Mexico, as an addition to training for an occupation, social service activities are undertaken for the benefit of the community. Another method of relating theory with practice is provided by external activities such as research, advisory work, consultancy, special studies, installations, construction, design, experiments and testing.

In Argentina, most businesses offer salary incentives for staff taking training courses. Continuing education in Finland has no separate organization, but its principles are implemented under the framework of the educational system. In Finland, the Act on Study Leave improves the opportunities of employed people for education. In Poland, the worker is allowed to choose the type of school he or she wants to enter and is given an educational leave of 21-28 days per year for participation in classes and for the preparation of examinations.

Question (4) Please describe various forms of continuing technical and vocational education programmes, offered through:

a) courses organized at the place of work;
b) part-time training and upgrading courses at secondary and tertiary level;
c) evening courses, or week-end courses provided by various training institutions;
d) correspondence courses;
e) educational television courses;
f) periodic seminars; and
g) inter-enterprise programmes.

Part-time vocational education differs from country to country. Industrialized countries usually maintain a formal apprenticeship system and a full range of shorter courses for workers, conducted in the evenings or on week-ends. Part-time vocational education in developing countries is still sporadic, and less systematized. Indonesia, for instance, does not yet have any part-time courses in the formal system.

The majority of the reprots show that continuing technical and vocational education is offered by a variety of organizations with different interests. Career education is relatively new and courses organized by employers generally tend to serve the latter's interests.

Austria reported the existence of many schools offering evening or off season courses for persons in employment, leading to the same qualifications as their full-time counterparts. There are no age restrictions for these courses. Austria also organizes a number of bridging courses, which ensures articulation with the full-time courses and work experience. Botswana mentions the availability of a full range of course offerings, which are fee paying.

Argentina and Mauritius report about part-time courses and the introduction of modular courses. Argentina mentions that such courses are available in their State and independent universities. Finland reported that the educational system provides for close links between levels and types of instruction enabling flexible study regardless of age and making it possible to go from vocational school to higher education.

There was only limited mention of correspondence courses and distance education in this context, these were reported in use in Argentina, Finland, Mexico and Nicaragua and seem to have been particularly well-developed in New Zealand.

In the Republic of Korea, in addition to formal technical education at vocational high schools and junior colleges, non-formal education is offered in the form of correspondence courses, part-time courses and an open college has been established. A large number of courses are offered to persons in employment by the formal school system and by training centres of other ministries. The enrolment in Air and Correspondence High Schools and in the Air and Correspondence Colleges increased. There are 311 vocational training institutes under the Ministry of Labour offering part-time courses for employed people.

In Mexico, the Open Education System, the Centre for Continuing education, Educational Television (canal 11) and the Foreign Languages Centre, offer courses for employed workers.

By responding to the UNESCO questionnaire most of the countries emphasized the importance of the active collaboration between educational institutions and industries.

Many of the responses described different modalities of co-operation between technical and vocational institutions and various industrial, business, agricultural and other enterprises. Most of the responses revealed the bilateral character of this co-operation: both the vocational education system and the enterprises benefitted from their collaborative endeavours.

Vocational Degree Courses: A Few Considerations

R.SRINIVASAN

The launching of vocational degree courses in India from this academic year (1994-95) is definitely a welcome addition to the expansion of higher education scenario. The main emphasis of these courses is on training people for middle level positions in general higher education. The candidates joining these courses are expected to pursue relevant theory in the chosen vocation besides equipping themselves adequately to perform skill oriented task in job situations whereby making them terminal in their studies.

Vocational courses will be more popular only if the students prepare themselves to get self employed in the absence of suitable placements. This venture though a latest attempt has a tremendous success rate considering the Indian socio-economic conditions if properly tailored.

FACILITIES REQUIRED

It is not enough just to commence courses without creating suitable academic climate in colleges and openings in the labour market. The basic prerequisites of such an endeavour are:

(i) The nomenclature of courses to be renamed to suit the job requirements of specific activities. For example, one could think of courses in the following areas:

a) Archaeology and tourism management
b) Applied linguistics and communicative skills
c) Journalism and printing technology
d) Banking and financial/portfolio management
e) Applied electronics/domestic appliances
f) Biotechnology
g) Clinical psychology and social work
h) Ecology economics and economic policies
i) Transport and trade management
j) Industrial and public health statistics
k) Corporate secretaryship and office management
l) Textile chemistry and laboratory management
m) Radiology and medical electronics
n) criminology and public administration
o) Entrepreneurship and labour welfare
p) Commercial and industrial law
q) Commercial and computer practice
r) Computer science and information processing
s) Fibre optics and laser technology
t) Rural development and micro level planning
u) Culture and fine arts
v) Nutrition and nygiene

This list is only tentative and can be added or suitably modified keeping their relevance to society.

ii) One of the handicaps is the availability of suitable instructional materials. Unless materials are made available to amount of training will be effective. It is high time reading and reference manuals are produced to help prospective learners.

iii) Mere job oriented approach will not ease unemployment. Follow up and product evaluation to gain evidence in skill application is to be incorporated in course review exercises.

iv) A professor to coordinate skill development component needs to be entrusted with the job of offering suitable practical training in identified organizations. He could be asked to liaise with employers.

v) Mid course evaluation to assess the lacunae in implementation and to assess suitability of teachers in their changed roles.

vi) Mandatory field work/internship for about a month preferably in the last year of the course and integrating skill activities all the three years of study.

vii) Organizing seminars inviting prospective employers and giving them detailed career prospects in different organizations and their suitability. Enlisting institutions/enterprises for practice training in the neighbourhood.

viii) Restructuring examination system incorporating more or less equal weightage for theory and practice components and making them fabricate low cost equipment especially in science/rural development/medical electronics etc.,

ix) Earmarking a percentage of jobs for vocational degree holders and extension of apprenticeship training facilities. Only such a move will pave way for social recognition and continued support in the years ahead.

x) Arranging campus interviews and career guidance programmes sponsored by employers in respective fields.

xi) Providing proper facilities in colleges and a congenial atmosphere for learning the skill will enthuse students in the new innovative processes.

xii) Making these courses rural biased and preference to semi urban/semi rural colleges in sanctioning courses considering indigenous resources available in the vicinity of institutions.

The focus should be on the particular vocational subjects pursued with adequate provision of time for both theory and practice sessons. Even it is possible to restructure the common language elements offered in the first two years to suit differently for the various combinations. For instance English for science and technology would be appropriate for science graduates; business correspondence for office and financial management courses; public speaking and creative writing for journalism students; low cost appropriate technology for rural development etc., to mention a few could be incorporated in course offerings.

In the light of this development universities can even think of renaming their traditional degrees such as B.A., B.Sc., B.Com., etc., as BVS (Bachelor of Vocational Studies) or BVE Bachelor of Vocational Education) creating a faculty of studies for vocational courses which would be a fitting recognition for this component of education.

Avoiding overgrowing in colleges by revamping curricula on the lines of need oriented job specific courses should be the avowed maxim of sound vocational courses. They should not be on paper just alternative

courses in the place of conventional disciplines. It is impossible to draw a clear cut line of demarcation for any position in this complex world.

An inter-disciplinary orientation in each major vocation selected if implemented on the lines suggested above will go to make them prepare themselves adequately in anyone of the specific fields with knowledge in the other related areas. This would also enable the employers to optimally utilise their talents in similar fields. Undoubtedly in the low run vocational courses would be a fillip to the new economic initiatives contemplated by the Government. The National Council of Vocational Training (NCVT) could also extend a helping hand to universities in this attempt. The attempts made by Bharatidasan University, Tiruchirappalli, some years ago to offer Associate degree courses did not fructify for want of social and economic support of society.

Consequent on the introduction of vocational education at the college level the college faculty could be given orientation in universities and other national/regional organizations for various combinations of subjects. A little stretch of imagination could help in listing the following organizations at the request of universities for a few streams.

Besides the refresher courses offered by Academic Staff Colleges (ASCs) functioning in select universities can also be entrusted with the responsibility of identifying personnel entrusted with the responsibility of identifying personnel and courses for college teachers teaching in vocational classes.

It is hoped this novel educational programme would convince society of the effectiveness of college courses of study and would help to ease unemployment as well to design courses changing them according to new trends. This move will definitely help in redesigning courses with poor patronage appropriately making them as effective alternate programmes to add up to the society's stock of human resource potential.

STREAM OF TEACHERS

Banking and Commerce	Computer Science & Information Technology	Criminology & Public Administration	Economic Policies and Ecology	Industrial law and labour law	Linguistics and appropriate language proficiency	Nutrition and hygiene	Rural development and social work
at	at	at	at	at	at	at	at
IIMs, IIB, Bank Staff Colleges, Management Departments of Universities etc.	TTTIs, NITTIE, DCE, Technical Universities etc	ASCI, IIPA, BPRD etc	ISEC, IIPPS, CDS etc.	RLIs, NPC, etc.	CIEFL, CIIL	TTTIs etc.	NIN, ICMR ec.

Human Resource, Vocational/Technical Education and Economic Development in Nigeria

AFUGBUOM, EMEKA C.,

ABSTRACT

Human resource of a nation refers to all people resident in the nation who are not incapacitated beyond the possibility of contributing to the social and economic well-being of the nation. The resources available in a country can be classified into the human and material components. Human resource is the major catalyst of economic development and vocational/technical education is one of the most successful ways of developing human resource.

In this paper a deliberate effort was made to establish links between human resource, vocational/technical education and economic development in Nigeria.

INTRODUCTION

Today, the world is familiar with space ships, fast flying jets, telecommunication systems of various sophistications, and various labour saving devices at home and in work environments. About eighty decades ago, many of these inventions or devices were either unknown or untried. God created the earthcrust and created man to dominate it. Since its creation, the level of development vis-a-vis the standard of living of man has depended on his ability to create materials from nature for his use.

The extent to which a country is able to use its human resource in exploiting nature through science and technology determines its level of technological, industrial and economic development. Countries are classified as developed, developing and underdeveloped depending on the extent to which they have been able to utilize their human resource for the exploitation of the available natural resources.

This paper is intended to look at human resource development as the key to technological, industrial and economic development. the rule of vocational education in human resource development as well as some strategic needs of vocational education, with particular reference to human resource development will also be highlighted.

HUMAN RESOURCE AND ECONOMIC DEVELOPMENT

The human resource of a nation refers to all people resident in the nation who are not incapacitated beyond the possibility of contributing to the social and economic

well-being of the nation. Manpower on the other hand is that portion of the nation's human resource which is involved in the creation of wealth. According to Ojo (1986):

> Manpower in the economic sense is the managerial, scientific, engineering, technical, craftsman and other skills which are employed in creating, designing, developing, organising, managing and operating productive and service enterprises and economic institutions.

The resources available in a country can be classified into the human and material components. The material resources can in turn be sub-divided into natural and developed resources. Like the physical law which states that "matter can neither be created nor destroyed", material resources are produced or exploited from nature. According to Awaritefe (1988), a nation's natural resources must therefore, be supported with appropriate human resources in order to achieve growth and socio - economic development.

The wealth of a nation is largely dependent on the quality of human resource within it. Countries that lack skilled manpower are invariably faced with slow rate of economic growth and development (Okunrotifia 1978; Awaritefe 1988). According to Olutola (1986), it has gradually become generally accepted that there is a direct and causal link between trained and skilled labour force and a country's level of economic development. For meaningful development to result, a country's human resource must, among other things be able to:

(i) exploit and utilize the raw materials, power, labour and financial resources available;

(ii) provide the framework for the country's industrialization by determining its methods, trends, scale and growth rate;

(iii) plan and implement workable development strategies for the nation;

(iv) design, construct, operate, manage and maintain enterprises;

(v) produce majority of the goods needed by citizens of the country and at the same time generate enough output to ensure economic independence of the nation;

(vi) explore and research into other natural resource potentialities of a country that could be tapped and utilized for economic development.

Even in the force of economic adversities, a nation with well developed human resources can always be confident that it would tide the storm. Such economic problems would only ginger up the skilled manpower within the country to be more productive and creative.

VOCATIONAL EDUCATION AND HUMAN RESOURCE DEVELOPMENT

Olutola (1986) opined that the abilities and skills of the labour force are directly related to the educational level and the investment the society makes in education. Vocational education is that form of education that places emphasis on the development of skills needed as preparation for work. The basic functions of vocational education in human resource development include:

(i) the promotion of the dignity of labour, and

(ii) preparation of individuals for the world of work.

According to Oranu (1991), it is not a basic function of vocational education to provide jobs for people. Vocational education only prepares people for existing jobs, thus enhancing their employability. It is however, possible for creative and innovative minds to use the vocational education received by them in tapping the nation's natural resource and creating job opportunities for themselves and others.

Vocational education in Nigeria had a sad experience under the colonialists. The educational system under the colonial regime was patterned after the British system which glorified the liberal arts and treated vocational education as the type of education for the less able. It was not until after independence when the nation's strive for development was seriously constrained by shortage of skilled manpower that the role of vocational education in human resource development appeared to have been realised.

Consequently, while planning the national education policy, the need for education to prepare people for productive work was reflected as one of the national education objectives. One of the four national educational objectives states as follows:-

> The acquisition of appropriate skills, abilities and competencies both mental and physical as equipment for the individual to live in and contribute to the development of his society. (National Policy on Education, 1981).

The national policy also stated six aims of technical education which at close look shows that they are actually human resource development functions of vocational education. These functions are:-

(i) providing trained manpower in applied science, technology and commerce particularly at sub-professional grades.

(ii) providing the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development.

(iii) providing people who can apply scientific knowledge to the improvement and solutions of environmental problems for the use and convenience of man.

(iv) giving an introduction to professional studies in engineering and other technologies.

(v) giving training and imparting the necessary skills leading to the production of craftsmen, technicians, and other skilled personnel who will be enterprising and self-reliant.

(vi) enabling the nation's young men and women to have an intelligent understanding of the increasing complexity of technology.

Effective vocational education is the key to the production of skilled manpower who would be able to utilize the resources available in the country for national development.

VOCATIONAL EDUCATION AND THE ECONOMY

Man is the prime mover of the economy and if economic growth is the result of the effectiveness of the productive process, then man is the primary catalyst of that growth. The economy of a nation at any point in time depends on the prevailing work behaviour patterns of its human resources.

Education is the process of bringing about behavioural changes that are worthwhile in individuals. These behavioural changes include the acquisition of new knowledge, attitudes, skills and abilities. As these behavioural changes take place, the individuals become more effective in their work roles and may even be creative enough to develop newer methods. In realization of this fact, the National Policy on Education (1981), states inter alia:

> Not only is education the greatest force that can be used to bring about redress, it is also the greatest investment that the nation can make for the quick development of its economic, political, social and human resources.

Vocational education prepares people for specific occupational roles and such people stand to be useful to themselves and the nation's economy after training. The training received enables the trainees to improve their economic well-being and that of the nation when they graduate. The first three aims of vocational/technical education in Nigeria stated, in the National Policy on Education (1981), reflect this consciousness of the importance of vocational/technical education in human resource development and its indirect influence on the economy.

We live in a world of constant industrial and technological changes. The past few years of the 20th century are called the Jet age not because jets were developed in our time but by my observation, it is because the rate at which the novelties of yesterday become obsolete can be compared to the speed of a jet. The implication this has for vocational/technical education is that as new pieces of equipment and technologies are introduced, new skills are needed to man them. Vocational/technical education must therefore, be able to keep pace with changes in the world of work and manpower demand so as the remain relevant to national economic development.

Some Strategic Needs Of Vocational/technical Education For Effective Human Resource Development

Vocational/Technical education programmes can only be effective in human resource development if they actually qualify to be called vocational/technical education programmes. In otherwords, some programmes classified as vocational/technical education may fail to meet the characteristics of vocational/technical education and thus end up producing unemployable graduates. Some of these characteristics are so vital that they cannot be compromised. Some of these characteristics and strategic needs implied in them are:

1. The training environment is the working environment itself or a replica of the working environment. This implies that forever occupational training programme; care must be taken to ensure that the environment in which learners are trained resembles the work environment for which they are being prepared.

Consequently, a programme that trains people on manual typewriters when most offices now use IBM and Computers may not be preparing people for the world of work of new era technology.

2. The training is given to those who need it, want it and can profit by it. In other words, people admitted into vocational training programs should be career-minded. A programme of vocational education could fail to achieve its objectives if the admission procedure does not sieve career motivated ones from those who enroll as a last resort option.

3. The instructor is himself a master of the skills and knowledge he teaches. This

principle explains why many vocational educators are lured into the industrial sector. As masters of the trade, employers realise that their products can hardly do better than them. Vocational training programs must therefore, offer sufficient motivation (and emolument) in order to retain their good quality staff.

4. Training is carried out to the extent where it gives the trainees productive ability with which he can secure employment or hold employment.

CONCLUSION

Human resource is the major catalyst of economic development and vocational/technical education is one of the most successful ways of developing human resource. In this paper, a deliberate effort was made to establish links between human resource, vocational/technical education and economic development in Nigeria.

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Impact of Change in Technology on Human Resource in Industry

K. ABDUL GHANI

1.0 INTRODUCTION

Technology today is the most powerful change agent in developing countries. Technological change can bring new solutions and is the key factor for progress in every society. During the last decade there has been a fast growth in manufacturing industry and export of products. The priorities of industries at present are to gain competitive advantage, improve total quality, achieve global reach and capitalize to automate production process. Computer Numerical Control Machines and Robots are seen in shop floors automating the skillful aspect of production work and replacing repetitive works of operators. Many industries reorganise work and change job content based on advanced technology. It requires design of advanced work system and change in human resource of industries. It is a tremendous task on the part of human resource manager to organise training, retraining & redeployment of human resource to suit to the change in requirement.

2.0 CHANGE IN TECHNOLOGY

In a developing country, the manufacturing industries play a vital role in the economy. Unless these industries adopt new technology and change their conventional systems of manufacturing the survival of these industries will become a question mark. All industries have some inherent resistance to change and a strong inclination to maintain the status quo. The capacity of the industry to assimilate new technology depends on both its capacity to adapt the technology to its own condition and its capacity to adapt itself to the needs of technology. The technology transfer is not so readily accessible partly because it must be learnt by doing. Some technologies are readily accepted as for example the cinema or video. Others may require a massive education and training and much wider propaganda to make it acceptable.

It has been estimated that over 40% of Indian industries use CNC technology for manufacturing and more than 60% of technical, managerial and administrative personnel in India use computers on their jobs today. Computers are used for design and production work. scheduling and assembly, stores and inventory control, data management and analysis, sales and marketing as well as accounting in an enterprise.

3.0 CHANGE IN HUMAN RESOURCE

Introduction of advanced technology in manufacturing micro processor based technology has wider impact on the functioning of technical personnel especially with respect to skill required. The new technology required change in human resource upskilling the jobs and change in the work place. The shift is

towards understanding the newer technologies rather than developing manual skills alone. Consequently with more and more skilled jobs being taken over by machines, the demand is more for people with adequate education than with experience alone. What is increasingly required is the ability to understand and work with data.

One of the implications of new technology is the pressure it creates for reduction of manpower. Large number of technical personnel may became redundant. Those who have acquired valued skills after several years of effort and experience now find that those very skills are obsolete. Reduction in the growth rate, quality of potential employees, lack of sufficiently skilled workers for increasingly complex nature of jobs industries reorganise work and change job content involving increased use of information technology. Young engineers and technician engineers are ill prepared for jobs. Deterioration in the quality of education causes mismatch between increasing skill requirements and declining aptitude. These result in poor market performance leading to decline in global competitiveness.

In many industries existing technical personnel no longer have the adequate skills necessary to perform their jobs. The upskilling of jobs has resulted in increased training expenditure by industries. The upskilling of the human resource has to be done with the existing work force not just the new employees. In most cases unskilling is required to obtain higher quality, reduction in product development time and lower the cost considerable difficulty is experienced with existing workers sufficiently skilled to transfer to new plants or newly created jobs.

4.0 CHANGE IN WORK PLACE

Many industries reorganize work and change job content based on new technology. It is challenging to create a truly responsive work place for change in technology ad workers. This will require change in organisation, work design, management and career development. The new work place demands innovative approaches on the part of management to design advanced work system in manufacturing. In new technologies, electronics is fast replacing mechanical devices in helping man to fine tune to monitor the processes for the expected results. Management of new work place in an innovative approach involving the socio technical work design which is less conversant. This unfamiliarity highlights is a need for more education at the top and else where it is needed.

5.0 EDUCATION AND TRAINING

A massive effort in the orientation of industrialists, engineers, supervisors and workers to the advanced technological processes is therefore important in terms of education and training. To day the tendency is to promote technological change from top assuming that it will gradually filter down to all levels. Instead the technical personnel must first be equipped with new techniques to set the technical progress on. Modernisation would be accomplished from the bottom up as the technological capabilities of the human resource become progressively more sophisticated. The multiskilled approach which fast emerging as a response to high tech needs may be introduced. With the shortage of trained engineers and technician engineers in the advanced technology which is one of the most critical limiting factors in the effective implementation of this technology, the technological institutions, universities and training institutions have

decisive roles to play in diffusion of the advanced technology to the users.

To develop and produce right type of engineers and technician engineers to work in the areas of CAD, CAM, CNC and CIM a thorough study of the tasks performed by those personnel working in the above areas have to be carefully analysed. The levels at which the actual requirement of technical personnel have to be assessed. A need analysis to assess the number of personnel required in different categories has to be conducted.

The new technology can be introduced in the curricula of postgraduate, under graduate and diploma engineering courses to educate and train the required manpower as long term approach. To cater to the immediate requirements of the industries, short programs of 2 to 3 weeks may be organised. Through these programmes the existing industrial personnel who are involved or likely to be involved in the new areas may be trained.

6.0 CONCLUSION

The real advantages of advanced technology are greater flexibility, faster response to market demand, higher quality and reduction of wastes. Advanced manufacturing optimizes the operation of an industry to maximize profits. Implementation of the new technology needs careful planning and step by step approach. To sit back and wait for the technology to become more mature is a mistake as international competitions will always be ahead. Hence the driving force to implement advanced technology must come from top management.

The required human resource to man new technology can be supplied by technological universities/institutions by introducing advanced technology courses on CAD/CAM, CNC, FMS and CIM in diploma undergraduate and post graduate programmes as a long term approach. Immediate requirement of human resource may be met by short term training programmes conducted by training institutions/establishments. Advanced technology like CNC and CIM involves knowledge of manufacturing technology, machine tools, electrical, electronics, computer engineering and hydraulic pneumatic system and robots. A comprehensive multi-skill approach called 'Mechotronics' may be a good strategy.

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The Funding of Technical and Vocational Education in a Depressed Economy: A Clarion Call for Multi-Organizational Participation

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ABSTRACT

The education system in Nigeria is generally beset with myriads of problems. These problems traverse educational planning, implementation, supervision and financing. Education, particularly technical and vocational education which demands huge human and material resources, is starved of funds by the government.

Today, it is apparent that the government pays little attention to the funding of education in the country. It therefore becomes imperative that alternative sources of funding are sought. Therefore, this paper highlights the various agencies and organizations whose assistance is required urgently in educational funding especially technical and vocational education. Such bodies include the private sector viz. industries and banks; wealthy individuals, voluntary agencies, social clubs, age grades, town unions, trade unions, parent teacher associations etc. Their areas of participation and/or contributions to the enhancement of technical and vocation education are equally indicated.

1.0 INTRODUCTION:

Education is an important tool for the development of any nation. It is a service par excellence provided for the citizens for effective national development. Ezewu and co - workers (1981) defined education as the process by which an individual born into a human society, learns the ways of life, which include knowledge, skills and values of the society, at home, community and schools, so that he can function effectively as a member of the given society.

The acquisition of practical skills and knowledge is achieved through technical and vocation education. This type of education was institutionalized into the Nigerian educational system vide the 1980 National policy on Education. This policy defines technical and vocational education as that practical and applied skills as well as basic scientific knowledge. The aims of technical and vocational education, outlined in the 1980 Nation policy on Education, are:

(a) To provide trained manpower in applied science, technology and commerce particularly at sub - professional grades;

(b) To provide the technical knowledge and vocational skills necessary for agricultural,

industrial, commercial and economic development;

(c) To provide people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man;

(d) To give an introduction to professional studies in engineering and other technologies;

(e) To give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self - reliant, and

(f) To enable our young men and women to have an intelligent understanding of the increasing complexity of technology.

By 1970, government took over the running of education form the missionaries and individuals. In this case therefore, education became the full responsibility of the government by way of establishing schools, educational planning, implementation, supervision and financing of educational programmes in all levels of our educational systems. It is now apparent that the government is unable to totally and single-handedly finance education particularly technical and vocational education. This is as a result of multifarious factors such as the global economic recession and depression and oil glut which collectively necessitated the introduction of the Structural Adjustment Programme (SAP) which itself complicated the already complex economic problems of the nation. Also, bad leadership has accentuated the problems of our educational system. The leadership has no proper plan and vision for education and our leaders appear to be interested in such projects and programmes that enhance their capacity to enmass wealth to the utter neglect of the provision of essential services to the people. Therefore, there is obvious misplacement of priority on the part of the leadership coupled with the general indiscipline and corruption pervading the nation.

Inspite of the admirable objectives of technical and vocational education in Nigeria such as for lucrative employment now that times are hard (Okeke, 1993), little attention is given to its improvement by various governments in Nigeria. It is therefore to avert the total collapse of education and to achieve the lofty objectives of technical and vocational education that there is need to load for alternative means of funding education in Nigeria. It is thus axiomatic that the private sector and voluntary agencies, social and philanthropic organizations be involved in the funding of education especially technical and vocational education. In this paper, mention will be made of the various bodies and organizations whose assistance is greatly needed for the survival and advancement of technical and vocational education in Nigeria.

2.0 PARTICIPATORY AGENCIES AND ORGANIZATIONS:

In view of the deteriorating situations in our educational institutions as a result of poor funding by Nigerian governments, it becomes very imperative to look elsewhere for aids to assist our educational system. Technical and vocational education needs larger volume of equipment and materials for its effective implementation. For effective funding of technical and vocational education and for this type of education to achieve its set goals, we must look beyond the government for educational financing. Consequently there is the need for the involvement of the private sector, voluntary, social and philanthropic organizations and wealthy individuals in the funding of education particularly technical and vocation

education in Nigeria. In this discourse, attempt is made to identify these agencies and organizations and also highlight the way(s) by which each can assist in the improvement of technical and vocational education.

2.1 Industries:

There are many profitable and financially equitable industrial establishments - whether indigenous or multinational - in all parts of this country. These industries should as a matter of policy devote specified percentage of their annual profits to educational development in the country. The industries should pay this amount into what may be regarded as Technical Educational Development Endowment Fund (TEDEF). The money can then be disbursed to the various schools that are technically biased by an Endoment Committee made up of reputable educationists. More so, the industries can be mandated to support education in their ares of operation. This they can do by way of donations to higher institutions to enhance their technical programmes, construction of buildings for schools, sponsorship of the training of Nigerians within and outside the country in areas of technology, issuance of research grants to deserving scientists and technologists in relevant areas of invention and fabrication of gadgets needed for effective technical and vocational education.

2.2 Banks:

As a result of the Structural Adjustment Programme (SAP) of the government with consequent abysmal devaluation of the Naira, the money market became a booming one. As a consequence, there is the evolution of many merchant banks in Nigeria. These banks make huge profits from their currency exchange business transactions. Instead of diverting these profits into purchasing posh cars, the banks can assist the educational sector to step up the level of technical and vocational skills of our people. The banks can procure and distribute to technical colleges, equipment and materials needed for qualitative education; provision of research grants in essential areas of technology; award of scholarships of indigenous publication of relevant texts; establishment of well - equipped libraries in technical schools; donations to the Technology Adaptation Centres in many states of the country and any other ways whatsoever that will enhance educational development in Nigeria.

2.3 Voluntary Agencies:

There are many voluntary and philanthropic organisations in Nigeria that could extend their hands of assistance to the educational sector. These include the Rotary Club International, Lion Club, Amnesty International, Human Rights Organizations, Inner Wheel Clu, International Foundation for Self - Help Programmes to mention but a few. Most of these organizations are composed of wealthy nations and/of individuals who can contribute little of their wealth to the development and enhancement of education particularly technical and vocational education in Nigeria. Apart from their specific objectives, these agencies can extend their hands of philanthropy to education. For instance, the president of International Foundation for Self - Help Programmes, Dr. Sullivan (1993) noted that apart from their health schemes, his organization would equally embark on equipping some technical colleges in Nigeria. This gesture is greatly commendable and national and international organizations in Nigeria should take a leaf from this,. Their assistance in education is highly needed now that governments attention and resources are diverted from educational development to political democratization.

2.4 Wealthy Individuals:

Nigeria is blessed with persons who have made it economically. There are many millionaires, multi-millionaires or even billionaires in Nigeria who can offer just a small proportion of their wealth for the development and improvement of technical and vocational education. Unfortunately a few of these wealthy Nigerians are actually contributing to enhance education in this country. Instead, most of them utilize their wealth in having flamboyant type of life, purchase of the most expensive posh cars and wearing apparels, lodging in the most expensive five star hotels in town, taking of innumerable number of chieftaincy titles that gulp millions of naira, marrying many wives and keeping many concubines and such other activities that exude wealth.

The wasted money can be profitably utilized in the funding of technical colleges and technical programmes in our higher institutions.

2.5 Social Clubs/Age Grades:

Social clubs in Nigeria should be made to realize that times are hard and should cut down their expenditures on sumptuous social activities like new year and end of year parties. Their assistance is of immense importance for the development of education in Nigeria. Many social clubs in Nigeria are even richer than oil producing states in the country. These clubs can contribute to the funding of technical and vocational education by the establishment and equipping of technical colleges in their areas of operation, sponsorship of scholarships in technical fields and provision of infrastructural facilities in higher institutions that mount technical programmes.

The same applies to the age grades in various communities. They should re-orient their priorities by giving more attention to the funding of education. The age grades should as a matter of policy map out an annual subvention to schools in their localities for the provision of equipment and maintenance for technical and vocational education.

2.6 Town Unions:

Town Unions are known to have made a considerable impact in the development of education since 1970s. Most Secondary Schools in Anambra State, for instance, were established by town unions (communities) and then handed over to the government. Now that these schools are starved of fund by the government such that these schools are becoming a ghost place, the town unions should intensify their efforts to ensure that there is no collapse of the educational system. Technical and Vocational education requires much equipment, gadgets, materials and books which are expensive. These cannot be fully procured with the little fund that trickles from the government. Therefore, town unions apart from establishing technical colleges, should from time to time make funds available to schools for the provision of needed equipment or can establish libraries for the upliftment of technical and vocational education.

2.7 Trade Unions:-

The various trade unions in Nigeria, whether related to education or not, should map out strategies to solve some of the teething problems facing education particularly poor funding. From the 1993 general strike of teachers in our public schools and the nonchalant attitude of the government to the entire situation, it is apparent that the leadership is not interested in education. For a nation to allow her educational system in the dark for up to two months gives a danger signal to the

insincere posture of the government on education. But we should not fold our hands and watch the decay of our institutions.

We should not abide by the jargon: "If you can't beat them you join them". No, we cannot join hands with the government to kill education which is the corner-stone of the development of any nation. Trade unions should therefore pull resources together to embark on the equipment of laboratories, workshops and libraries in technical colleges and higher institutions. They can realize money by embarking on appeal fund launchings for educational development.

2.8 Parent Teacher/Alumni Associations:

Parent teacher associations and town unions are the two-some bodies that are known to be greatly committed to the improvement of education particularly at the primary and secondary levels. These two bodies contribute immensely to the administration and funding of schools. Parent teacher associations appeared to have earlier recognized the apathy on the part of the government for adequate funding of education and have therefore taken it upon themselves to see that essential inputs for qualitative education are provided in schools. Parent teacher associations are known to have built classroom blocks, dormitories, laboratories, introductory technology workshops, libraries, staff quarters and offices, examination halls etc. In their respective schools. The point here is that since little attention is now given to education by government, these associations should intensify their efforts in the provision of needed teaching aids in their schools and colleges for the improvement of technical and vocational education.

Moreover, old boys/girls and alumni associations in colleges and higher institutions should equally come to the rescue of their alma mater. This they can do by the provision of relevant infrastructures, technical equipment and materials for improved technical and vocational education. They should divert much funds to this direction to avoid the total collapse of the acquisition of practical skills in our schools.

3.0 CONCLUSION/ RECOMMENDATIONS:

It is obvious that education is faced with myriads of problems today in Nigeria. These problems contribute to the falling standard of education. Nigeria has been having problems in the areas of educational planning, implementation, supervision and financing and these have been affecting the advancement of our educational system negatively (Ayodele, 1993). A good educational system worth its salt does not only need good planning but also effective implementation by way of ensuring proper and efficient supervision and financing.

In conjunction with the problem of inadequate supervision and financing are the problems of students' population explosion and teachers' welfare. it is now certain that there is population explosion among children of school-age in Nigeria such that the existing infrastructural facilities especially in public schools, have proved inadequate. But government's efforts in ameliorating the situation have proved grossly inadequate. Teachers' welfare is another problem militating against our educational advancement. In actual fact, teachers have not been adequately remunerated and motivated and this has adversely affected their productivity as evidenced by poor performances of students in some major examinations.

In view of these pressing problems, there is bound to be a collapse of the educational system in Nigeria if other bodies and organisations other than the government do not consider it expedient to participate in the funding of education. Industries, banks, voluntary agencies, alumni associations and so on need to come to the rescue. The Government should commit itself to creating enabling environment for the enhancement of the private sector participation in education by removing such bottlenecks and bureaucracies that retard their involvement. This can be achieved thought the establishment of the proposed Small and Medium Industries Development Agency of Nigeria (SMIDAN). This organization will co-ordinate the activities of the small and medium industries to induce them to contribute to educational development in the country especially technical and vocational education. Small and medium scale industries should through this organization be mandated to make available for educational development a specified percent of their annual profits. More so, wealthy individuals, social clubs, age grades, trade unions, town unions, parents - teachers' and alumni associations should contribute in one way or the other to the enhancement of technical and vocational education in the country.

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Science and Technical Teachers' Development and Improvement Schemes in a developing country

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ABSTRACT

The problems of underdevelopment plaguing the third world countries could be partly traced to poor development in Education. The quality of Education Endeavours in turn are believed to be directly linked with the teachers' disposition and output.

The various development/improvement programmes open to the teacher in a developing country are outlined and the reasons for embarking on them discussed.

The availability of these programmes and ways of facilitating their accessibility to a serving teacher were highlighted since it is believed that steady development/improvement of the teacher contributes significantly towards the overall development of the Nation, albeit indirectly.

INTERPRETATION OF TERMS

1.	S.S.C.:	Senior Secondary Certificate
2.	T.C. II:	Teachers' Grade II Certificate
3.	N.C.E.:	Nigerian Certificate in Education
4.	B. Ed:	Bachelor of Education
5.	M. Ed:	Master of Education
6.	Ph. D:	Doctor of Philosophy (in Education)

SCIENCE/TECHNICAL TEACHERS' DEVELOPMENT AND IMPROVEMENT SCHEME IN A DEVELOPING COUNTRY

All systems either grow or die. Maintaining a stable (or call it stagnant) posture is a rare happening, rather peculiar to systems that have attained equilibrium state. Similarly, Science Education and Technical education grow. Like all other human endeavours, Science/Technical Education has many facets of growth:

- Students' development
- Teachers' development and improvement

- facility/equipment provision, development and improvement and
- curricular development

Osuala (1981) said that career development is "a life long process involving a series of experiences, decisions and interactions, which taken cumulatively, results in the formulation of a viable self-concept and provides the means through which that self - concept can be implemented both vocationally and avocationally". In another vein Popoola (1991) held the view that "staff development is a systematic process by which an individual's knowledge, skills and personnel qualities can be broadened, deepened and enlarged to the benefit of the individual, the department in which he operates and the organisation that employs him". In his account concerning developing Nations, Dalgleish (1975) saw development as having double meaning viz:

- progress a forward movement in man's mastery of the world around him.
- growing wealth of a country or region.

The Advanced Learner's Dictionary of Current English looks at the word developing in the following ways:

(1) "(cause to) grow larger, fuller or complete (cause to) unfold".

(2) "(of something not at first active or visible) come or bring into a state in which it is active or visible".

On the word development, it says:

(1) "developing or being developed".

(2) "new stage which is the result of developing".

It cannot be over - emphasized that there is the need for the trained teacher to embark on self - development programmes either on a regular basis or from time to time. The teachers' professional growth, or lack of it will be reflected in his methods, in his willingness to change, in his working relationships with children, and in his overall efficiency as a teacher". Blair et al (1975). A school of thought views the teacher training as preparation to start teaching and preparation to continue systematic learning after his formal course work is over.

A DEVELOPING COUNTRY

The countries of the world have been variously classified. In one vein, the classification takes the form of first, second, third and fourth world countries while in another, it takes the form of developed, developing and non-developing or underdeveloped countries.

The highlights of the demarcations between any two adjacent classes is not the primary concern here. An average position which gives one a fair idea of what is meant by a developing nation will suffice. One of the cardinal considerations made when countries are classified on lines of development is the scientific and technological attainment made by such countries.

We will mirror Nigeria here as an example of a country so classified (Dalgleish, 1975). The teaching of science and technical subjects was initiated by the colonial masters in the 1920's. Teaching and progress in this field has since followed a rather gradual process at a very slow pace. The greatest lag lies in the lack of translation of the theories developed in science and technology into practical terms that will in turn boost industrial growth. This failure to keep pace with industrial growth was largely due to misplaced priority on the one hand and lack of commitment on the other. In the developed nations, educational objectives are usually geared towards solving specific

problems which in the short/long run gains practical usage. In Nigeria, policies are usually tagetted but are rarely pursued to any logical conclusion. The reasons, perhaps, could be found in the plaguing political instability which has bedevilled her since independence. There are no finished products of manufacture (like transportation facilities, technical equipment for mechanised Agriculture, processed food, weapons of defence, improved social facilities and continuing and progressing scientific/technological enquiries) to attest to the nation's commitment in this area.

All of the above (including some other products not mentioned) are usually imported. This leads to technological slavery, accompanying neo-colonisation and prepetual under - development. It appears that there is a correlation between successful educational endeavours and progress in science and technology.

Dalgleish (1975) stated that "Education is a key factor in development". He pointed out further that education speeds up the spread of new ideas in health, hygiene and modern farming methods. In addition, education trains the labour required for the general production activities. The political instability (or call it frequent change of governments) in many developing nations has not encouraged any meaningful progress in all facets of human endeavours. The damage done to education is usually most pronounced. Dalgleish (1975) pointed out that about 50% of the adult population in the developing nations are illiterate. The case for Africa is most woeful as the figure was estimated to be approximately 74%.

Only a few developing nations possess the natural and man - made resources required for expanding educational facilities and thereby increasing output. Many depend on aids from developed nations for erecting buildings for educational purposes, training and retraining of teachers and buying of books and equipment for students and teachers Dagleish (1975). It is correct to say that coal and iron were the basic raw materials of the industrial revolution of the 18th and 19th centuries, but oil has gradually taken over the role of energy production for our daily activities. Nigeria (though belonging to the group of developing nations) has a large endowment of crude oil. Poor harnessing and mismanagement of proceeds from the Oil sector has left the country under - developed. Much of this proceed is not channelled towards education nor industrialisation.

DEVELOPMENT AND IMPROVEMENT SCHEMES FOR SCIENCE AND TECHNICAL TEACHERS

We have mentioned earlier on that the following contribute to the general development of science and technical education.

1. Students' development by way of readiness to receive a designed programme
2. Teacher development and improvement
3. Adequate provision of facilities and equipment
4. Curricular development and improvement
5. Improved management of Science and Technical programmes.

In this paper, we shall concentrate on the second point, that is the development and improvement schemes for teachers of science/technical subjects. This group of teachers are found right from the post - primary schools through the polytechnics to the universities. Such teachers teach subjects like the natural and physical sciences, pure technical

subjects (such as introductory technology, wood and metal works) and social science subjects which depend solely on postulates, theories, principles and laws derivable from science and technology. These areas are filled with emergence of new ideas, new vocabularies, new inventions and innovations to the end that the attendant knowledge explosion is comparable to the multiplications of microscopic organisms. Surely, to keep pace with a vibrating cantilever, one needs to vibrate in resonance with it. The case of the science/technical teacher and development is similar to that of the vibrating cantilever; either one keeps pace with the avalanche of knowledge explosion or literarily one becomes a hindrance to the progress of science and technology in one's environment.

Intuitively, one considers such exercises assignment, projects, seminars, workshops and programmes which are geared towards providing an effective answer to the question, "What makes a good teacher?" as development and/or improvement schemes progressing from one level or rank of classification (mostly based on certificates or level of institution attended) to another is considered here as development, while progressing from one 'scale' to another on the same level is considered strictly as improvement. This means that a teacher can develop along the line:

T.C. II ⟶ N.C.E. ⟶ B.Ed ⟶ M.Ed ⟶ Ph.D

Also, a teacher who initially possessed a B. Sc. degree in Mathematics (for example), develops himself by taking courses which ultimately leads to the award of a professional teachers' certificate such as post-graduate diploma in Education (PGDE), Technical teachers' certificate (TTC) or Bachelor of Education (B. Ed). On the other hand a teacher who initially possesses a B. Ed degree will be improving himself by attending workshops, seminars, short courses; enlisting in professional associations and by subscribing to professional journals and reading the same.

Having successfully laid the foundation, we can now discuss the various programmes open to a teacher desiring to enhance his proficiency in the teaching art. A teacher can develop himself by:

1. attending higher levels of institutions in order to acquire higher qualifications.

2. undertaking programmes to enhance one's professional status or to acquire professional qualifications and recognition.

3. undertaking projects and research works aimed at acquiring higher or proficiency certificants.

4. getting involved in distant education programs, in-service training and open correspondence courses.

Figure 1: Teacher development scheme

All these endeavours are aimed at a vertical ascension. A teacher who previously had no teaching qualification (i.e. a professional teachers certificate) but keeps on acquiring higher qualifications (which are not professional in nature is seen to be developing assymetrically.

On the other hand, a teacher can improve himself by embarking on any of the following exercises or a combination of them.

1. Attending Workshops
2. Participating in project work
3. Attending conferences
4. Undertaking research work
5. Attending seminars
6. Undertaking short courses

7. Subscribing to professional journals

8. Embarking on field trips

9. Participating in voluntary overseas academic missions like the Nigerian Technical Aids Corps (TAC) scheme and the U.S.A. peace corps scheme

10. Literature writing.

Figure 2: Teacher improvement scheme

Having enumerated some of the programmes which a teacher can embark upon to develop and/or improve himself, we come to the crux of the matter: availability of these programmes to a serving teacher. As we have pointed out earlier on, educational endeavours (especially in science/technical field) require huge capital outlay. The provision of funds for prosecuting academic intensions remains the major hindrance to academic attainment and ultimate self - actualisation. Another issue that contributes to determining the readiness of teachers to take on development/improvement programme is National policy provisions. So also, personal disposition, availability of incentives: either in the short run or long run and imposition of sanctions on non-participants contribute towards increasing the flair for teachers' engagement in development/ improvement programmes.

DEVELOPMENT AND IMPROVEMENT SCHEMES IN A DEVELOPING COUNTRY LIKE NIGERIA

We have mentioned earlier on that a teacher may need to develop and improve on his teaching competence either on a steady basis or from time to time. Primarily, the basic need for teacher improvement is summed up in the quest to provide an answer to the questions: "What makes a good teacher?" Slavin (1988) has the following to offer as an answer to this question:

> 'What makes a good teacher? warmth, humor, caring about people planning, hard work, self - discipline. Leadership, enthusiasm and speaking ability. Subject matter knowledge. Instruction (ability to present information clearly) to motivate students and evaluate their learning'.

Slavin in his solution has touched on every stage on teaching/learning process. We need to recall that in most developing nations, western education never really evolved locally but rather was imported. This necessitates a steady and determined rehearsal of the underlying principles and practices in order to make them permanent and easily retrievable at the point of need. The following is a partial listing of the reasons why it is necessary for teachers in developing countries to embark on development/improvement programmes.

1. Acquisition of higher level education in order to increase the volume of knowledge of the subject matter.

2. Acquisition of professional training for the inculcation of the requisite skills and competence for proper execution of the teaching/learning exercise.

3. Updating one's information sphere regarding the principles and practices of the tenets of the teaching field.

4. Increasing one's social interaction ability through co-operative activities with contemporaries and colleagues.

5. Brightening one's prospects for eligibility for responsible assignments and appointments.

6. Enhancement of personal confidence and efficiency.

7. Increase in general contribution towards one's school's progress and the society in general.

Blair et al (1975) stated the following as some of the reasons why a teacher needs steady development/improvement programmes.

1. Stagnation may lead to grumpiness, unhappiness and irritation.

2. Repetition of the same assignments and discussion will make the teaching job a boring one instead of the challenging one it can be.

3. Continuous systematic learning can make teaching a very pleasant and exhilarating experience.

We can find leading in the words of Ebenebe et al (1991); who said:

> 'There are ample opportunities and provision for staff development in the areas of subjectmatter and research. The polytechnics give awards to staff for periods varying from one year to three years to go to universities to do higher degrees. During such training, staff improve their subject matter as well as acquire skills in carrying out research. Further more the NBTE has set aside money to sponsor action research in the institutions. A few polytechnics also send their staff to industries from time to time to update their skills. Occasionally, staff are sent for management training in the form of workshops, or short term courses. At present there is no provision for staff development in the area of acquiring teaching competence'.

This view is partly correct concerning what is obtainable in the polytechnic sector in Nigeria. To present a clearer understanding of the situation, it is pertinent to describe the levels of institutional management in Nigeria. There is a three tier system of Government in Nigeria, viz: Federal, State and Local Governments. The Local Governments are in charge of primary schools located in their areas of authority. The state Governments manage the post-primary institutions which they established (that is, secondary schools, technical/ comprehensive colleges, colleges of education, polytechnics and Universities). The Federal Government in turn manages all post - primary institutions which it established. FRN (1981). There is a policy provision for voluntary and private organisations to establish schools from the pre - primary to the university level: FRN (1981). It should be noted that though Nigeria is split up into 30 States, it operates a federal system of Government.

Figure 3: Levels of institutional management in Nigeria.

The teachers in primary schools hardly have any incentives to encourage them to pursue development/improvement programmes in order to enhance their performance. Those who ever engaged in such exercises are either propelled by sanctions FRN (1981) or motivated by individual desire to enhance academic attainment which will be followed by change of employment and higher standard of living. For this level of teachers, the words of Etuk (1981) can hardly be disputed. He said that the Nigerian worker "projects the picture of a complacent individual whose sense of responsibility has been dulled by frustration and negatism". The situation is so hopeless that the menfolk have almost completely deserted this level of the profession. The reasons for this dismal situation may be found in the lean purse of the Local Governments or the over dependence of the Local Governments on the Federal Government.

At the post - primary school level, the situation is fairly different because of the different levels of administration. Opportunities do exist for teachers serving in Federal Schools to embark on development/improvement schemes. Teachers are allowed to go on study leave with pay. In some cases the authorities go further to provide some learning materials for the teachers concerned. Also, some teachers in such schools are encouraged to embark on self - improvement exercises. Be it as it may, the situation is far from being satisfactory. In state schools, matters are almost exactly the same with their counterparts in primary schools. Any attempt at development is carried out at one's expense and risk. Teachers are not encouraged to take part in improvement schemes except in some states. The public and self image of the teachers in this category is so poor that more or less, it is thought that only the low achievers are considered suitable for this level. The employers do more to worsen the already battered image of teachers. The average teacher at this level always has his eye on the labour market. Nevertheless, the prevailing economic situation warrants that at any given time, teachers will be found in this category, if not for any other reason, to avoid being jobless. Also, at this level the menfolk cannot rank more than fifty per cent, especially in the urban centres where corrupt men and officials do all within their powers to make sure that their wives are located in such places.

In the tertiary institutions the situation once more is bipolar. In Federal Universities and polytechnic the situation is fairly as Ebenebe et al (1991) put it. In the state institutions, provision is always made in principle but is rarely implemented to the end that attainment and productivity decrease or increase at much slower rate in the state institutions. The foregoing statement is justifiable on the ground that Academics can move from a Federal institution to a state institution with enhanced statue but the reverse is most unlikely; at best, one makes it at par.

The disparity in the practical conditions of service between the Federal and State institutions became so pronounced during the tenure of the last administration in Nigeria (1985 - 1993). This reason coupled with economic discomfort led to a clamor for Federal Government take-over of schools previously owned and administered by states. Trade Union unrests among teachers and other sectors of labour led to a sharp fall in standard of education culminating in international abhorrence of Nigeria's products of education. Persistent demands from the Nigerian union of teachers (NUT) and unrelenting strike action by teachers led to the Federal Government take over of the payment of teachers' salaries in primary schools in Nigeria. We hope that these changes will bring about the much desired results.

The key statement on teacher education as annunciated by the Nigerian National Policy on Education is "Teacher Education will continue to be given a major emphasis in all our Educational planning because no education system can rise above the quality of its teachers", FRN (1981). This statement is actually in order. The policy further listed the following as the purposes of Teacher Education.

1. To produce highly motivated, conscientious and efficient teachers.

2. To encourage further the spirit of enquiry and creativity in teachers.

3. To help teachers socialise in the immediate and remote parts of the society and to enhance their commitment to National objectives.

4. To equip teachers adequately for executing their tasks the world over.

5. To enhance teachers commitment to the teaching profession.

In this context, teacher education is seen as teacher's basic training, retraining and improvement schemes. The writers of the Education policy understandably are experts in the field of Education. As we have pointed out earlier, the major problem is implementation of the polices.

Much that can be added to the National policy provisions has to be suggestions that will aid smooth implementation of the policies. Blair et al (1975) suggested the following (among others) on how to improve the teachers' performance.

1. Making provisions in the work schedules of teachers so that some time each week can be utilised for studying new practices and trends.

2. Making a long standing arrangement (by the various Governments) with publishers and book sellers to supply literature (especially professional materials) to the teachers on regular basis.

3. Making salary increases partially contingent on evidences of professional growth.

4. Making arrangements with institutions of higher learning for teachers to go to such institutions for development and improvement schemes.

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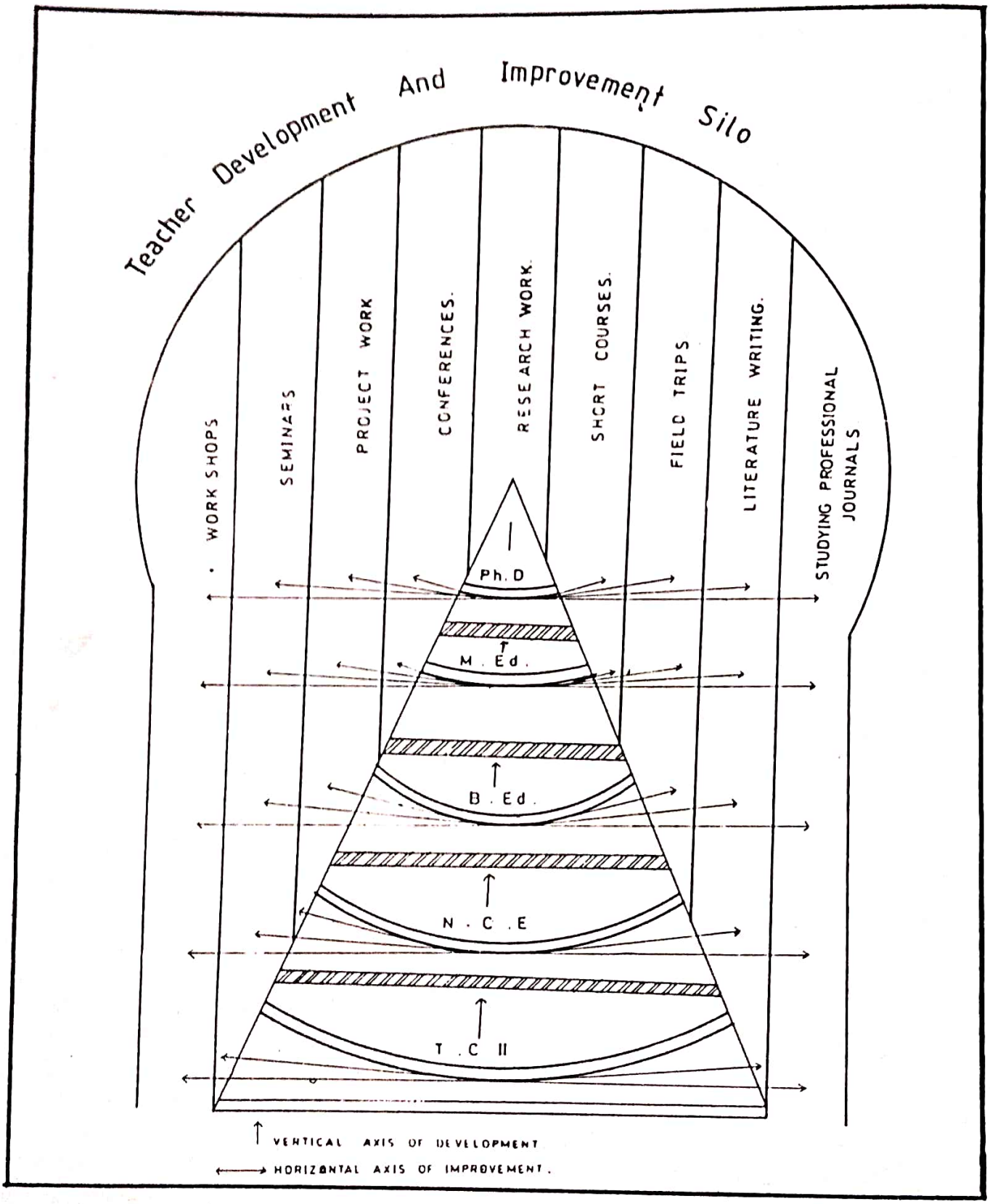

Fig. 1. Teacher Development and Improvement Silo

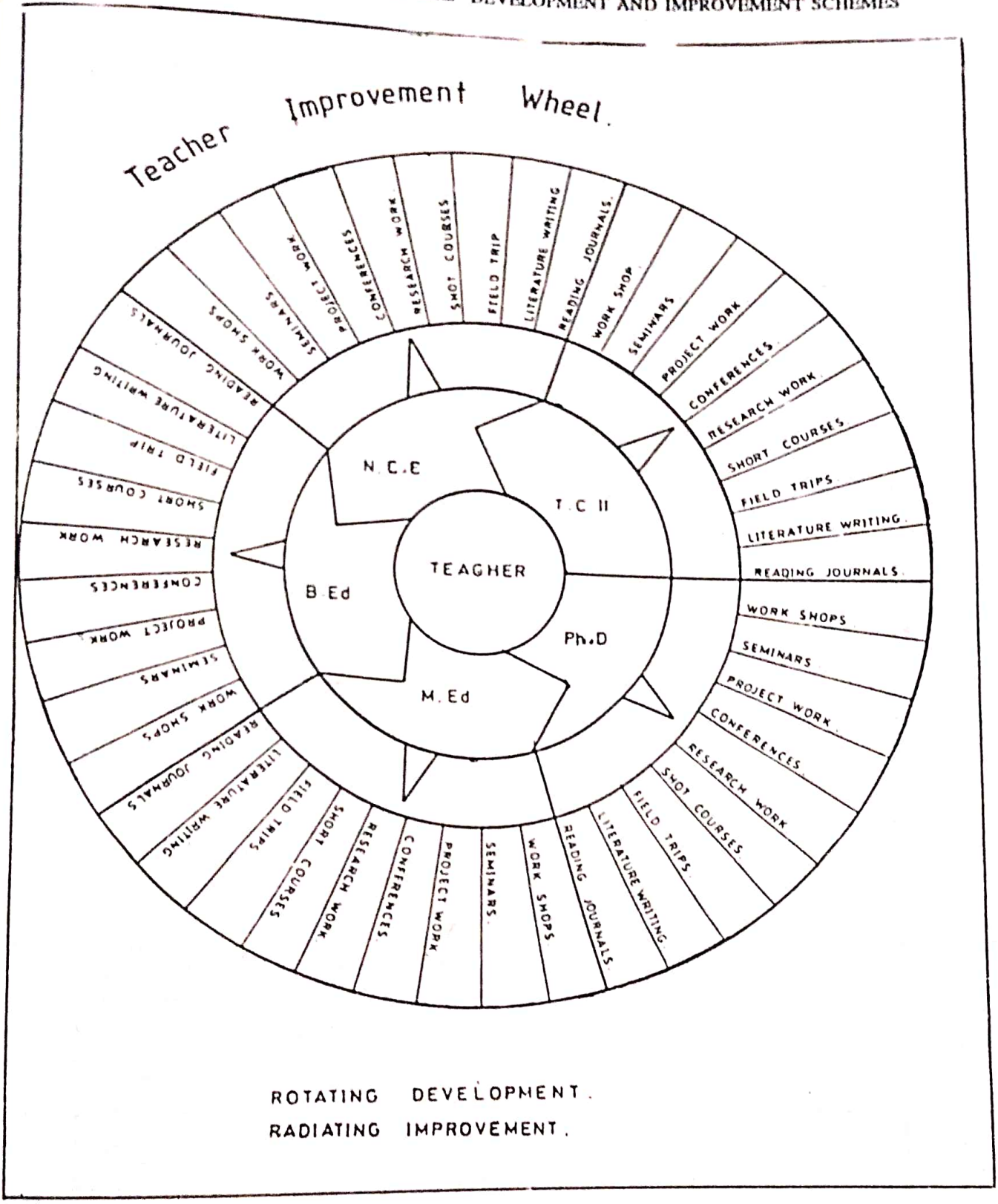

Fig. 2. Teacher Improvement Scheme

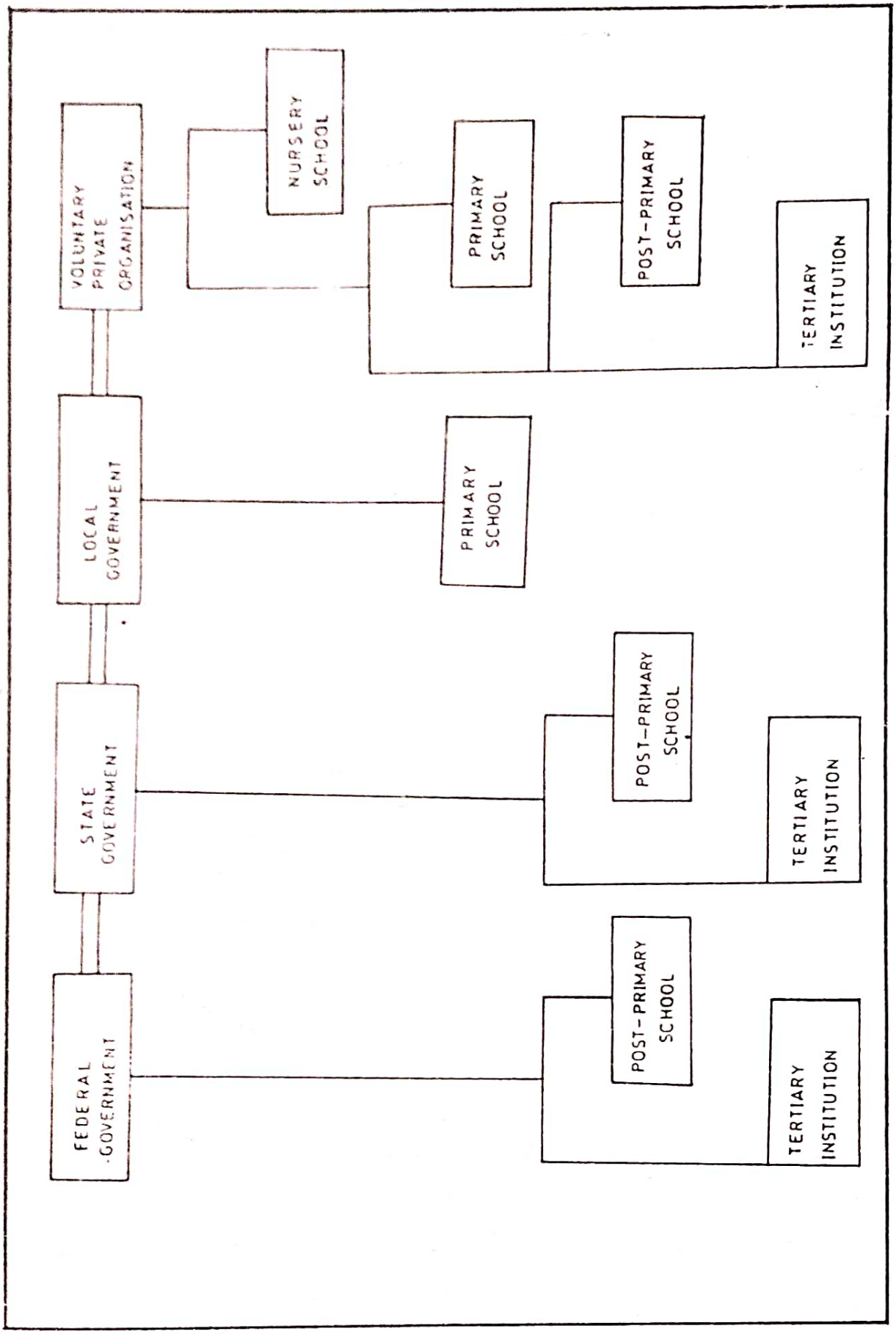

Fig. 3. Levels of Institutional Management in Nigeria

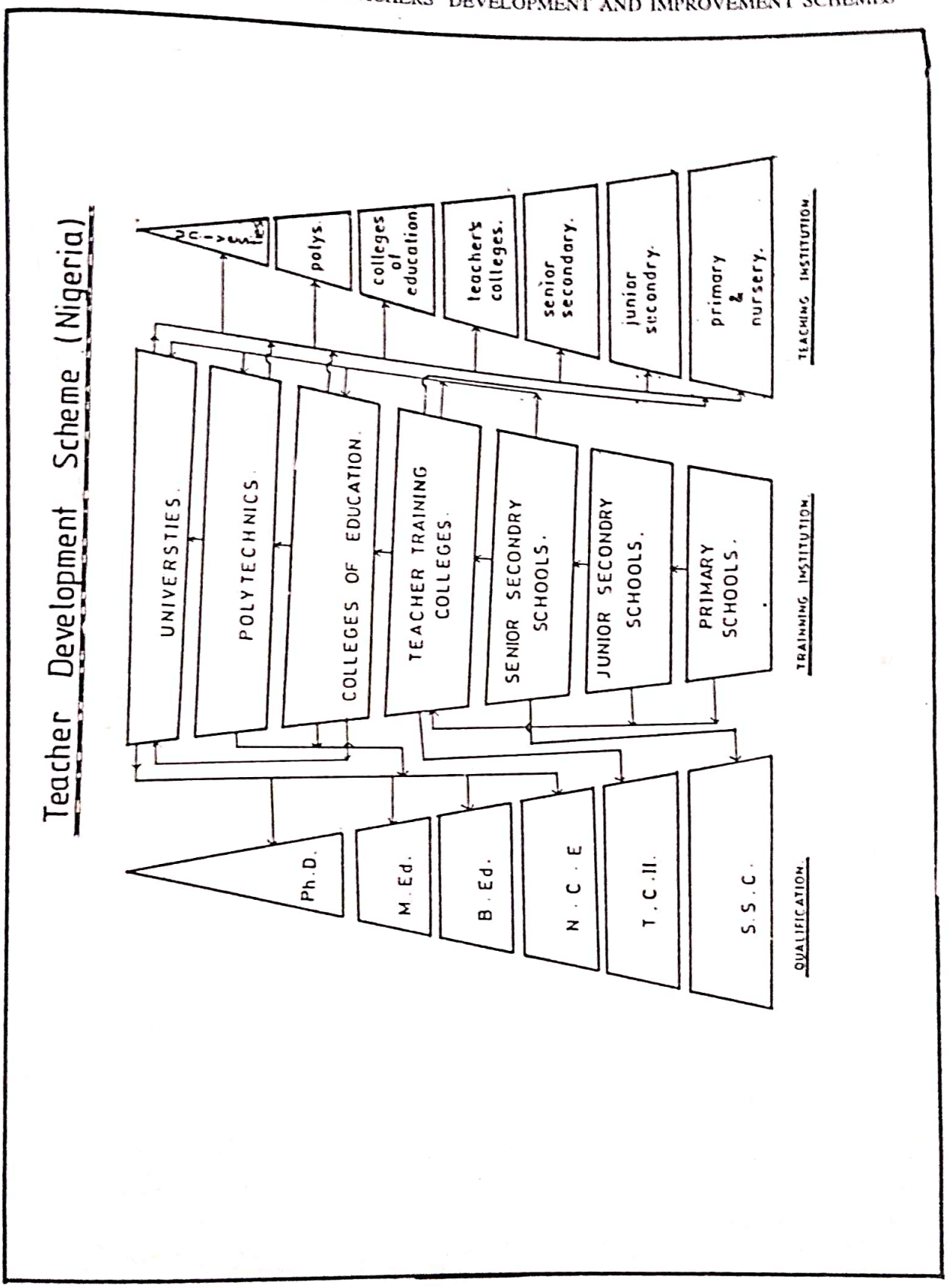

Fig. 4. Teacher Development Scheme (Nigeria)

Scheme of Centres for Development of Rural Technologies (CDRTs)

V.K. NATARAJAN

India today is one of the leading nations among the world in the field of Science and Technology. The role of Science and Technology in promoting and accelerating the process of socio - economic development in rural areas is now being increasingly accepted by the planners, policy makers, scientists and administrators. Though a large number of technologies have been developed by various research institutions and laboratories in the country, the benefits and fruits of such technologies have not percolated down to the needy and the target groups. In other words, it may be stated that the achievements made in Science and Technology have not adequately been harnessed for ameliorating the miseries of the rural poor. This is because the process of transfer of technology to the rural areas has not been systematically and scientifically undertaken in a planned manner. This lacuna has seriously been viewed by our planners and administrators as one of the main reasons for the present state of affairs in rural areas characterised by misery, poverty and unemployment in a large scale. The question of developing and effective methodology for the application of Science and Technology essential for transformation of our villages has been considered as a matter of urgency and important. It is therefore strongly felt that through the technological inputs, it is possible to raise productivity, employment and income generating capacity of the rural people and thereby bring about the desired result of rural development.

ROLE OF POLYTECHNIC

It was against this background that an idea was conceived: the involvement of polytechnic in the process of transfer of technologies in rural areas would go a long way in this direction, since polytechnic as technical institutions are well equipped with the required types of equipment, physical resources, expertise and technological knowhow and other infrastructures.

In this context the Government of India launched the Scheme of Community Polytechnic (CPS) and the Scheme of Centre for Development of Rural Technologies (CDRTs) in the year 1978 - 79. In general, both these schemes are intended to act as effective change agents in increasing productivity, employment, income and improving life style of rural masses with focus on Science and Technology inputs.

Of the Twelve CDRTs started in the country in 1978 - 79, five were established in the Southern States. Later when the scheme was expanded for the first time, three more institutions were added in 1992. As on date, eight polytechnics are implementing the Scheme of CDRTs in the Southern Region.

In this paper, an attempt has been made to discuss the salient features of the Scheme of CDRT in the Southern Region, its role, achievements, its linkages with other organisations, the problems and constraints faced by the polytechnic in implementation and its impact in rural areas.

CENTRE FOR DEVELOPMENT OF RURAL TECHNOLOGIES (CDRTS)

In order to provide R & D support to the Community Polytechnic, a few selected polytechnics were identified as Centres for Development of Rural Technologies (CDRT) by the Ministry of Human Resource Development, Government of India under the Direct Central Assistance Scheme with the following objectives:

- Conducting Socio - economic and technical survey and identification of the technologies to suit the needs of the villages based on these survey.
- Design, develop and manufacture of the items of technologies which have a already been identified.
- Repair, maintain and monitoring of prototypes installed in villages under demonstration projects through the Community Polytechnic as well as directly as per requirements.
- Testing - cum - large scale demonstration of the manufactured items of technology in actual rural situations, through Community Polytechnic and in a few cases directly to give first-hand experience.

FINANCE

The Ministry of Human Resource Development, Government of India, extends financial assistance to the polytechnic implementing the scheme of CDRT. Each CDRT is being given a recurring grant of Rs.2 lakhs each year. Besides, a non-recurring grant of Rs.5 lakhs has also been provided to each institution for purchase of necessary additional equipment, machinery and a vehicle.

ACTIVITIES

As regards the Scheme of Centre for Development of Rural Technologies (CDRT), the following are the main activities:

- Act and function as a major resource institution for Community Polytechnic.
- Conduct survey in rural areas to identify problems with required application of S & T.
- Design and develop new gadgets to meet their local requirements.
- Field test the gadgets and ensure satisfactory compliance with local needs.
- Develop technical literature and material for propagating the gadgets.
- Compare the performance of the gadgets developed with other similar gadgets available in the country and improve them wherever possible.
- Disseminate information about all types of gadgets for wider propagation and utilisation in the rural areas.
- Conduct training programmes wherever necessary for staff of the Community Polytechnic and to explain functioning of various gadgets developed.
- Undertake job orders from the Community Polytechnic for manufacture and supply of appropriate technologies and obtain feedback from Community Polytechnic

about the performance of the gadgets and suitable to the local needs.

- Identify various organisations working in the areas of appropriate technology at the field level and establish rapport with organisations and utilise their expertise in promoting the activities of the Centre.
- Develop rural entrepreneours who can take up manufacture of technological items which have been adopted in the area.

ACHIEVEMENTS

Keeping the above objectives and functions in view, the CDRTs in the Southern Region have substantially contributed a lot by developing and fabricating a number of appropriate technologies and prototypes on various fields during the last decade, since the Scheme was launched. These include Nonconventional energy saving devices, pedal operated devices, drudgery reducing technologies. etc. Some of the rural appropriate technologies developed and improved by the CDRTs in the Southern Region are as follows:

Solar cookers (Domestic/Community types), solar stills, solar ovens, solar driers, solar water heater, solar water lens, solar distillation plant, low cost refrigerator, groundnut dehuller, hand operated washing machine, hand operated improved chakki, wood burning stove, booster pump, low lift pump, pedal operated water lifting pump, bee box, honey extractor, foundry sand mixture, stablished soil block making machine, pedal operated brick moulding machine, wind mills, F.R.P. sanitary ware smokeless mud stove, inertia pump, hollow cement concrete machine, low cost house, paddy thresher, pedal operated pump, photo voltaic cells-cum-wind generator, bio-gas plant, lorena smokeless stove, bullock driven prime mover. Bat-trap bond for wall construction, filter slab for roof, treatment of coconut leaf thatch for extension of life, soil stablished blocks, lime - sand blocks, pulleys with ball bearings for drawing water from wells, curd stirring machine, chips cutter, water filters. Besides these, some technologies relating to handlooms, power looms and sericulture are also developed by one institution. They are listed below:

Portable pirn winder, take up and let off mechanisms for handlooms, computer aided fabric design, continuous weap sizing for handlooms, thermal bonding machine, hank mercerising unit, automative shuttle changing mechanism and semi-positive let off mechanism for powerloom, production of coarse blended and fance yarn through open end rotor spinning machine, narrow width fabrics, modified silk reeling machine, solar stifling machine (for silk), waste silk process, training on embroidery machine etc. Most of the above models are displayed in the exhibitions being organised by the institute on various occasions in different places in collaboration with national Handloom Development Corporation.

As stated elsewhere, the CDRTs have succeeded in developing a large number of rural technologies. Though most of these technologies developed were successfully tested and found suitable for adoption and transfer to the rural areas, they remain stored in the laboratories. Much attempts were not made by the polytechnic implementing the scheme for transfer of these developed technologies from the laboratories to the land. However, a few CDRTs have supplied items of a few developed technologies to some user organisations and institutions.

One centre had imparted training in the technologies developed by it to the village youth as part of the project on "Technological tools for village and training of village youths".

Another institute has been recognised by the State Government to conduct training programmes to the Block Development Officers and other Revenue Officers.

DISSEMINATION OF INFORMATION

Dissemination of information about the activities and functions of these Centres were not paid much attention by most of the institutions. However, each Centre has brought out a number of printed leaflets, booklets, brochures, etc. pertaining to the main features of all the technologies developed by them. A few institutions have also established a demonstration - cum - display unit where all the developed technologies are kept in one place for the use of visitors and others.

LINKAGES

Linkages with Block and District administration, State energy development corporations, University departments, State Science and Technology Centres, Rural Development Departments, NHDC CAPART, DST, etc. have been established by most of the centres. These types of collaboration enabled and facilitated the CDRTs to exchange and gain favourable and technical knowhow and also to improve and expand their spectrum of activities for further development.

The rapport thus established by the CDRTs are actually useful assets in further expansion and diversification of their activities and also in developing as a Technology Resource Centre in the region.

PROBLEMS

The Centres are faced with some practical constraints and difficulties. Since the inception of the Scheme, the polytechnics run the centres without full - time staff on regular basis but manage with the part - time staff and in sometimes with contingency staff whenever the need arises. In the absence of an approved guideline document for CDRTs as in the case of Community Polytechnic Scheme, stating clearly the details of technical, administrative, operational and monitoring strategies, the CDRTs could not operate and implement the scheme uniformly. A clear cut guideline from the monitoring authorities, it is felt, would enable the centres to remove the prevailing impediments and the slackness for effective implementation of the Scheme.

Besides, transfer of certain technologies in rural areas is bound to face some barriers and problems. The problems are mostly centred around users. For example, illiteracy, poverty ignorance etc. on the part of the villagers make them to disbelieve modern science and technology gadgets, equipment, etc. In some cases, the inability of the beneficiaries to pay or install the latest modern technological gadgets for this day to day use and also non availability of subsidies and other incentives. Added to this, the non availability of trained technicians to attend repairs and services of the technological gadgets in rural areas in time dampened the users.

The polytechnic may identify and analyse the above problems and adopt appropriate strategies and suitable remedies to overcome them.

IMPACT

The main purpose of Transfer of Technologies in rural areas is to bring about socio - economic transformation by using available local resources and materials. The application of such a technology is expected to help generate employment, additional income, minimum fatigue, reduce drudgery among the

users, eliminate wastage and ultimately improve the total life style of the rural masses

In has been observed the complex problems faced by the rural people cannot be solved with the help of traditional tools and outdated technologies. The polytechnics implementing the scheme of CDRT have done appreciable work in the fields of agriculture alternate sources of energy, low cost housing, water management, minor irrigation, rural transport, bio - gas systems, rural sanitation drinking water, village industries, domestic gadgets labour saving devices, etc.

The polytechnics implementing the Community Polytechnic Scheme have generated tremendous awareness about the importance and utilisation of these technologies in rural areas. The villages as a result slowly and steadily have started using these technologies in their day to day affairs. The implication and the impact of these technologies-clearly visible in rural areas where the polytechnics are implementing the Community Polytechnic Scheme.

The operation of the CDRTs is more or less on par with Community Polytechnic Scheme. All these centres (CDRTs) have accomplished moderate to high degree of success in developing various rural appropriate technologies. However, the spreading of these technologies to the needy rural areas and the resultant multiplier effect by the CDRTs through the Community Polytechnic Scheme is observed as minimal. In the beginning, it was conceived that the CDRTs would cater to the technology development requirements of the Community Polytechnic. But in practice, the CDRTs have been functioning independently and not established a well net-work system with the Community Polytechnic in their respective states.

In order to make these centres more meaningful and purposeful it is suggested that all the polytechnics implementing the scheme of CDRT should identify a few cluster of villages in and around their institutions where all the technologies developed and tested successfully by them should be made transferred by the eligible users. These in turn, should make multiplier effects. Second, the polytechnic implementing the Community Polytechnic Scheme should have close rapport with all the CDRTs and jointly strive to propagate and popularise the various technologies and gadgets developed and tested by the CDRTs. Finally, the government may extend some concessions and incentives in the form of subsidies to those gadgets developed by the CDRTs so that the rural people will be motivated and encouraged to buy and utilise these technologies on a large scale.

Vocational Agricultural Education: The Key to Women's Effectiveness In Agriculture in Nigeria

AFUGBUOM, UCHE J. (MRS)

ABSTRACT

The "oil - boom" induced rural - urban migration; thousands of lives lost in the Nigerian civil war; and the growth of western education has depleted the agricultural human resource of the country. Able-bodied men have vacated rural areas and farming in search of golden fleece in urban centres, leaving women and the aged behind such that the proportion of women involved in agriculture is now put at between 70 and 80 percent. Thus the bulk of agricultural production, processing, and marketing operations in the country are performed by women.

Most Nigerian women involved in farming have been found to lack capital, education, sufficient labour for their operations and modern inputs. Unfortunately, previous government efforts at improving agriculture have been directed more at men than women.

This paper makes a case for women as the bedrock of Nigerian agriculture and proposes that Vocational Agricultural education for women farmers would help remedy their education difficiencies, put them in a position to compete for available credit facilities and subsidized inputs, enhance their participation in extension and farmer organizations, and raise their level of productivity.

INTRODUCTION

During the colonial era, agriculture was the main stay of the Nigerian economy. During the period before independence, palm produce, coca, groundnut, cotton and rubber were important foreign exchange earners accounting for about 68% of the nation's foreign exchange receipts. (see table I).

The first decade of independence (1960-69) saw a decline in agricultural production in the country resulting in significant dwindling of the nations earnings from agricultural exports (see table II) short-falls in food supply resulted in escalating prices of food items.

Since 1976, the nation has been unable to meet its food supply short - falls and this is evident in the high cost of food in the country. Ayo (1988) attributed this to the rate of population growth which has been greater than

Table I : Nigeria's exports selected years (% of total by value)

Item	1962	1967	1971	1975
Crude oil	9.9	29.8	73.4	92.7
Cocoa	19.8	22.6	11.0	3.6
Palm oil	5.3	0.5	0.3	0.0
Palm kernels	10.0	3.2	2.0	0.27
Groundnuts	19.2	14.6	1.9	0.0
Groundnut oil	3.6	3.0	1.0	0.0
Groundnut cake	1.4	1.7	0.5	0.06
Raw Cotton	3.5	2.7	0.8	0.0
Rubber	6.7	2.6	1.0	0.30
Other commodities	16.5	13.7	6.3	7.04
Total	100	100	100	98.47

Source: Teriba, O. and Kayode, M.O. eds. (1977) Industrial development in Nigeria. Ibadan: Ibadan University Press.

Table II : Industrial Composition of GDP

Selected years

	1958/59	1966/67	1970/71	1975/76
Agriculture	65.9	53.8	41.8	24.5
Industry	9.2	19.8	32.8	49.1
Transport and communication	4.1	4.0	3.7	3.2
Distribution	12.5	12.4	11.5	10.5
Government	3.1	3.2	5.3	7.9
Social services	3.0	4.2	3.2	3.7
Others	2.1	2.6	2.1	1.6
Total	100	100	100	100

Source: Teriba, O. and Kayode M.O. eds. Op. cit. p. 21.

the rate of growth in agricultural productivity. The writer believes that low agricultural productivity in the country is as a result of the fact that majority of those who produce food are not adequately equipped with modern knowledge and skills for increased effectiveness in agricultural production operations. The writer is of opinion that Vocational agricultural education is an indispensable tool for improving the effectiveness of rural women farmers.

THE ROLE OF WOMEN IN NIGERIAN AGRICULTURE

The proportion of women engaged in agriculture in the country varies from one socio - economic and religious background to another. Nesekka (1980) estimated that women account for 60 to 80 percent of the agricultural labour force in Nigeria.

The astronomic increase in formal education ushered in by the free Universal Primary Education Schemes, the 28 months civil war which reduced drastically the population of men and the unprecedented increase in the oil prices resulted in the neglect of the agricultural sector and further depletion of the farming populace.

The preponderance of women in the agricultural sector moved Rogmbe (1988) to say that they constitute the backbone of rural development. Olayide and Bello-Osagie (1980) enumerated the tasks of women in agriculture in the country as:

(i) Cultivation:

The activities include planting or seeding, input distribution and supplies, such as fertilising, watering, live stocks feeding, thinning and supply and spraying. The proficiency in accomplishing these activities, however, varies among the women.

(ii) Harvesting:

This involves such operations as gathering of ripe crops, threshing, cleaning, clearing, transporting or storing of product.

(iii) Distributing:

This involves transporting or movement to the farm gate/local markets. It also involves concentrating, sorting/grading and merchandising. The above activities ensures that consumers obtain the required materials in good quality and quantity.

(iv) Alimentation;

This involves processing, packaging and preparing into various forms of food materials. These activities ensure that agricultural products are made available to the consumers in forms readily acceptable, while assuring good health of the citizens.

It has been discovered that women combine active roles in farming with domestic duties (Okorji, 1990). It has also been reported that women on the average put in more hours of work per annum in the farm than men. (Okorji, 1983). Based on these findings, therefore, Bill (1986) and Okorji (1990) concluded that women contribute a significantly higher proportion of total labour in farming than men.

Appreciating the extent of women's participation in agriculture, Adebusoye (1980) reported that there is a loss of potentials for economic growth in any agricultural policy that neglects the role of women in food production. The contribution of women in agriculture has not been given enough recognition so that women are systematically discriminated against in agricultural extension work, provision of subsidized inputs, facilities and services. (Chikwnedu, 1980) and Onwubuya, 1987).

Despite these shortcomings, women have made tremendous contributions towards the agricultural development of Nigeria.

Agricultural Education as the key to Women's Effectiveness in Agriculture

Human labour and management are central to agricultural production - since human beings must plan, take decisions and perform farm operations. The level of knowledge and skills possessed by an individual determines the extent of performance of agricultural tasks.

Floyd (1980) noted that the reason behind the show adoption of innovations by Nigerian farmers is the generally low level of education amount the farmers. Agricultural education relevant to their occupations is needed to improve illiterate women's effectiveness.

Agricultural education provides:

(i) information about new inputs that have been tasted and found to be capable of increasing the farmers' level of productivity;

(ii) information about new techniques of production which can enhance the farmers' level of output if adopted; and

(iii) information about how to apply economic principles in the production process to ensure efficient use of available resources.

Apart from technical knowledge and skills, agricultural education will help farmers become better managers by providing them with knowledge upon which to base their decision - making on production especially in the areas of fluctuation in product prices, selection of the enterprise best suited to their land and principles of harmonious property relations in the use of agricultural resources.

In addition, agricultural education will assist, farmers to develop an understanding of the inter - relationship of urban and rural life and provide counselling about agricultural careers.

It will also provide training for specialist agricultural occupations such as livestock and plant breeding, food storage and processing, and agricultural financing and insurance to help minimise uncertainties for those producing food and other agricultural by-products in future.

Finally, agricultural education will produce more trained personnel involved in extension services for farmers and translation of research findings into field trials prior to commercial application as well as provides personnel needed as subordinate staff in the agricultural research institutions and Universities. According to Ochu (1991) agricultural education broadens the borizon and raises the farmers' expectations, provides them with some familiarity with modern concepts and techniques, develops their commitment and makes them more aggressively innovative.

FORMS OR AGRICULTURAL EDUCATION FOR FARMERS

In Nigeria, various forms of non - formal education are being used to improve farmers' knowledge and skills,\. The popular forms include adult literacy programmes, functional iteracy, fundamental literacy, second change schools, Vocational agriculture for farmers, extension services and "animation rurale" (Uwadiae and Ochu, 1991).

Adult Literacy Programme:

Adult literacy is based on the philosophy that a literate and numerate farmer would certainly operate a more profitable production function than an illiterate farmer. According to

Azikiwe (1990) literacy eliminates such inhibiting factors as low income, inferior social status, superstition, ill - health, dogmatism and early marriage.

Functional literacy:

Functional literacy programmes enable women farmers to acquire new knowledge and skills for efficient living in the process of learning to read and write. Floyd (1930) while recommending functional literacy for Nigerian farmers, claimed that keeping records of farming operations, financial accounts of transactions, completing application forms and writing reports are fundamental for transforming traditional agriculture.

Vocational Agriculture for farmers:

This is a training programme designed to equip farmers with modern knowledge and skills. This programme usually offered in a centre or school could either be residential or non - residential. Women can benefit from this programme if it is planned to suit their own schedule.

Extension services:

This is the farmer education strategy most used in Nigeria. It involves visits, discussions and demonstrations. Extension services have expanded to include the provision of farm inputs to farmers at subsidized rates and the organisation of farmer's associations/ cooperatives as well as agricultural shows.

Fundamental literacy:

Fundamental literacy is both work - oriented and work - specific. It is designed to improve the vocational competence of farmers.

"Animation Rurale"

In 'Animation Rurale' a few farmers are trained who in turn influence or train their colleagues in the villages. Since the production of women extensionists might be difficult because of their roles in the Nigerian society, using "animation rurale" programme would be the best option open to Nigeria.

CONCLUSION:

This paper examined the genesis of food crisis in Nigeria, the role of women in agriculture and the role of agricultural education in improving the effectiveness of women farmers in their occupations. Agricultural education is of paramount importance to women since majority of them are illiterates. Vocational agricultural education for women will help remedy their educational deficiencies, put them in a position to compete with men for government support, and enhance their participation in extension services, farmers' organizations and raise their level of productivity. The mechanisms for agricultural education discussed in this paper could be considered with a view to determining the one that is most suitable for women in various socio - cultural backgrounds.

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A Research Project to Present the Prime numbers as a Sequence

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ABSTRACT

This research is a basic research aimed at determining whether the set of prime numbers is in fact a well defined sequence. In carrying out this research trial and error, careful thought, existing theories and analysis of the set of integers were used. The set of integers modulo 3 and 5 were particularly useful in flushing out composite numbers from the isolated sequences and in providing the sequences.

The entire set of prime numbers are contained in the solution sets of exactly eight simultaneous linear congruences modulo 3 and 5. This is because using Euler function, $6(5) = 4$ and $4(3) = 2$ and $4 \times 2 = 8$; the number of ways to combine one congruence class modulo 5 relatively prime to 5 and another congruence class modulo 3 relatively prime to 3 to form systems of simultaneous linear equations is $4(5) \times 4(3) = 4 \times 2 = 8$., If $x \equiv a \pmod m$ and $x = b \pmod n$ where $(a, m) = 1$ and $(b, n) = 1$, then any simultaneous solution is such that $(s,m) = 1$ and $(b, n) = 1$, and $(s,n) = 1$ and if S_1 and S_2 are two solutions then $S_1 \equiv S_2 \pmod{mn}$. This is the Chinese Remainder Theorem.

The following eight simultaneous linear congruences were used for the research.

1. $x \equiv 2 \pmod 5$
   $x \equiv 1 \pmod 3$

2. $x \equiv 2 \pmod 5$
   $x \equiv 2 \pmod 3$

3. $x \equiv 1 \pmod 5$
   $x \equiv 2 \pmod 3$

4. $x \equiv 1 \pmod 5$
   $x \equiv 1 \pmod 3$

5. $x \equiv 3 \pmod 5$
   $x \equiv 2 \pmod 3$

6. $x \equiv 3 \pmod 5$
   $x \equiv 2 \pmod 3$

7. $x \equiv 4 \pmod 5$
   $x \equiv 1 \pmod 3$

8. $x \equiv 4 \pmod 5$
   $x \equiv 2 \pmod 3$

The relevant solution set of the above eight systems of simultaneous linear congruences were respectively:

(1) 7, 37, 67, 97, 127, . . . , 30n-23

(2) 17, 47, 77, 107, 137, ... 30n-13

(3) 11, 41, 71, 101, 131, ... 30n-19

(4) 31, 61, 91, 121, 151, ... 30n+1

(5) 13, 43, 73, 103, 133, ... 30n-17

(6) 23, 53, 83, 113, 143, ... 30n-7

(7) 19, 49, 79, 109, 139, ... 30n-11

(8) 29, 59, 89, 119, 149, ... 30n-1

These eight sequences were further confirmed to be comprehensive by analysing the set of integers in terms of numbers ending with

1, 3, 7, 9 which are ending digits for prime numbers.

Using the fact that multiplication is well defined in the set of integers modulo n, composite number were flushed out from the eight sequences leaving a set of purely prime numbers.

The smallest among the eight sequences is 7, 37, 67, 97, ... 30n-23 and is named the leading sequence.

This research has systematized the concept and incidence of prime numbers. To determine whether a is prime, suppose the nth term of the leading sequence is the biggest term less than or equal to $\sqrt{a}$, then we need to prove or disprove a, a prime by test - dividing a by less than 8n integers. For example to test whether 1497 is a prime the term of the leading sequence which satisfies the above condition is the second, hence less than $8 \times 2 = 16$ test - divisions are needed.

Indeed only ten divisions are needed and the divisors are all terms in the eight sequences less than or equal to $\sqrt{1497} = 38.69$. These divisors are 7, 17, 11, 31, 13, 23, 19, 29, 37 and of course 3 which does not belong to any of the sequences. Even numbers and multiples of 5 are trivially prime numbers. Perhaps one of the greatest achievements of this research is that the computer can now be programmed to produce the first n consecutive integers for any n. This will throw light on the distribution of prime numbers on the real line axis.

BACKGROUND TO THE PROBLEM

Prime numbers are of great historical importance because they form the backbone of the integers. Every integer is a product of prime numbers.

To day the prime numbers are even more important featuring prominently in the study of rings and groups. We still need to produce a comprehensive table of prime numbers; we need the primes as a sequence for this purpose. We are interested in knowing how the prime numbers are distributed in the set of real numbers.

PURPOSE OF STUDY:

The purpose of this study is to try to isolate subsequences which collectively exhaust the set of prime numbers and then to put the subsequences together again to form a sequence of prime numbers.

RESEARCH QUESTIONS

The research question for this research is "Do the prime numbers constitute a sequence with a rule specifying the n th term?".

POPULATION

The population for this study is the set of integers and linear congruence sets modulo $n, \equiv 1,2,3,.....$

SAMPLE:

The sample is the set of integers and linear congruence modulo 3 and 5. This is representative since if contains all the integers and hence all the prime numbers.

INSTRUMENT FOR DATA COLLECTION

The instrument for data collection is an eight item test on solution of simultaneous linear congruence equations.

VALIDATION OF THE INSTRUMENT

The much needed content validity of the instrument was secured by a boaster analysis

based on step by step process. (see analysis to the test results of items)

METHOD OF DATA COLLECTION

Data was collected from test results administered on the researcher himself.

METHOD OF DATA ANALYSIS

Analysis is based on the fact that additional and multiplication are well defined in the set of integers modulo n.

DATA PRESENTATION AND ANALYSIS

TEST ITEM ONE

Solve the following simultaneous linear congruences and isolate any prime sequence(s).

$$x \equiv 2 \pmod 5$$

$$x \equiv 1 \pmod 2$$

The solution set of this system in the arithmetic sequence

22, 37, 52, 67, 82, 97, 112, 127, 142, 157, 172, 187, 202, 217, 232, 247, 162, 277, 242, 307, ... (15n+7).

The following probable prime sequence was isolated from this solution set 37, 67, 97, 127, ... (30n+7). Every term of this subsequence is congruent to 1 modulo 3. To determine the nature of composite numbers which it contains, we examine the nature of arithmetic in the set of integers modulo 3. In this set $[1] \times [1] = [1]$ and $[2] \times [2] = [1]$. Hence in this sequence any composite number is made up of two factors from the equivalence class of 1 or two factors from the equivalence class of 2. However, any composite number ending with 7 as a digit is a product of 7 and 1 or 3 and 9. It follows that the composite numbers in this subsequence are of the following types.

(1) Products of two numbers one ending with a seven in class one and the other ending with a one in class one.

(ii) Products of two numbers, one ending with a seven in class two and other ending with a one in class two.

(iii) Products of two numbers, one ending with a three in class one and the other ending with a nine in class one.

(iv) Products of two numbers one ending with a three in class two and the other ending with a nine in class two.

A closer look at the above results shows that all the enumerated combination of numbers exhaust all possible ending digits for prime numbers which are 1, 3, 7, 9, except 2 and 5 which characterise only two primes 5 and 2.

If we can identify all the above enumerated possible combination of numbers we shall be in a position to purify the sequence 37, 67, 97, 127, ... , (30n+7) by removing all the composite terms. Incidentally this sequence itself is one possible factor in the enumerated products, being a set of numbers ending with a seven and all congruent to one modulo 3. In (ii) we mentioned a set of numbers all ending with a seven and all congruent to two modulo 3.

TEST ITEM TWO

Solve the following simultaneous linear congruences and isolate and prime sequence.

$$x = 2 \ (mod\ 5)$$
$$x = 2 \ (mod\ 3)$$

The solution set of this system is the arithmetic sequence

17, 32, 47, 62, 77, 92, 107, 122, 137, 152, 167, 182, 197, 212, 227, ... (2+15n)

The following probable prime subsequence was isolated from the this solution set, 17, 47, 77, 107, 137, 167, 197, 227, ... (30n-13).

Every term of this subsequence is congruent to two modulo 3. To determine the nature of composite number which it contains we examine the nature of arithmetic in the set of integers modulo 3. In this set $[2] \times [1] = [2]$. Hence in this sequence any composite number is made up of one factor from equivalence class of 2 and another factor from the equivalence class of 1. However, any composite number ending with 7 as a digit is a product of 7 and 1 or 3 and 9. It follows that the composite numbers in this subsequence are of the following types.

(i) Products of two numbers one ending with a seven, and congruent to 2 modulo 3 and the other ending with a one congruent to one modulo 3.

(ii) Products of two numbers one ending with a seven congruent to one modulo 3 and the other ending with a one and congruent to 2 modulo 3.

(iii) Products of two numbers one ending with a three, congruent to 2 modulo 3 and the other ending with a nine and congruent to one modulo 3.

(iv) Products of two numbers, one ending with a three and congruent to one modulo 3 and the other ending with a nine and congruent to two modulo 3. We require all the enumerated products to enable us to purify the sequence 7, 17, 47, 107, 137, ... 30n-23 into a purely prime sequence.

TEST ITEM THREE

Solve the following system of simultaneous linear congruence equations and isolate any prime sequence(s).

$$x \equiv 1 \pmod 5$$

$$x \equiv 2 \pmod 3$$

The solution set of this system is the arithmetic sequence 11, 26, 41, 56, 71, 86, 101, 131, ... (15n-4).

The following probable subsequence was isolated from this solution set 11, 41, 71, 101, 131, ... (30n-19). Every term in this subsequence is congruent to 2 modulo 3. Now owing to the nature of arithmetic in the set of integers modulo 3. $[2] \times [1] = [2]$. Hence in this subsequence any composite number is made up of one factor from the equivalence class of 1 and the other from class 2. However any composite number ending with 1 as a digit is obtainable either as a product of 1 and 1, or 3 and 7 or 9 and 9. It follows that the composite numbers in this subsequence are of the following types.

(i) Products of two numbers, one ending with one, congruent to 2 modulo 3 and the other ending with a one and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a three congruent to two modulo 3 and the other ending with a seven and congruent to one modulo 3.

(iii) Products of two numbers one ending with a three, congruent to one modulo 3 and the other ending with a seven and congruent to two modulo 3.

(iv) Products of two numbers, one ending with a nine, congruent to two modulo 3 and the other ending with a nine and congruent to one modulo 3.

TEST ITEM FOUR

Solve the following simultaneous linear congruence equations and isolate any prime sequence(s).

$$x \equiv 1 \pmod 5$$

$$x \equiv 1 \pmod 3$$

The solution set of this system is the arithmetic sequence, 16, 31, 46, 61, 76, 91, 106, 121, 136, 151, 166, ... (15n+1).

The following probable subsequence was isolated from this solution set.

31, 61, 91, 121, 151, ... (30n+1).

Every term in this subsequence is congruent to 1 modulo 3. Owing to the nature of arithmetic in the set of integers modulo 3, $[1] \times [1] = [1]$, and $[2] \times [2] = [1]$. Hence in this subsequence any composite number is made up of two factors from the equivalence class of one or two factors from the equivalence class of two. As noted earlier such a composite number is obtainable as a product of 1 and 1 or 3 and 7 or 9 and 9. It follows that the composite numbers in this subsequence are of the following types:

(i) Products of two numbers, one ending with a one, congruent to one modulo 3 and the other ending with a one and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a three, congruent to one modulo 3 and the other ending with a seven and congruent to one modulo 3.

(iii) Products of two numbers, one ending with a nine, congruent to one modulo 3 and the other ending with a nine and congruent to one modulo 3.

(iv) Products of two numbers, one ending with one, congruent to two modulo 3 and the other ending with a one and congruent to the two modulo 3.

(v) Products of two numbers, one ending with a three, congruent to two modulo and the other ending with a seven and congruent to two modulo 3.

(vi) Products of two numbers, one ending with a nine, congruent to two modulo 3 and the other ending with a nine and congruent to two modulo a three.

TEST ITEM FIVE

Solve the following system of simultaneous linear congruence equations and isolate any prime sequence(s)

$$x \equiv 3 \pmod 5$$

$$x \equiv 1 \pmod 3$$

The solution set of this system of equations is the arithmetic sequence 13, 28, 43, 58, 73, 88, 103, 118, 133, 148, 163, 178, ... (15n-2).

The following probable subsequence was isolated from this solution set 13, 43, 73, 103, 133, 163, ... (30n-17).

Every term in this subsequence is congruent to 1 modulo 3 in the set of integers modulo 3, $[1] \times [1] = [1]$, and $[2] \times [2] = [1]$. Also any composite number ending with 3 as a digit is obtainable either as a product of 3 and 1 or 7 and 9.

It follows that the composite numbers in this subsequence are of the following types:

(i) Products of two numbers, one ending with a three congruent to one modulo 3 and the other ending with a one and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a three congruent to two modulo 3

and the other ending with a one and congruent to two modulo 3.

(iii) Products of two numbers, one ending with a seven congruent to one modulo 3 and the other ending with a nine and congruent to one modulo 3.

(iv) Products of two numbers, one ending with a seven, congruent to two modulo 3 and the other ending with a nine and congruent to two modulo 3.

TEST ITEM SIX

Solve the following system of simultaneous linear congruence equations and isolate any prime sequence(s).

$$x \equiv 3 \pmod 5$$

$$x \equiv 2 \pmod 3$$

The solution set of this system of equations is the arithmetic sequence:

8, 23, 38, 53, 68, 83, 98, 113, 128, 143, 158, 173, ... 15n-7.

The following probable subsequence was isolated from this solution set. 23, 53, 83, 113, 143, 173 . . . . . (30n-7).

Every term in this subsequence is congruent to 2 modulo 3, following the nature of arithmetic in the set of integers modulo 3, $[2] \times [1] = [2]$. As noted earlier any composite number ending with 3 as a digit is obtainable either as a product of 3 and 1 or 7 and 9. It follows that the composite numbers in this subsequence are of the following types:

(i) Products of two numbers, one ending with a three, congruent to two modulo 3, and the other ending with a one and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a three, congruent to one modulo 3 and the other ending with a one congruent to two modulo 3.

(iii) Products of two numbers, one ending with a seven congruent to two modulo 3 and the other ending with a nine congruent to one modulo 3.

(iv) Products of two numbers, one ending with a seven congruent to one modulo 3 and the other ending with a nine congruent to two modulo three.

TEST ITEM SEVEN

Solve the following system of simultaneous linear congruence equations and isolate any prime sequence(s).

$$x \equiv 4 \ (mod\ 5)$$

$$x \equiv 2 \ (mod\ 3)$$

The solution set of this system of equations is the arithmetic sequence:

19, 34, 49, 64, 79, 94, 109, 124, 139, 154, ... (15n+4)

The following probable subsequence was isolated from this solution set 19, 49, 79, 109, 139, ... (30n-17). Every term in this subsequence is congruent to 1 modulo 3. In the set of integers modulo 3, $[1] \times [1] = [1]$ and $[2] \times [2] = [1]$. Also any composite number ending with 9 as a digit is obtainable either as a product of 3 and 3 or 7 and or 1 and 9. It follows that the composite numbers in this subsequence are of the following types:

(i) Products of two numbers, one ending with a 3 congruent to one modulo 3 and the other ending with a three and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a nine congruent to one modulo 3 and the other ending with a one and congruent to one modulo 3.

(iii) Products of two numbers, one ending with a seven congruent to one modulo 3 and the other ending with a seven and congruent to one modulo 3.

(iv) Products of two numbers, one ending with a three congruent to two modulo 3 and the other ending with a three and congruent to two modulo 3.

(v) Products of two numbers, one ending with a nine congruent to two modulo 3 and the other ending with a one and congruent to two modulo 3.

(vi) Products of two numbers, one ending with a seven congruent to two modulo a 3 and the other ending with a seven and congruent to two modulo 3.

TEST ITEM EIGHT

Solve the following system of simultaneous linear congruence equations and isolate any prime sequence(s).

$x \equiv 4 \ (mod\ 5)$

$x \equiv 2 \ (mod\ 3)$

The solution set of this system of equations is the arithmetic sequence: 14, 29, 44, 59, 74, 89, 104, 199, 134, 149, ... (15n-1).

The following probable prime sequence was isolated from this solution set 29, 59, 89, 119, 149, ... (30n-1). Every term in this subsequence is congruent to 2 modulo 3 and in the equivalence set of integers modulo 3, $[2] \times [1] = [2]$. Also any composite number ending with 9 as the digit is obtainable either as a product of 3 and 3 or 7 and 7 or 1 and 9. It follows that the composite numbers in this subsequence are of the following types:

(i) Products of two numbers, one ending with a three congruent to two modulo 3 and the other ending with a three and congruent to one modulo 3.

(ii) Products of two numbers, one ending with a 9, congruent to two modulo 3 and the other ending with a one and congruent to one modulo 3.

(iii) Products of two numbers, one ending with a nine, congruent to one modulo 3 and the other ending with a one and congruent to two modulo 3.

(iv) Products of two numbers, one ending with a seven, congruent to two modulo 3 and the other ending with a seven and congruent to one modulo 3.

SUMMARY

The following eight arithmetic sequences which contain both prime and composite numbers were isolated. They collectively contain all the prime numbers except 2, 3 and 5.

(1) 7, 37, 67, 97, 127, ... (30n-23)

(2) 17, 47, 77, 107, 137, ... (30n-13)

(3) 11, 41, 71, 101, 131, ... (30n-19)

(4) 31, 61, 91, 121, 151, ... (30n+1)

(5) 13, 43, 73, 103, 133, ... (30n-17)

(6) 23, 53, 83, 113, 143, ... (30n-7)

(7) 19, 49, 79, 109, 139, ... (30n-11)

(8) 29, 59, 79, 149, 179, ... (30n-1)

These eight arithmetic sequences were purified to obtain the entire set of prime numbers.

Indeed, if these sequences are represented as follows:-

$A = \{30n - 19\}$ $B = \{(30n + 1)\}$

$C = \{30n - 17\}$ $D = \{30n - 7\}$

$E = \{30n - 23\}$ $F = \{30n - 13\}$

$G = \{30n - 11\}$ $H = \{30n - 1\}$

then the entire primes minus 2, 3 and 5 are obtained as the union of the following sets:

(i) $A - [(A \times B) \cup (D \times E) \cup (C \times F) \cup (H \times G)]$

(ii) $B - [(B \times B) \cup (C \times E) \cup (G \times G) \cup (A \times A) \cup (D \times F) \cup (H \times H)]$

(iii) $C - [(C \times B) \cup (D \times A) \cup (E \times G) \cup (F \times H)]$

(iv) $D - [(D \times B) \cup (C \times A) \cup (F \times G) \cup (E \times H)]$

(v) $E - [(E \times B) \cup (F \times A) \cup (C \times G) \cup (D \times H)]$

(vi) $F - [(F \times B) \cup (E \times A) \cup (D \times G) \cup (C \times H)]$

(vii) $G - [(D \times C) \cup (H \times B) \cup (G \times A) \cup (F \times E)]$

(viii) $H - [(C \times C) \cup (G \times B) \cup (H \times A) \cup (F \times F) \cup (E \times E) \cup (D \times D)]$

With the eight arithmetic sequences one can determine whether a given whole number is a prime number. To determine whether a is a prime number try dividing a by 3 and all terms in the eight sequences which are less than or equal to $\sqrt{a}$.

Using this method a teacher can programme a class of 40 students to produce all prime numbers less than 1000000 in about 45 minutes. Indeed that capacity of the modern computer memory is the limit to the size of numbers which can be handled. With the result of the study we see that the prime numbers cannot be presented as a sequence.

However, they can be presented as a finite sequence since there is no rule specifying the n^{th} term but we can now produce the first n prime number for any finite n. We note that even numbers and all multiples of 5 are trivially assumed to be none-prime numbers.

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The Elasticity of Substitution in Educational Investment between Vocational Graduates and Academic Graduates from the perspective of changed growth in labour force: A Model of Research

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ABSTRACT

There is evidence that vocational education investments are profitable both to individuals and to the society and that, in these respects, investments in vocational education are beneficial to economic growth. However, the economic growth could cause both the investment in education training and educational involvement for young adult preparing to enter the labour market. In other words, the direction of causation might have been from economic development toward increased enrolments in vocational schools. Even though the expansion of vocational education and training is considered by many educators to be of paramount importance, therefore, the ability of vocational education programmes, to foster economy growth remains questionable. This article uses economic production function to interpret the interaction between growth in labour market and graduates in both types, and subsequently, explains the substitutive relationship between vocational graduates and academic graduates by using Cobb-Douglas production function and economic term 'elasticity of substitution'. This analysis concludes that vocational education should be treated not only as a form of broad education but also as related to the world of work and demand so that vocational education programmes become more effective and efficient.

INTRODUCTION

The very idea that manpower training can be a developmental factor started with the launching of the Soviet Sputnik in the mid 1950s. This technical achievement encouraged the idea that the promotion of science could lead to innovations not only in space but in industry as well, thus accelerating economic growth. (Psacharopoulos 1982:158) After the development in technology, technical and vocational education become the main role in educational stage. Consequently, the World Bank suggests "in the future... a decrease for... higher education is projected. Learning for general education... will decline and support for technical education... will remain..." (World Bank 1974:59). These reports appear to show that the trend of technical and vocational education would become increasingly popular and, in particular, its role in training young adults with practical skills. In terms of its purpose, some studies argue that vocational and technical education has had a very significant

role in the development of nation's economy (Hicks, 1987; Cohn, 1990). By contrast, Psacharopulos points out the initial enthusiasm for technical education was dampened by the evidence that a high correlation between technical education and economic development does not necessarily mean the former caused the latter. (Psacharopoulos, 1982:158).

In fact, the economic growth could cause both the investment in education training and educational involvement for young adult preparing to enter the labour market. In other words, the direction of causation might have been from economic development toward increased enrolments in vocational schools.Even though the expansion of vocational education and training is considered by many educators to be of paramount importance, therefore, the ability of vocational education programmes to foster economy growth remains questionable. Exploring the economic effectiveness of vocational education remains an issue, therefore, and is all the more important since it costs more than general education. There is also a concern that pupils graduating from vocational education may lack transferable skills, unable to use skills in new occupations. In other words, what is 'elasticity of substitution', in employment for pupils with vocational training as compared with a more general academic education?

DEFINITION OF SUBSTITUTION

By substitution is meant briefly: if the price of a certain good X is increased, the demand of goods Y is increased as well, and vice versa. Take the example of the relationship between movies and television; if the price of a movie ticket is increased by one pound, we can predict the increased sales of TV set - this is a substitutive relationship between the two goods.

This concept can be applied to the relationship between the wages of students and the demand of work market. For example, assuming that there are only two types of graduates employed in the labour market ranging from 16 to 19 years old and there is no great change in economic activities (assuming under perfect competition market), if the influence of increase in vocational graduates' wages results a large demand for academic graduates in employment market, we can tell the substitutive existence. This implies the employer would rather choose the academic graduates that vocational graduates if the latter's wages increase. In other words, in terms of vocational and academic education, can the students graduating from technical and practical education be substituted in the work place by those from academic education? If so, what is the specific effectiveness of vocational education, all the more if skills are not transferable. As a criticism made by McMahon shows vocational skills are often the putty - clay type, so that once the technology in a specific field is embodied, the individual is more inflexible and unable to adapt to other fields or new technologies (1992:186).

A somewhat different argument relates to the objectives of students who may wish to use vocational education and training to get access to colleges or universities. A report from Appraisal of First Education Project shows that about 80% of the teachers in Vocational Education and Training (VET) institutions were underqualified; and many students never intended to be technicians when they enrolled in VET programmes but did so hoping (without much success) to continue their study at a university. (World Band, 1973)

Of course, vocational education could provide, not only the practical skills which may foster economy growth, but could also have

'invisible effects'. In assessing the effects of vocational education and training, we cannot ignore possible educational 'invisible effect' for communities and individuals. This consideration should form part of a wide economic assessment of provision. Usually, these hard-to-estimate achievements are ignored when cost - effectiveness analyses are undertaken but their effect should not be ignored. Thus, to some extent, the investment in vocational education may not totally reflect the performance of our students. It could be explained by the 'invisible effects' in vocational education as 'value-added' in terms of economy. For each group, vocational and general training, it is possible to determine both the costs of the training programmes and the monetary values of the earnings of graduates. Clearly, the cost-effectiveness could be more worthwhile if pupils' performance appears to gain easier access to steady employment and high earnings of graduates.

MODEL

As mentioned above, vocational skills sometimes described as putty - clay type, so that once the technology in a specific field is embodied, the individual is more inflexible and unable to adapt to other fields or new technologies. One question is raised here: Could it be that general education graduates are more flexible in adaption to new situations, whereas vocational education graduates learn narrow vocational skills so as to have no alternative value when technology changes? To put it differently, do graduates from main academic courses have a greater potential to learn other skills while they are in work place? Is any influence reflected in the lifetime path of their remuneration compared to their training costs? The implication is whether vocational education can provide appropriate curricula, facilities, training and qualified teachers to meet the requirements of a changing labour - market.

To examine this aspect of actual performance in labour market between academic students and vocational students, the economic terminology of elasticity. of substitution (*delta*) could be applied in this section both in terms of the actual demand in labour market to the ratio of quantity employed of academic students (q_a) to quantity employed to vocational students (q_v) and in terms of the proportion in wage change between academic (w_a) and vocational (w_v). It appears that these substitutive relations have not been addressed by researchers of education. This may be because it is not easy to decide when the substitutive relation happens or it may be because no aggregate information is available to empirically examine the substitutive relationship.

First of all, how do we apply the elasticity of substitution? We begin by assuming that a society employs three types of labourers in terms of the age range of 16 - 19 - graduates from academic schools (A) and vocational (V) as well as under high schools (S). Output (X) is a function of A, V, S. A generalised production function would have the following form (1):

$$X = f(A, V, S) \qquad (1)$$

Equation (1) is completely static, that is, it involves no time dimensions. Also, no account is taken of changing states in technology or other social factors. It points out that the quantities of A, V and S affected output, X, in accordance with the process specified by the functional operator, f. The assumption is also that the production function will not change in this period.

This explicit model is advanced by Cobb and Douglas (1928). They assume that "their function holds for the American economy and develops the formula into a mathematical manipulation to prove the actual percent of contributions of capital (K) and labour (L) to economy growth" (Cohn & Geske 1990:140). In this thesis, the central concept is applied to explain the contribution of academic and vocational students to the labour market. According to their manipulations, the production function, $X = f(A, V, S)$ becomes:

$$X = e^{\phi} \cdot A^{\alpha} \cdot V^{\beta} \cdot S^{\gamma} \qquad (1.1)$$

Where ϕ, α, β and γ are constant, assuming $\alpha + \beta + \gamma = 1$, and e is a constant and value is about 2.71828. After calculation according to Cobb - Douglas (1928), formula it becomes:

$$\text{In } X = \phi + \alpha \text{ InA} + \beta \text{ InV} + \gamma \text{ InS} \qquad (1.2)$$

after calculating and then

$$\frac{\Delta x}{x} = \phi + \alpha \frac{\Delta A}{A} + \beta + \frac{\Delta V}{V} + \gamma \frac{\Delta S}{S} \qquad (1.3)$$

Equation (1.3) implies the growth rate of labour market change ($\Delta X/X$) is contributed by the relative growth rates in each change rates among the academic students ($\Delta A/A$), vocational students ($\Delta V/V$), under high school students ($\Delta S/S$) and un - educated young adult or other factors (ϕ), with each different proportion α, β and γ. Assuming that the growth rate in employment market (labour market) is 5 percent, and $\alpha = 0.31, \beta = 0.64, \gamma = 0.05$ (α, β and γ) are assumed according to the rough enrolment percentage of 16 - 19 workers' background in Taiwan), this implies the academic students' share of contributing to the employed labour market is 31 percent, and vocational students' share is 64 percent. Then, if the rate of change in the quantity of demand in academic students is 4.8 percent, its contribution to the growth rate in employment market roughly amount to $4.8 \times 0.31 = 1.49$ percent. Similarly, the rate of change in the quantity of demand in vocational students is 4.0 percent, its contribution to the growth rate in employment market amount to $4.0 \times 0.64 = 2.56$. Consequently, the rate of change in the quantity of demand in under high school students is 2.4 percent. Its contribution value is approximated by $2.4 \times 0.05 = 0.12$. The total $\alpha \cdot (\Delta A/A) + \beta \cdot (\Delta V/V) + \gamma \cdot (\Delta S/S)$ is approximate 4.17. When this number (4.17) is compared to the actual rate of change in employment market 5 percent, the residual is 0.83 percent. This residual will be explained by the contribution from un - educated young adult or other factors contribution to $(\Delta X/X)$. This production function, however, will facilitate the exploration of the elasticity of substitution. In fact, an alternative formulation has proven to be superior to the Cobb - Douglas production function application. This is the so - called CES production function (Arrow et al., constant elasticity of substitution, 1961). It is used to estimate (2):

$$X = \alpha[\beta A - \rho + (1 - \beta)V - \rho]^{-1/\rho} \qquad (2)$$

where $\infty \geq \rho > -1 > \beta > 0$, and $\alpha > 0$, ρ is a substitutive fraction (because the elasticity of substitution $\delta = 1/1 + \rho$), β is a positive fraction, and α is a fraction implied for the technological variable in this labour force. Consequently, this production function implies the assumption that the variables are randomly distributed. Since this equation (2) is non - linear, Taylor series expansion could be used in this equation to get linear estimation. After manipulation, equation (2) becomes:

$$\text{InX} = \text{In}\alpha + \beta \text{ InA} + (1 - \beta) \text{ InV} - 1/2\rho\beta (1 - \beta)[\text{In}(A/V]^2 + C \qquad (3)$$

In the equation (3), InX, InA and InV are observed data from statistical output, thus

variables, such as β and ρ, could be obtained by estimating after regression coefficients or time series process. The amount of substitutive relation of vocational graduates and academic graduates can be calculated according to the value of ρ (because of δ is equal to $1/1+\rho$).

Alternatively, substitutive elasticity values could be estimated according to its definition. The elasticity of substitution is explained by "the percentage change in the ratio of any two inputs divided by the percentage change in the marginal rate of technical substitution between the two inputs, where the marginal rate of technical substitution between the two inputs measures the reduction in one input per unit increase in the other that is just sufficient to maintain a constant level of output" (Gould and Lazear 1989: p.439). They denote the two inputs by q_1 and q_2 and the marginal rate of substitution by MRTS. The mark, 'Δ', means the change of proportion between two inputs. Then the elasticity of substitution (δ) is (p.440):

$$\frac{\left(\frac{\Delta (q1/q2)}{q1/q2}\right)}{\left(\frac{\Delta \text{MRTS}}{\text{MRTS}}\right)} \qquad (4)$$

By way of reviewing many applied studies of substitution (Tuckman & Katz, 1981 & 1984; Chang & Tuckman, 1986; and Hoffman 198;), this analytical structure and idea could be applied to discuss the substitutive relationship between academic students and vocational students. Alternatively, an advantage of the CES form, $X = \alpha [\beta A - \rho + (1-\beta), V - \rho]^{-1/\rho}$ is that it allows for any value of elasticity of substitution (δ) that is equal to $1/(1+\rho)$.

Formally defined, δ is equal to:

$$\delta = \frac{\left(\frac{d(q_a/q_v)}{q_a/q_v}\right)}{\left(\frac{d(W_a/W_v)}{W_a/W_v}\right)} \qquad (5)$$

Where $\delta = \frac{1}{1+\rho}$, $0 \le \delta \le \infty$, q_a/q_v is the optimal input ratio which is the employed quantity in academic students to the employed quantity in the vocational students, and W_a/W_v is the ratio of the academic students wage to the vocational students wage.

CONCLUSION

These different equations could be used to develop information on the relative elasticity of substitution between the two groups and to plan the employed population of academic and vocational students. Researchers can gain the value, positive or negative, of elasticity of substitution by using one of or both of calculating methods to prove further detailed relativity between both of calculating methods to prove further detailed relativity between both commodities or samples selected. Likewise, it would be also helpful for policy makers to see the relation between the two employed groups. Also, the model used could be treated as a tool to forecast the relationship between the growth of labour market and manpower of 16 - 19 students in future. At a minimum, this approach developed suggests that the policy makers of technical and vocational education should be aware of the technological change and societal tendency free from ignoring the importance of growing labour market and fast change in technology. At the same time, when many attempts, at least by the time being, to advocate the importance of adult learning education, in - service training and effectiveness and efficiency in schooling are made, it appears to be more significant to provide a reasonable approximation of what is likely to happen in

labour market and technological manpower since a wrong policy in decision making without proper evidence is worse than anything. In particular, this analysis concludes that vocational education should be treated not only as a form of broad education but also as related to the world of work and demand so that vocational education programmes become more effective and efficient.

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REMEDIATION — AN ESSENTIAL COMPONENT OF TEACHING LEARNING PROCESS

UMA SIVARAMAN

Placement of remediation in the Teaching learning process:

In the teaching learning process, the main protagonist is the learner. In order to make him a successful learner, the teacher has to perform several complex roles and undertake multifarious activities.

In a formal classroom situation, the teacher has to *present* the lesson through meaningful situations. *Contextualisation* is important because the learner has to be motivated to learn and learner participation is secured through effective teaching methodology or presentation techniques. The learner, in turn, has to *internalize* the concepts. This is done when the teacher is able to give him ample opportunities *for practice*. His learning is *monitored* through evaluation tasks to find out if the teacher's exercise is productive. While monitoring, the teacher can ensure that —

- he/she has organised his/her teaching in an interesting and easy manner to enable the learner to understand the concept or underlying pattern.
- provide problem solving situation and tasks which will motivate, encourage and compel the learner to use his concepts or insight.
- provide examples, explanations, generalisation, mnemonics and rules which help to strengthen his concepts.

After internalising the concepts, the learner should *use* what he learns — This is fulfilling the instructional objective of enabling students to apply or express knowledge. Further if the use of the concept learnt is not *repeated*, the learner may tend to forget. The teacher cannot assume that anything that he/she teaches is learnt hence he/she ought to periodically *renew* learning.

Although, the teacher performs the above exercises methodically, there can be a gap between teaching and learning. This gap may arise because of two reasons.

1. the learner has not learnt what the teacher intended him to learn.
2. the learner learns something which the teacher never intended him to learn.

The first problem could be resolved by repetition of message but the second "mishap" is more problematic because the teacher assumes that the learner has not learnt the concept and keeps on repeating the concept, which only confuses the learner. This calls for the effort on the part of the teacher to be able to cancel what has been learnt wrongly and teach the correct one, otherwise, there will be

problems of "interference". The gap between teaching and learning becomes so wide that, on reaching Std XII, the average learner learns practically nothing or he/she is able to cope with only 35% of what is taught — thanks to our promotion policy he/she has been promoted right through with a mere score of 35%.

WHAT IS REMEDIATION?

The effort to fill in the gap between teaching and learning is one of the functions of remediation. Remediation, a derivative of "remedy", is a cure which calls for an effort to set something right. It is obvious that it concerns itself with correction of wrong and undesired learning, to supplement incomplete and inadequate learning. In short, the teacher should be able to repair all kinds of breakdown and failures in the learning system by finding different remedial solutions to different learning problems. Many of us think that remediation is a process to be carried out outside class hours, spending extra time and energy. It is also thought of, as a follow-up activity or even an optional activity necessary only for the weaker students. Although there may be some validity in it, yet it has to be clearly understood that remediation is an integral part of the class room activity; infact, it is said that every lesson after the first lesson is a remedial lesson.

POSSIBLE CAUSES FOR FAILURE IN LEARNING:

1. Interference from previous learning.
2. Over simplification of the concepts especially where the student doesn't want the extra burdent of learning.
3. Over generalisation on the basis of previous learning.
4. bad memory on the part of the learner leading to improper learning.
5. Poor teaching due to inadequate knowledge and lack of awareness of teaching strategies on the part of the teacher.
6. Unenthusiastic teachers fail to inspire learners and in the bargain demotivate the learners and create a hatred for the subject.

REMEDIAL STRATEGIES:

1. More exposure to knowledge other than what is presented with in the leaves of the text book.
2. More elucidation of rules and concepts with examples to see the operation of various concepts.
3. Streaming of students to enable teachers to attend to homogenous groups of learners.
4. Simplified learning material — to present concepts from simple to complex, know to unknown.
5. Identification of errors and remediation through behaviouristic or cognitive lines, ie, either through intensive practice or rational explanation of concepts. This is also called the a pot — repair method.
6. Pit Corder in his book, "An intermediate English practice book" makes the remark regarding remediation.

"Remember also that exercises are meant for exercise — that is, you are meant to repeat them again and again until you have a mastery of the construction, vocabulary or point of grammar that you are practising. If you are learning a musical instrument or a game like tennis, you have to repeat certain movements over and over again until they are perfect. The same is true when you are learning a language".

6. Extensive reteaching involving sustained, controlled and progressive learning.

7. Bridge course — relevant especially for the remediation in Science, Maths and language.

Some more effective methods:

8. Make the entire course material related to real life situation. This motivates the students to learn.
9. Motivate learners to learn with the teacher acting as facilitator — show HOW TO LEARN rather than WHAT TO LEARN. It is known that this strategy is adopted by the best teachers of the profession.
10. Focus on positive and constructive learning rather than merely attending to unlearning wrong concepts.
11. Facilitate acquisition of knowledge offering problem solving tasks which enables the learner to muster all his/her knowledge and resources to learn.
12. Remediation could be self-directed with no time available for teachers and with unwilling learners remediation can be self-directed.

CONCLUSION:

Practising teachers would agree that his list is by no means exhaustive. For, committed teachers take upon themselves the role of a pedagogical physician setting right bad and wrong learning. In fact teachers have also the need to introspect the lapses on their part — inadequacies in their contribution to the acquisition of knowledge and to equip themselves to fit into their role well. Teachers have also to act as amateur psychiatrists to instill and develop in the learner the necessary and right attitude to learn, for, more than any other strategies for learning and relearning of concepts, the learners, need the determination to learn in the right way and the dead pan seriousness to rectify wrong learning in order to be a successful learner.

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RESEARCH ABSTRACT

A Study of Preparing Job Descriptions of Technicians Employed in High Technology Industry

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Technicians are the middle level personnel in industrial organisations and the method and ideas put forth by the engineers and technologists are put into action by the technicians. On one side these technicians are to work with skilled workers and on the other side they are to work with middle level managers. The job of a technician in an industry, therefore, is more complex than other personnel. This vital work force is being produced by our polytechnic system and in order to understand clearly the problems and issues connected with the improvement of the technician education, there is a felt need to identify and conduct research work on problems and issues connected with this subsystem.

Polytechnics should produce employable technicians who can prove to be useful for the industries. For preparing employable technicians, their job descriptions should be available to curriculum framers and administrators working in the technical education system, so that appropriate inputs can be provided through polytechnic education. High technology area happens to be the national priority, and therefore the job descriptions of the technicians working in these industries need to be explored immediately.

Hence the title "A study of preparing job descriptions of technicians employed in high technology area" has emerged on the basis of the felt need and this study was identified as one of the research projects under World Bank Technicians Resource Development Project.

OBJECTIVES:

The objective of the study was to prepare job descriptions of technicians employed in high technology area. To achieve this major objective, the following functional objectives were taken into consideration.

1. Develop a working definition of job description relevant to industry — institute context.
2. Identify the strategies to collect job description data from high technology industries.
3. Design the format for data collection.
4. Collect job description data for technicians, from various high technology industries.
5. Analyse and interpret the data to prepare job description lists for the technicians employed in high technology area.

METHODOLOGY:

Samples:

The purposive sampling technique was used for the present study. The classification of normal and high technology industry is based on technology used. In addition, types of technicians on the basis of their basic discipline and present type of work were considered as another parameter.

Fifteen representative high technology industries/organisations situated in Madras and

Bangalore were covered under this study. The sample also includes Central Electronic Centre of IIT Madras. Twenty five managers responsible for managing and controlling 590 technicians were taken into consideration for data collection.

Tools:

To collect job description data from managers, one structured Interview Schedule was prepared on the basis of accepted definition of Job Description. The interview schedule is divided into three major areas viz. Information Profile of Industry/Organisation, Profile of Manager Interviewed and Job Profile of Technicians. The third part, i.e. Job Profile of Technicians, contains items like Designation of the technician, Engineering area of work, Approximate salary per month, Essential qualification and experience, Training requirements, General duties and responsibilities, Specific performing abilities and skill required and Area where further training is required.

Procedure:

Structured interview was conducted with each identified manager. Before the actual interview was started, the purpose and the parameters of the project were explained in detail to each manager. The responses of the managers were noted with respect to each item. The interview data was analysed to prepare job descriptions of technicians working in high technology area. Apart from job descriptions of technicians a list of common performing abilities and skills required by technicians in more of the industries was also prepared.

RESULTS:

On the basis of analysis of data 15 lists of job descriptions of working technicians in high technology industry were prepared. These lists are industry specific. Following is the list of specialisation of the Industry/Organisation from where the present job descriptions were collected.

1. Power Electronics.
2. Communication Engineering.
3. Electronic Communication Equipment.
4. Servicing Electronic Communication Equipment.
5. Computer Hardware Design and Software Operation.
6. Electronics Bio-Medical Equipment.

   Electromechanical Equipment required for Automobiles.
8. Automobile parts.
9. High Technology Part of Cement Manufacturing Industry.
10. Static and Rotating Electrical machines.
11. Training in Electronics.
12. Tool, Die Manufacturing and Training.
13. R & D in Aeronautics.
14. Automobile Servicing.

It was observed that the common notion of working of a technician in general industrial organisation as supervisor is not always tenable in high technology industries. Most of the technicians working in high technology industries have been working as specialised technicians in a team and their role as supervisor is rather limited. Further there is a wide variation of performing abilities required by technicians from one industry to another industry. Even in the same industry, in some sections there is a variation of job between two technicians. Therefore, in this study, job descriptions highlight general duties and responsibilities of technicians working in a particular industry specialised in manufacturing

a particular product or a set of products or rendering a specific service.

Apart from preparing job description lists, several attitudes and abilities were identified from the analysis of the interview data which were reported to be important for technicians.

A few of the important attitudes and abilities are as follows:

- Aptitude to learn with the team
- Communication Skills
- Ability to work under stress
- Assertiveness
- Problem solving skills
- Planning skills
- Aptitude for developmental work
- Leadership traits
- Positive attitude towards work culture
- Day to day management skills
- Concern for quality of work
- Knowledge of ISO quality standards.

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