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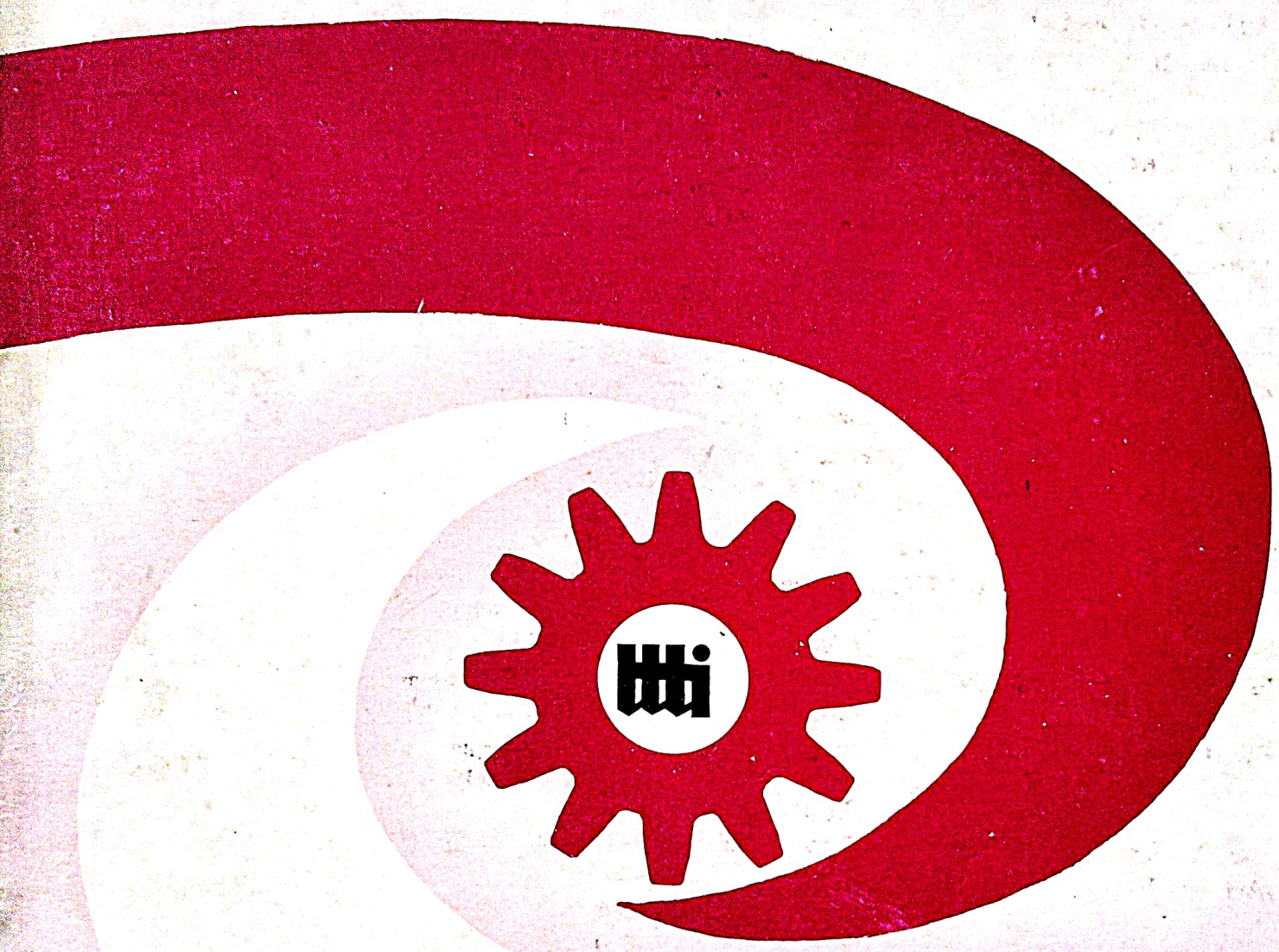

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CONTENTS

Editorial

This ninth issue of the journal of Technical and Vocational Education Contains three general articles relevant to technical and vocational education contributed from UNESCO, Canada and Australia; five research reports from Northern and Eastern regions of India, Nigeria and China; and three research abstracts from southern India.

Dyankov's description of a new international project called UNEVOC launched in August 1992 provides very practical guidelines for developing and improving technical and vocational education all over the world. The three main programme areas of the project focus on Research and development, dissemination of findings and international access to data bases and documents. Activities envisaged and listed for 1992-93 will benefit all those concerned with this educational subsystem in increasing facilities for the growing population. Arblaster's proposal to introduce distance education for implementing technical/vocational studies based on his experience in Canada Community Colleges. His discussion on the scope and forms of the initiative, costs and leadership and motivation is more suggestive than merely descriptive so that developing countries can take advantage of these considerations. This is an edited version of his address in an international seminar on distance education under the auspices of the Commonwealth of Learning conducted in India in July 1992. Shannon's paper on Scientific and computer Literacy is carried in this issue for want of space in the previous one. Yet it is not too out-dated in emphasising the need for computer literacy in developing/revising curricula for technical/Vocational education. Scientific, rather mathematical, base for computer technology should be made common to all in the new curriculum.

The two Indian reports on research deal with polytechnic education in Indian Perspective. Gopalan and his team from The T.T.T.I., Chandigarh, tend to describe planning process being followed in one of the North Indian States adopting case study method in educational management projects. Subrahmanyam and his colleague from T.T.T.I., Calcutta, report on their survey of teacher perceptions on polytechnic - T.T.T.I. interactions. This is a sort of introspection on T.T.T.I's and communication with their clientele system trying to achieve the objectives of their establishment in the second half of 1960's. It is in the fitness of things to publish this paper as a sequel to the silver jubilee celebrations of the four T.T.T.I.'s in India. The two Nigerian Studies are trend analyses of the present practice of Building Education and the development of Apprenticeship system in that country. Ogbodo's call for integration of building education with field experience providing for flow of education from scholars to labourers as well as workers to learners is worthy of consideration by the implementors of technical/Vocational curricula. Njaku's historical approach in analysing the apprenticeship scheme in operation almost all over the world sounds the danger of overlapping of mechanisms introduced to improve the effectiveness of the scheme. The Taiwan questionnaire-survey study reported by chien-Jung Tien along with his project supervisor Wolansky proposes a three-axis cluster curriculum model to make industrial/Vocational education practical in the sense knowledge and skill components of learning are not to be distanced from each other if this educational subsystem is to deliver goods in the country's practical development.

The three research abstracts focus on job potentials of the products of technician education

in India. While Mukhopadhyay studied motivation and emotional maturity of entrepreneurs attending an awareness camp, Pillai and Srinivasan collected data from the live registers of employment exchanges in the South Indian City of Madras and inferred on the inadequacy of employability infused in the polytechnic products. Thanikachalam made his study as part of his programme with the colombo Plan Staff College on Technician Education established in the Philippines to point out the lacunae in civil engineering courses offered in the polytechnics of Tamil Nadu in the context of the job potentials in private sector and self-employment.

The silver jubilee celebrations of T.T.T.I Madras included a three-day workshop on emerging technologies such as bio-technology, info-technology, eco-technology, micro-electronics manufacturing systems technology and materials technology in considerations of the development and revision of technician curricula. This was conducted at T.T.T.I Madras in 22 to 24 April 1992 with industries and institutions equally sharing their participation in the proceedings. In January 1993 there will be a two-day seminar on Restructuring Industry and Economy and Consequent changes in the world of work and Employment Patterns with similar equal participation from industries and institutions. The outcomes of these activities are expected to provide a boost to technician education moving towards higher productivity, greater relevance and faster development.

The journal of Technical and Vocational Education wishes all its contributors and readers and call those concerned with this crucial sector of educational development throughout the world a purpose fully development, oriented prosperous New Year of 1993.

The UNESCO International Project for the Development and Improvement of Technical and Vocational Education - UNEVOC PROJECT-

ALEXANDER DYANKOV

ABSTRACT

This paper describes in brief, the new International Project on Technical and Vocational Education-UNEVOC PROJECT, launched by UNESCO in August 1992. Based on the findings and recommendations presented in a Feasibility Study carried out in 1990/91 and on a Resolution of the General Conference of UNESCO adopted at its 26th Session, UNEVOC project has been established, aiming at developing and improving technical and vocational education at a global level.

The article outlines UNEVOC's Key features, principles of action and modes of operation - through a network of associated national institutions. The workplan of the project for 1992/1993 is presented, outlining the forthcoming activities in three main programme areas; namely:

A. International exchange of ideas and experience and studies on policy issues;

B. Strengthening of national research and development capacities; and

C. Facilitating access to data bases and documentation.

The importance of technical and vocational education is enhanced by increasing social demand and the ever-growing technological component of human activities. In the past few decades productive activities have evolved significantly, mainly because of automation of operations, robotization, computerised control, development of new material, more efficient use of energy and innovative organisation patterns of production. This evolution entails a general shift from manual skills towards technical knowledge, and the advent of new fields of competence at all levels. Social demand calls for emphasis on job creation and training for self-employment. At the same time, significant changes in the occupational profile take place continuously coupled to expansion of technology-based activities.

Technical and vocational education has to evolve and expand accordingly and this poses problems of various kinds. Solving them is more difficult in developing countries than in the industrialized world: awareness of technical advances and their impact on technical and vocational education in developing countries expanded at a faster pace, and the human and material resources are often insufficient or not up to standard.

UNESCO has been active in the field of technical and vocational education for more than 30 years. Its programme has evolved according to changes in science and technology, socio-economic realities, and human resources development policies in the

Member States. This evolution has been made possible by the continuous flow of information and data from the countries, implementation of field project, studies etc.

From 1 August 1992 UNESCO undertook a new endeavour by launching the International Project on Technical and Vocational Education (UNEVOC), inviting UNESCO's Member States; Specialized Agencies of the United Nations' System concerned with education and training, as well as Donor Agencies to play an active part in the promotion and implementation of this new venture. This project was created in accordance with a Resolution of the 26th Session of the General Conference, in 1991.

The original idea of creating this international project may be traced back to 1987 when UNESCO held its first International Congress for the Development and Improvement of Technical and Vocational Education. At this congress it was suggested that:

"...an international plan of action be drawn up for the development of technical and vocational education and for promoting international co-operation in this field", and further also that: "...UNESCO should support the establishment of an international centre for research and development in technical and vocational education. Such a centre could, among things, collect and categorise relevant information concerning technical and vocational education in the various Member States, establish a data base of knowledge items and reference in the various disciplines and fields and create an international computer network to promote effective use of this information..."

Based on the suggestions put forward at the 1987 Congress, and following a recommendation by the Executive Board at its 131st session in 1989, the General Conference at its 25th session in 1989, adopted a resolution inviting the Director General:

"...to carry out...a feasibility study on the establishment of an international Centre for Technical and Vocational Education".

On the basis of the feasibility study, undertaken by UNESCO, the 26th session of the General Conference adopted the Resolution No.18 for the establishment of UNEVOC project, pursuing the following aims and objectives:

UNEVOC is an international project aimed at developing and improving technical and vocational education. It will focus on exchange of information, networking and other methods of co-operation between high level technical and vocational educationists in the Member States at the national, regional and international level. Its programme actions and activities are aimed at:

- fostering international exchange of ideas, experiences and studies on policy;
- strengthening national research and development capabilities;
- facilitating access to data bases and documentation;
- promoting innovations in staff development; and
- supporting international co-operative actions.

One of the main objectives of this new project is to provide a forum where countries can discuss similar questions and problems they are facing and learn from each other by means of a direct exchange of ideas and experiences. To this end an international network of Technical and Vocational Education will be established which will utilise and diffuse existing expertise, experiences and knowledge. Closer links between UNESCO and the UN Specialized Agencies, Inter-government Organisations, Non-governmental Organisations, funding

agencies, foundations and industry will be established and assistance will be sought for both material and financial support.

The following main *key features* will characterize this project:

UNEVOC will focus on technical and vocational education at the pre-university level, i.e., secondary technical and vocational education and technician education at the post-secondary level. It is recognized that international co-operation is needed most in view of continuing developments in science, technology and production techniques, which results in changing employment profiles and the present gap in the area of training between developed and developing countries. The exchange of information and access to data bases and documentation will play role in improving national capabilities in research, policy formulation and decision making.

Based on the participating Member States' national development goals in the context of their socio-economic realities and human development policies, corresponding to changes in science and technology, UNEVOC project is a co-operative endeavour of the Member States, sharing a common need to further develop and improve their technical and vocational education and training.

THE TWO MAIN CHARACTERISTICS of UNEVOC project are:

1. The countries' participation in UNEVOC project activities is aiming at international co-operation in solving common problems in social and economic development.
2. The Member States jointly design, execute, sponsor and evaluate the UNEVOC workplan, and the relationship among them is based on reciprocity, mutual learning and self-reliance;

UNEVOC project has been designed to enhance national capabilities for undertaking necessary changes in the education system in order to realize national development goals. Furthermore, UNEVOC project would remain in constant evolution in order to ensure responsiveness to the emerging new technological development in the participating countries, and towards this end, evaluation will be built into its methods of work and activities.

The UNEVOC project has been designed with the following *Lines of emphasis* in mind:

1. The sharing and exchange of experiences through co-operative endeavour among the Members States is based on their respective expertise and resources available;
2. The planning and organization of activities and programmes co-operatively by the Member States, appreciating that they are in the best position to know about their needs and problems and to decide on the solutions;
3. The planning and implementation of educational programmes in accordance with the areas of concern as reflected in the national development plans of the Member States, bearing in mind that the Member States are themselves at different stages of development;
4. The flexibility for the Member States to be selective in their participation in UNEVOC project activities, bearing in mind the important of (i) relevance to the Member States; (ii) follow-up action; and (iii) multiplier effect;
5. The continuous evaluation of each activity and project through regular feedback from the participating Member States and provision of professional support services during the implementation stage;

6. Continuous expansion of the knowledge base for design, implementation and evaluation of project activities through support for experimental and developmental research;

7. The promotion of bilateral, regional sub-regional co-operation and collaboration among the Member States which have similar problems and needs;

8. The use of resource personnel needed for specific activities drawn as far as possible from the participating Member States.

It is envisaged that the UNEVOC project is to be governed by an *Advisory Board*, and the implementation of the project activities - co-ordinated by *project Implementation Units*, through a *network of Associated Centers (Institutions)*.

The *Advisory Board* of UNEVOC project will function as an international task force with the special function of facilitating inter-country co-operative action, serving as a catalytic agent for stimulating innovations in the countries, identifying gaps and growth points in national efforts, giving the project work and promoting the exchange of educational expertise and experiences.

At the so-called "grass roots level", the activities of UNEVOC project will be carried out by a network of *Associated Institutions (Centers)*, identified and offered for association with the network by the respective national authorities in each country, through their National Commissions for UNESCO, which are the proper channel of communication with the project Secretariat located at UNESCO Headquarters, in Paris.

The Associated Centers shall be such institution of a Member State or an inter-governmental body of Member States which are associated with UNEVOC project at the instance of the concerned governments. They join the project to contribute and benefit from the exchanges of insight, skills and expertise promoted under the project. Increasingly, the Associated Centers will assume the role of co-ordinating other national projects in the area which is the responsibility of the Associated Centers (Institutions).

At present, the main functions of these National Associated Institutions are foreseen to include:

1. Sharing of innovative experiences with other centers in the network;

2. Organizing national or regional project activities such as training workshops, seminars, development of instructional materials,and review of experiences;

3. Participating in the design, conduct, hosting, evaluation and follow-up of some inter-country/inter-project visits and studies;

4. Participating in the exchange of personnel with other UNEVOC associated centers;

5. Facilitating the dissemination and exchange of information on educational and technological innovations; and

6. Co-operating with other centers in project activities of mutual and common interest.

The financial resources for funding UNEVOC project activities and running cost will be mainly provided by the regular programme of UNESCO, voted by each session of the UNESCO General Conference, enhanced by some Contributions from the participating Member States. For example, the Government of the Federal Republic of Germany has contributed an amount of 724,000 US. Dollars (matching the equal amount envisaged in the UNESCO Regular Budget for project activities during 1992 and

1993); the Italian Government has also contributed an additional amount of 300,000 US Dollars to sponsor UNEVOC project activities during 1992; and further contributions are on their way.

During the period 1992-1995, the UNEVOC project will concentrate on exchange of information and experience among Member States - promoted in order to make technical and vocational education more relevant to these national education systems, taking into account various factors both inside and outside the education system. Its programme Actions and activities will be carried out in the following programme areas:

A. fostering international exchange of ideas, experiences and studies on policy issues;

B. strengthening national research and development capabilities;

C. facilitating access to data base and documentation.

Under the above-mentioned programme Areas, the activities undertaken within the UNEVOC project will include in particular:

Programme Area A: International exchange of ideas and experience and studies on policy issues.

Activities envisaged in 1992-1993 in programme Area A:

During the 1992-1993 period, a consultation meeting will be held, aiming to identify the factors which determine the role of technical and vocational education. Based on the results of this consultation meeting, a number of case studies will be undertaken on the role that these factors play, in particular, national set-ups. A synthesis will be prepared and addressed to policy makers in regional or international symposia in the next biennium.

Comparative studies will be also undertaken on different approaches in Member States to their policies and legislation in different sectors of the economy. A synthesis of these studies will be prepared.

A symposium on future trends in continuing technical and vocational education and retraining corresponding to the emerging needs of the 21st century will be held.

Programme Area B: Strengthening of national research and development capabilities. The activities in this programme area will be aimed at promoting co-operation between education and enterprises. This will be achieved through application of selected *methods of curriculum development,* which will be implemented in selected *pilot projects* undertaken by some technical and vocational education institutions.

Activities envisaged in 1992-93 in programme Area B:

Different existing methods of curriculum development will be analysed in an expert meeting. Selected methods will be applied in industrial, commercial, agricultural and other fields to develop prototype curricula: Some developing countries as well as industrialized countries will be considered. These prototype curricula will be made available for application and evaluation during the next biennium.

At the training level, different mechanisms for co-operation between institutions of technical and vocational education and the world of work will be promoted through pilot projects undertaken jointly by educational institutions and enterprises.

*Programme Area C:*Facilitating access to data bases and documentation.

For the 1992-1995 period, efforts will focus on interchange of information and documentation closely related to the above described programme Areas A and B. Infrastructure needed to facilitate communication

between existing national and regional institutions in technical and vocational education will be developed.

Activities envisaged in 1992-1993 in Programme Area C:

A bulletin will be devoted to issues related to the programme areas and activities carried out within the UNEVOC project. It will include information on relevant events and abstracts of publications and give examples of shareable experience of the Member States. The bulletin will be supplemented with computerized data, stored on floppy disks and where applicable,using UNESCO's CDS/ISIS documentation software.

Within the general purpose of the UNEVOC project, a pilot venture using modern communication techniques will interlink selected national, regional and international institutions to facilitate mutual exchange of information and utilization of existing data. After the pilot phase in 1992-1993, it will make the network available to all interested specialized institutions.

An inventory of national and regional institutions working in the field of planning, research and development of technical and vocational education, will be prepared and disseminated.

WHO WILL BENEFIT FROM UNEVOC PROJECT?

The principal beneficiaries of the work undertaken by UNEVOC will be the technical and vocational planners, policy makers, educators and students throughout the world. Access to information as well as exchange of experiences will assist in reducing the gap between the North and South and in providing technical and vocational education to meet the growing needs of human resources which result from everchanging development in science and technology.

By 1995, the world's population will have increased to 5,700 million and is expected to rise to 6,100 million by the year 2000. In addition to this population increase, science, technology, production techniques, job patterns and the demands of the work market are also undergoing radical changes. Consequently,the size of the active population will also increase. It is therefore essential that adequate education and training be provided in order to meet their needs for food, housing, education, health and leisure. These two factors should therefore take into account the future needs of trainers and trainees, economies and societies and through this type of co-operation socio-economic prosperity and harmony can be achieved.

As a first step,we should ascertain our existing knowledge and with this know-how, develop the capacity of the Member States towards a better development and improvement of Technical and Vocational Education.

Practical Considerations for Implementing Technical/Vocational Studies Through Distance Education

JOHN R. ARBLASTER.

ABSTRACT

This article presents the Canadian distance education studies in general development and proceeds to identify the variables in Indian distance education movement. Out lining the key considerations for distance education initiative under four headings of Scope, Form, Costs and Leadership and Mobilization a detailed analysis of the subsets of each of these consideration in presented from an implementational point of view.

It also indicates a current project of cooperation between India and Canada through CIDA for improving technician education in three Southern States of Karnataka, Kerala and Tamil Nadu.

1.0 Canadian service in distance education for technical/vocational studies has two distinct phases. Up to 1986, the efforts of college were for its own local area, which is characterized by much geographical space and few people. The board of governors of the college decided early in the college's history that distance from a main campus should not prevent citizens of the college's service region from accessing the college's programs, and so our early efforts were in re-designing courses of study, and establishing a capacity for accessing college learning to small and remote communities. In 1986, the government of the province of Ontario provided funding to establish the Northern Ontario Distance Education Access Network, and my college co-operated jointly with her university and another college to establish and administer that learning network which established over 100 community access sites before 1990 across a thousand-mile span of Ontario. This became known as the contact north network.

2.0 Is distance education/open learning a field in which clear directional insights are obvious? Has appropriate practice been thoroughly tested and proven? That is not the case, even though there is a large and growing body of useful literature on both distance education and open learning strategies and results. Also, as demands for access of education, and information, increase locally, nationally and internationally, and resources are scarce, this alternate delivery movement in education has gained strength as a partial solution, and shows every sign of becoming a mainstream commitment of educational ministries around the world.

The establishment and growth of the commonwealth of learning internationally is a good example of an organisation that would not have been possible twenty years ago, but now serves a needed catalytic function to bring together

practitioners in this field, and thus assist new development towards mainstream acceptance of distance education.

3.0 Continuing briefly on this theme of general development of distance education, I find inevitably that two major variables greatly affect action decisions for operationalizing any initiative in the field. First, the characteristics of the physical, social and economic environment within which the endeavour will take place, upon analysis, do and should steer decisions on appropriate methodology and tactics. I say this of course to underline the point that to date, except for experience in several countries with international projects, my working environment in distance education has been Canada, and the Indian environment for distance learning differs greatly from the Canadian. The second significant variable is that the potential and capacity of new uses of technology for learning, or curriculum development, is still evolving. And so what might have been appropriate or possible for me to implement in the late 1980's may be superceded by advanced technology or curriculum tactics in the 1990's.

For Example, I noted recently that the indigenous Insat-2A Satellite, put into orbit last month, has already been used successfully to organise a training programme for block and village extension workers and farmers in Haryana, using one-way video and two-way audio communication to enhance the learning experience. By any standard, that is advanced technology in education.

4.0 Given these two overlying variables, the only useful image I find appropriate to accurately describe the experience of executing an open learning or distance education initiative is that it is like trying to change the tyre on an automobile while it is moving down the road.

But these initial cautions do not, and should not, deter advancement of this movement. The fundamental driving force which impels educators, administrators and politicians is the need to enhance access, and provide equity of opportunity of education, for those who would otherwise be excluded, and usually within an environment of scarce resources. This, I believe, is as true in India as it is in Canada.

My review of literature on distance education developments to date in India leads me to believe that the requisite knowledge, skills, past practice and resources are available here to consider and implement an initiative for technical\vocational education through distance education.

5.0 I believe that the key considerations (and their subsets) that must be addressed in the planning of any distance education initiative for technical\vocational studies, are presented below:

1. Scope of the initiative

1.1 Geographic

1.2 Target learners or clients

1.3 Fields of study

2. Form of the initiative

2.1 Local, state or national institution

2.2 Network type

2.3 Delivery format

2.4 Materials production and development

3. costs
4. Leadership and mobilization

While these are arbitrary categories for analytical thinking on the task, working through them is useful. As you proceed, you will find the need to revisit conclusion reached on previous topics on this list in order to adjust to new conclusion, and/or that previous decisions will steer the later conclusion.

5.1. Scope of interest of the initiative

5.1.1 Geography

A useful point of departure is the block entitled *Scope of Interest*, and within that, geography. This presumes there will be, or should be, a geographical catchment area within which the initiative will be executed, or from which students will be drawn. At the close of the 20th century it is possible to define this geographical catchment area as local to the delivering institution, as part or all of an Indian state, a region or group of states, national or international. In Canada, for example, where education is a provincial responsibility, distance education initiatives tend to have a catchment area up to the provincial level, but not broader than that. For example, contact north served northern Ontario; the open learning agency serves the province of British Colombia. There is however a Canadian Association of Distance Education, which primarily exists to enable communication amongst practitioners, and in 1990 I chaired a national consultation on distance education in technical/vocational education, which was organized by the association of Canadian community colleges, which has a national mandate.

Also it is worth mentioning here that we have delivered education on an ad hoc basis from the local setting both nationally and internationally. So while for planning and execution of a distance education initiative it is necessary for management purposes to draw initial geographical boundaries, experimentation and future collaborations can expand those initial decision. There is of course a direct relationship between geographical scope, resources, and network type of which I will speak later.

5.1.2. Target Learners or clients

A pitfall in our Canadian experience that has not always been avoided in distance education development is that one can become so focussed on, or enamored with the technology, or intricacies of managing the network, that we let those considerations alone drive the question of preferred clients or learners. Is the initiative open to all (suggesting an initiative which will be measured only in quantity of learners), or is it for subsets of people, for example those who otherwise would not have access to education?

Here is a sample, by no means comprehensive, of some of the learner or client market for distance eduction services in Canada:

- Employed adults requiring skill upgrading
- Unemployed adults seeking employable skills
- Native Canadians living on reserves
- Citizens of small towns lacking a post-secondary institution
- People who prefer the distance learning approaches to traditional classroom methodology. Usually this last group is also prevented by either distance or time from attendance at other opportunities.
- Business and industry contracting the distance education delivery institution for customized training.

Because of resource or capacity limitiations, there are, or soon will be, learner capacity limits to any distance education initiative, and so prior analysis, (perhaps leading to admission requirements or priorities) is useful. Also useful, when the geographical scope has been determined, is to know within that area if there is any one population of targeted learner that is greater than another, and, if one was going to provide greater access for learners, what are the learning groups with greatest need and benefit. Further, these questions of learner body, and their characteristics, lead to first considerations of fields of study.

5.1.3. Fields of study

It is a contentious point as to whether in the fields of technical/vocational studies all subjects fields are as yet appropriate to adaptation for distance education delivery. Certainly most of the theory components are, because they can be conveyed through traditional print or computer-based text, with or without audio or visual aids. However, most technical fields, especially at the non-degree level, require either capability for experimentation, or, applied skill development. While future technological advance in computer software will enable the learner to simulate applied learning competencies, we are not there yet, and so the planners of distance education, in choosing fields of technical/vocational study to offer learners must consider the exit competencies required by the learner in this field, and the capacity of the network infrastructure to enable achievement of those competencies.

In Canada, practitioners have addressed this challenge in the following ways. In urban settings, where educational facilities exist, we have often combined the distance study of theory with access to school lab and shop facilities for the applied components. For business subjects, as most people can access computer facilities in their communities or a distance education access site established for the purpose, we have accessed courses requiring applied computer use, and supplied the necessary software. In some cases, we have accessed groups of people in remote communities to large communities for their practicums. So these are useful strategies that can be undertaken to address this theory-practical application challenge, and I will come back to this in two later sections of the paper. However, if none of these strategies for learning applied components of technical\vocational subjects are feasible in the learning environment to be established, then the suitability of the field is in doubt for inclusion. I should also mention at this point that we have found in Canada that in technical\vocational distance education studies for the adult population, it is necessary to make available pre-technology and pre-vocational knowledge and skill subjects to ensure that the learner has the requisite level of basic mathematics, science, language and study skills. This is especially true for adults who are returning to a learning environment after several years' absence, and who may not have completed a high level of basic education before they left school.

Finally, on the subject of choice of fields of study, I should note that the Canadian Community Colleges and Institutes, who focus on labour force development and job-ready graduates, see themselves as contributors to the economic and work force development of the Canadian private and public sector. This overriding mission carries through into distance education programming, and so in choosing fields of study, care is taken to ensure that the programs offered not only have a potential student body, but also are needed by employers, and will result in employment for the graduates.

5.2. Form of the initiative

This first section of the paper has considered scope of interest of the distance education initiative, specifically the questions concerning geographic boundaries for action, the target student body, and fields of available and appropriate study. Let me turn now to the form of the initiative, and choices and considerations which exist to identify an enabling institution or agency, the type of net work, delivery and curriculum formats. As you can easily imagine, decisions already made on,for example, geographical scope, can drive the answers to the question of form. The reverse is also true. Form can drive scope. The key point is that the answers reached from these two sets of thinking must be functionally compatible with one another.

5.2.1. Enabling local, state, regional, or national institution

The college in Canada where I spent 22 years entered distance education in 1978 when the Board of Governors approved funds for a special outreach project to extend access to college education to the more remote communities of its catchment area. It offered its first subjects in this mode in 1979.

In India, the first open university in the country was established by the Government of Andhra Pradesh in 1982, and encouraging response to this university resulted in the establishment of the Indira Ghandi National Open University in 1985.

My point here is that a local or a national concept are two very different forms of response to the same need, access to education, but their common link is the identification and establishment of an enabling institution or agency. In between these polarities are other forms of enabling institutional involvement (e.g. The Indian open universities).

Important also is to understand the gains and losses between an institution or agency that is fully devoted to distance education, versus one that has a distance education cell or department. In Canada we have models of both, and our experience is that both can work successfully. In the case of an institution that is fully devoted to distance education, it can focus its full strategic and operational effort to that form of learning, as opposed to an institution containing a distance education department that has to compete annually for resources with department delivering education by traditional delivery methods. However, the advantage of being associated with a traditional delivery institution, especially for technical/vocational education is reduced cost, and access to currently existing facilities, (especially shops and labs), and staff. The cost of duplicating these facilities and human resources can be prohibitive.

My preferred model is an enabling institution or agency that has distance education as part of its stated mission are guaranteed program, but accesses to the distance education cell the staff and facilities that are involved with traditional delivery of technical\vocational education.

A second important consideration regarding enabling institutions and agencies, especially if the geographic or student scope of interest is widely dispersed is to consider collaboration with other institutions. And I don't limit that collaborative possibility to institutions that are similar in mission. In Canada for example, the province of British Colombia is served by an open university. Contact North, with which I am more familiar, was a collaboration in distance education amongst colleges and universities, and now has been extended amongst colleges and universities, and now has been extended to serving the distance education needs of secondary schools. I am a proponent of collaboration of institutions for distance education purpose because of the economics of scale, and efficiencies that can be realized

in settings where resources are limited. Because distance education initiatives that are more substantial than those that can be mounted from a single institution always imply a networking concept, which I will discuss next, the distance education network or infrastructure can be viewed as a service facility through which user institutions access their academic subjects to the learner, and conversely, this network configuration defines how the learner can relate to the academic institution. Collaboration then is a form of establishing a network or infrastructure for delivery,and/or, a way that many academic institutions, regardless of their mission, can cooperate. Collaboration is not easy. Our Canadian experience is that it takes time and strong leadership initially, usually from Government, to establish the level of goodwill and resource-sharing that is necessary to achieve a synergistic result.

5.2.2 Network Type

Let us turn now to some initial considerations of network type. Most times, I have found that designers of distance education networks focus initially far too much on the hub or controlling centre of a learning network, and challenges of extending access from the hub, rather than analysis the learning challenge from the learner's point of view, and the subject areas that will be delivered, and letting those considerations determine to a great extent the form of network that is appropriate.

Also, as there are often choices concerning appropriate technology for the network, (such as satellite television, or two-way audio, or use of computers) and each of these distance education technologies have their advocates, because of this technological considerations can often drive network configuration decisions and obscure that real issue, which is how best to assist learners to learn. My experience in this regard is that the potential applications of technology in the learning process and far ahead of the distance education institution's comfort in applying them, the teaching faculty's wishes, and the learner's needs. Therefore technology decisions should be taken with great care, because often unless the right conditions prevail, they can mean great expense with little value added to the quality or quantity of the distance eduction experience for the learner.

But these two cautions are background considerations only to decisions of network type. The best Canadian networks that I know have focussed first on the size of the projected student body, their location, and fields of study, and then designed ways of informing them of the availability of the learning service, and linking them to the enabling institutions or agencies for information, registration and course delivery purposes.

As previously stated the planning, management and maintenance of the network can be a separately managed function from the academic concerns of materials production and course delivery.

5.2.3. Delivery Format

While these considerations of network type result in the infrastructure of a network for distance learning, we have found in my experience in Canada that the most important variable to affect the quality of the learning experience for the individual learner (and they do enroll and succeed or fail one at a time) is the amount of assistance and support for the learning experience provided by the network and enabling institutions. Here is the brief list of questions to be considered that will assist decisions on delivery format, especially for initiatives in technical/vocational education:

Are there adequate facilities (including required technology) and personnel, both in

the field and in the central office, for carrying out the instruction, for the processing and maintaining of student records, and for the tracking of student progress and numbers?

Is there provision for counselling and academic advising to alleviate the potential feeling of isolation and to ensure matching of curriculum to learner needs, ensure reasonable entry level skills, etc.

Where required, is there a mechanism to ensure access to library and other reference materials? or laboratory and other special equipment?

What means are available for providing students with appropriate and timely feedback on assignment and examinations during the delivery of programs? Is adequate provision made for the writing of examination on site?

Is there a means to provide ongoing, two-way, communication between students and the central office, and between field-based support personnel and central office to ensure quality supervision?

5.2.4. Materials Production and Development

For any distance education initiative, especially for those in technical/vocational education where the practical or applied skills to be mastered usually are as or more important than the theoretical base, we have found in Canada that it is wise to depend on the subject matter expert for subject matter expertise only, and to place the responsibility for the format of instruction, instructional materials design, media production and formative evaluation functions with the individual experts in learner-centered education. This is not a criticism of knowledgeable faculty members, but rather a recognition that distance education by its nature alters the role of the teacher from the traditional sole knowledge owner and dispenser, to that of advisor, coach, motivator and evaluator. Our most common format in Canada for distance education materials development is to have the content expert as part of a learning materials team that is managed, equipped and funded as part of the general institutional functions of the network. Learner-centered education, particularly for applied skills development, forces into the materials development process the need to think through not only the sequence of learning from the learners point of view, but also to train the teacher to do likewise, especially if the content expert is involved in the delivery function as well as that of materials design.

Despite all technological advance that creates the virtual classroom at a distance, learning is still an act of an individual devoting time and will, so the learners's course guide, which will have within it a map for the learner to sequentially accomplish competencies, and these course guides require in their preparation skills not always found with the traditional teacher. We have found however that the best way to train teachers for the role of teaching under a learner-centered distance education format is to have them as content experts in the disciplined design and development of an instructional materials package. Further we have found that this has also the result of improving the quality of that individual's teaching in the traditional setting.

5.3. Costs

It is my opinion that distance education initiatives should not be underfunded. While this may seem to be an obvious statement, it is particularly applicable to distance education, and within that technical/vocational education, because it is so easy to overlook a category of cost, and find for example that while one was able to design and establish the network, prepare the courses, and purchase equipment,

one overlooked maintenance and repair costs, or underestimated the demand for the courses and found two years down the line there was no money left for delivery. The previous sections of the paper have outlined the considerations that can lead to costing of the initiative, but these are the categories of costs that in my experience must be included in distance education project budgets. It is particularly important to develop a financial plan which identifies one-time vs recurring cost, to identify costs associated with potential expansion of the project, and to be realistic about equipment replacement costs as well as to identify the sources of funds for these costs. Where non-traditional sources of funds are contemplated, such as private sector support, the resource acquisition plan should identify how all funds will be accessed. The cost categories are as follows:

1. Project start-up costs, such as

- Orientation and training visits by key personnel, feasibility studies, information, coordination and promotion workshops
- Needs assessment
- Familiarization and definition of technologies, training programs, instructional materials already available, and institutional set-up functioning elsewhere
- Set up of office facilities, telephone service, etc.

2. Program production costs

These vary significantly depending on the delivery methods used. In developing program production costs, relevant costs incurred in other project categories, such as training, must be noted appropriately.

- Facility costs, new or modifications need to be estimated
- Annualized capital costs for land, buildings, etc.
- Equipment costs, including cost to adapt them to local environment, for a generous supply or spare part, for operator training, and for maintenance capabilities. This should be supported by evidence regarding local repair capabilities or access to repair services.
- Recurrent staff costs for the full scope of production and materials development, for all types of production undertaken.
- Out-of-pocket operating costs for transport, supplies, telephone, petrol etc.

3. Program distribution costs

As program production costs vary depending on the delivery system, so do the distribution costs. Many distribution costs are hidden, such as logisitcs support, warehousing of materials, copying or record keeping. Assumptions regarding who will assume the costs need to be carefully spelled out. For example, questions of capitation fees, or purchase or print materials by the learner, or their free provision by the institution will alter the financial picture of the initiative.

- Central administrative costs for print and other materials distribution
- Transport/postage costs
- Access to broadcast service, for example, hourly or free service. Facilities for educational broadcasting exclusively need to be carefully analysed because they increase significantly the capital, operating and staff costs and are likely only reasonable when a significant number of hours can be broadcast
- Access to telephone services, in particular specially conditioned facilities to support computer linkages
- Firm quotations from the telephone company should be available, as well as their readiness to provide the service required.

- Capital, recurrent and technical support costs for other teaching technologies must be clearly identified and discussed.

4. Program reception costs

Again, the costs to the learner and the costs to the institution need to be spelled out. High learner costs, financial as well as in terms of time committment or travel to the learning site, can be a deterrent to suing distance learning, in particular for women.

- Facilities required for learning activities, particular learner access sites.
- Equipment required to receive learning materials, including Radio Sets, Batteries, Antennas, Teleconference Convenors, or TV Sets.
- other costs, such as tutor/teacher support, materials and supplies

5. Coordination and general administrative cost

- Materials, supplies and utilities costs
- Staff requirements in all categories, including engineering, travel and communications

5.4. Leadership and Mobilization

I would like for the final section of this paper to turn way from considerations of the scope, form and costing of an initiative in distance learning in technical/vocational education to that of leadership.

You will recall my earlier remarks on scope of the initiative where I said that the initiative could be solely to extend access to learners within the interest of a single, already existing institution. In that case, the leadership, and perhaps even the resources needed, would be available within the operating budget and staff of that institution.

It is my experience however, that any initiative beyond that requires leadership from government, or from government and the private sector if the private sector is to be a beneficiary of the training services. The question is who moves first. In Canada as well as India the governmental motivation to extend access to learning is high. In Canada, most often it has been leaders of educational institutions who approached government for assistance with provincial distance education initiatives, and in most of our provinces was found a receptive ear that has resulted in several excellent provincial or regional learning networks.

Often seed support is required, especially to develop a full and competent perspective of a complex initiative before it can be proposed formally to funding bodies. And I strongly support spending time and effort in pre-planning and feasibility to ensure that the considerations we have discussed today are dealt with fully. But I must tell you it has happened in Canada the other way. In 1985, in response to some relatively unorganized lobbying from northern Ontario educational institutions, the government of Ontario provided seven objectives and a four year commitment of substantial financial and personnel resources to mount the contact north initiative, and we went from there. Always, however, the leadership of these initiatives initially rests with a few credible institutions and individuals who have the will to action.

6.0 In closing, I want to mention briefly the Canada-India Institutional Cooperation Project (CIICP), which is supported by the Canadian International Development Agency, and executed in Canada by the Association of Canadian Community Colleges. The southern component of CIICP contains concrete initiatives in open learning/distance education in the states of Tamil Nadu, Karnataka, and Kerala. The general purpose of the project is to strengthen the polytechnic system through the joint application of

specific processes and projects during the period 1991-95. So it is well underway. In distance education/open learning, which is only a limited part of the southern plan, the 12 participating polytechnics, in collaboration with the Technical Teachers Training Institute, Madras, and the Canadians, will design an integrated model of open learning for the 12 polytechnics, develop the necessary human resources expertise, establish an open learning materials development centre, and pilot implementation of programs in the polytechnics. These pilot initiatives will be assessed and evaluated for broader replication. The Canadians involved in the CIICP project share a keen interest with the involved Indian educators in our two country's approaches and experience in open learning/distance education.

My assessment is that India is well advanced in establishing a distance education culture and practice, and that new initiatives in technical/vocational education can build on the knowledge, infrastructure and experience currently in place.

Some Reflections on Scientific & Computer Literacy

SHANNON A.G.

ABSTRACT

The paper emphasises that computer literacy should involve an appreciation of the limitations as well as the scope of computer technology. By reference to examples of simple calculational errors of computers, this aspect of literacy is introduced. It is observed that the inter-relationships of scientific measurement and computer calculations with interval arithmetic and real numbers serve to indicate omissions in the current curriculum.

Introduction

We rarely need reminding of the all-persvasive presence of computers, and often when our bank statements arrive we question their accuracy.

Just how accurate are computers? We do not need a computer to see that the answer to the calculation

$$10^{50} + 451 - 10^{50} + 10^{40} + 508 - 10^{40}$$

is 959.But my computer yielded zero as the answer. If computers can get this sum wrong, how do we know when they are right? Does this mean that the computer is not the perfect computational tool?

Perhaps, as Kulisch and Merenker (1984) suggest, the proliferation of computer usage makes it easy to overlook the central relationship between the computer and scientific computation and notation. Yet without understanding this central relationship computer literacy is incomplete.

Courses which introduce the nature and scope of computer technology many times do not focus on the limitation of computers. Neither do courses which utilize computational techniques seem to reappraise their goals in the light of what computers can and cannot do.

To start with the former types of courses, several questions suggest themselves: What is really being attempted? What are the criteria for achieving it? To what extent are schools in richer areas better able to implement programs?

Shannon and Hortle (1983) suggest that "some criteria for computer literacy include (a) being at ease in computing situations in everyday life, (b) being aware of the social changes caused by computing technology, (c) having a working competence with computing skills related to the foreseeable needs of the ordinary citizens, and (d) having a basic understanding of the scope and limitations of computers...this literacy must be viewed in the context of the total curriculum". The general educational level of the community is at issue here as we move to an era of information technology. The wider curriculum is involved as educators must be concerned not only with access to data but also with critical utilization of information. For example, many of the techniques of mathematical analysis were developed in the nineteenth century because of the computations required in many of the applications of mathematics were too difficult. Now that even school children have access to computing power which was beyond the

dreams of nineteenth century scientists and engineers, should we not re-assess the why, what, how and when of mathematics courses? These issues were explored in a previous article (Shannon, 1986).

A Dilemma

One of the characteristics of scientific literacy is the awareness that every measurement has an associated error: for example 12 ± 2 units. Not that those with a lot of formal education always exhibit this characteristic as is illustreated by an anecdote from Jeffcoate (1981). "I have discussed...the misleading idea that clinicians can get of the precision of immunoassays (particularly when results are consistently reported to 3 or more significant figures). These ideas can only be dispelled or modified by constant education and communication between the laboratoty and the clinician. I rashly suggested in an article some years ago that it might be rewarding if clinicians were given an idea of the confidence limits of the results they were sent. I received an amusing and salutary letter from a colleague in Australia from which I quote without further comment:

I agree with your suggestion in second last paragraph regarding analytical reliability of results, but much report that our own experience with such reporting procedures has been less than happy. For some time we issued results of hormone assays with the duplicate mean and the 95% confidence limits of precision for the particular assay. When one rather large obsterics hospital in this city ceased referring samples to our laboratoty, we enquired as to the source of their dissatisfaction and were told that the clinicians were very unhappy about the results from our lab, because clearly we were "unsure" of the precise level of hormone in the patient's serum. They preferred results from another laboratory which was able to give them precise measurements. Our chargrin at receiving this news was further compounded by being informed that the assays were now being performed by a private pathology laboratory which used commerical kits and ran the samples as singletons. The load of the reformer is indeed steep and slippery."!

To return to our measurement of 12 ± 2 units. What we really have is an interval of 10 - 14 units, which we know with a certain degree of probability. In passing, the concept of probability is also central to literacy, but space does not permit a digression to consider its various meanings in human discourse; the interested reader is referred to Hawkins and Kapadia [1984].

Instead of using interval artithmetic in our calculations we use artithmetic, that is, we approximate the interval of 10-14 by the real number 12. Yet the digital computer replaces real arithmetic by interval arithmetic. Scientifically, there is a dilemma in deciding whether the arithmetic of the digital computer can be fitted into an already crowded curriculum. Without it though, is the modern curriculum complete?

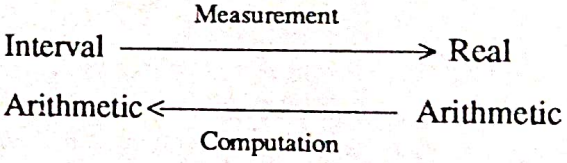

Figure 1: Interval and Real Numbers

Computational Anomalies

The foregoing suggests that one cannot be computer literate without an awareness of interval arithmetic, and that this is also important in scientific literacy. If this were an exposition of computer science, one would go on to explain the recent breakthroughs of Kulisch (of the University of Karsruhe) and Miranker (of IBM) in developing and interval artithmetic capable of furnishing the computer with control and validation of the computational process. One would also consider the implementation of floating-point arithmetic

with different accumulators and their effects on rounding and errors.

Here it is perhaps enough to illustrate some of the anomalies that one can encounter in computer calculations. Knowledge of these is part of computer literacy.

Kulisch and Miranker (1984) give an example of computing exp (-20) with a floating-point system with 6 decimal digits in the mantissa. By using the Maclaurin expansion and stopping after 63 terms when the last summand was less then 10^{-7} times the sum at that stage, the computer yielded an answer of 181.49600000. The correct answer, though, is 0.206115×10^{-8}. (This raises the topic of order of accuracy.)

If we calculate the inner product of two vectors A and B, where

A ← (2.71821828, –3.141592654, 1.414213562, 0.5772156649, 0.3010299957)

B ← (1486.2497, 878366.9879, –22.37492, 4773714.647, 0.000185049),

then $A \times .+ B$ yields $-3.941838937 \times 10^{16}$ on my computer and Kulisch and Miranker got $+0.335... \times 10^{9}$, whereas the correct answer is $-1.00657107 \times 10^{-11}$, but the computer delivers $-1.97815097635611891 \times 10^{-11}$. (This raises the topic of sign and order of accuracy.)

The polynomial defined by

$$P(X)=8118X^4-11482X^3+X^2+5741X-2030,$$

for $P(0.707107)=1.91527325270 \times 10^{-11}$, but the computer delivers

$-1.97815097635611891 \times 10^{-11}$. (The raises the topic of significant figures.)

The simultaneous equations

$$64919121.0X - 159018721.0Y = 1$$
$$41869520.5X - 102558961.0Y = 0$$

have solutions

$$X = 205117922 \text{ and } Y = 83739041,$$

but the computer delivers

$$X = 0.0987372352669808606 \text{ and}$$
$$Y = 0.0403093099594116210.$$

(This raises the topic of accuracy and the size of the mantissa.)

These examples show computers can deliver arbitrarily poor results in relatively simple and trivial calculations. The implications for more than a passing acquaintance with the parts of a computer, a little programming, and a survey of what computers can do. To have an informed citizen's view of what they should do, one should do, one must also be aware of what they cannot do!

Conclusion

The issue of what constitutes computer literacy has been raised here. That there are also implications for other subjects has also been indicated. "Do students need to comprehend the computer as a technology? And what about teachers? Most of what I have heard on this question suggest that the answer should be 'No'... A similar point of view underlines the emphasis on 'user-friendly' machines. I think that this approach needs to be examined rather critically. In the absence of such knowledge, teachers will lack the technical skills to evaluate the materials provided to them... The fundamentals of the binary system, of the process of designing and creating integrated circuits, and of the basic architecture of the digital computer are concepts that should be explained to teachers in a way that ensures their comprehension of the technology so that when the system doesn't work, they have an alternative to the commonplace model of the computer as homonculus... Moreover, I suspect that as the 'user-friendliness' of a system is increased, the gap widens between what the user perceives and the underlying reality. For these reasons,

it seems appropriate to build into the computer literacy some attention to the mechanisms by which the digital computer operates."(Calfee,1985).

This paper has aimed to raise questions rather than to answer them because the solutions to the problems suggested here will vary with the level of educational aspirations and the means available to try to achieve them.

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Technical Education System in a State in Northern Region of India: A Case Study in Educational Management.

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ABSTRACT

The objective of this case study is (a) to bring out the methodology adopted by the Directorate of Technical Education of a State for planning the tehnician education system, (b) to identify the strenghts and weaknesses of the planning process adopted, and (c) to highlight the problems experienced by the system and the issues that arose therefrom, so as to work out satisfactory solutions for improvement. It is hoped that this paper will help promote, amongst planners and administrators of polytechnic education, adoption of scientific approach to the management of technician education in the states.

Introduction

In India technicians are educated and trained in polytechnics. At the time of independence in 1947, India had 53 polytechnics with an annual intake capacity of 3500 students and an annual out-turn of about 1500 technicians. Today India has about 450 polytechnics with an annual intake capacity of about 65000 of which roughly about 50% come out as qualified technicians.

Education is primarily the responsibility of the state governments. But the central government is invested with certain specific responsibilities. It has the responsibility to coordinate the educational policies of the various states. Higher education, scientific and technical training and research are the special responsibilities of the central government.

At the national level, the All India Council for Technical Education (AICTE) plays an important role in the coordination and promotion of education of technicians, engineers and technologists. The All India Board of Technician Education under the aegis of the AICTE promotes and coordinates technician education at the national level. At the state level, the State Boards of Technical Education lay down curricula and conduct examinations for various technician courses. Technician education is the states in usually administered by the Dirctorates of Technical Education.

Relevant Information about the State under Study

The state which was considered for this study has 12 districts covering an area of about 44,000 sq.km. Its present population is around 13 million. There are 6 government polytechnics for boys, 2 government polytechnics for women, and 2 government-aided private polytechnics with annual intake capacity of 1050, 150 and 300 respectively offering various diploma courses. There are 3 institutions offering post-diploma courses in the state.

On the economic front, the state has acquired a pride of place on the industrial map of India. Starting with its predominantly agrarian character at the time of its establishment in 1966, the state has grown

very rapidly having established several large, medium and small scale industries producing machine tools, automobiles, tractors and a wide range of other goods such as refrigerators, sanitary ware, scientific instruments, electronic equipment, textiles, etc. In the state, there are at present more than 42,000 small scale industrial units as well as 300 large and medium scale units.

Present System and Methodology

Technical education in the state can be viewed as system based on 'Input-process-Output' model designed to achieve certain objectives. The system functions within an 'Environment', which provides 'Feedback' to the system to improve its effectiveness. Application of systems approach enables consideration of all the components (viz. Input, Process, Output, Environment, and Feedback) and interactions among these components of the system for achieving the system's objectives in an optimal and efficient manner. For the purpose of this case study, system's approach has been adopted. Fig.1 shows the polytechnic education system with its major components.

OUTPUT:

Output refers to the technicians who pass out of polytechnics with reference to their quantity, type and quality.

Manpower Planning:

Manpower planning is the basis for all planning and developmental activities conerning technician education. It enables to strike a balance between technical manpower requirements of industry and other sectors of economy on the one hand, and the supply of technicians from the polytechnics on the other.

Mechanism followed by the State for Manpower Assessment:

To assess and monitor the manpower requirements of the state, at least for a period of ten years, a planning cell was established in the state Directorate in 1981. This cell was intended to undertake the following tasks:

- collecting data,
- assessing manpower requirements and planning, and
- preparing new schemes and projects.

However, the infrastructure made available in the cell lacked the necessary professional expertise. Therefore, the Technial Teachers' Training Institute (TTTI), Chandigarh, offered technical expertise to the state to project its manpower requirements which resulted in the preparation of a plan for development of technician education in the State for the VII (1985-90) and VIII (1990-95) Five Year Plans.

Manpower assesment and extent of linkage with technician programmes:

The technician programmes introduced in the state, though relevant to the industrial requirements and societal needs, could not be linked to actual assessment of manpower needs. One of the causative factors for this is the limited interaction that exists between the Directorate of Technical Education and the employing agencies.

Present status of quantitative expansion of technician education in the state:

The concept of manpower planning is relatively new to the state. However, the Directorate proposes to expand technician education facilities by establishing at least one polytechnic in each district in a phased manner. The requirements in respect of new and emerging areas are also being considered. Other aspects of expansion of technician education include providing special opportunities for women by opening more women's polytechnics and catering to the needs of minority communities and weaker

sections of society. The state is also alive to the need to provide opportunities to working craftsmen and technicians as well as to teachers of polytechnics to better their competence and qualifications through continuing education programmes.

Linkage with Technical Manpower information System (TMIS):

The state has so far not formulated any scheme for linkage with the national TMIS which is still in the formative stage. There is no infrastructure available at the Directorate for this purpose.

Interaction with environment (employing agencies and community):

In order to train technicians whose performance may meet the requirements of the world of work and correspondingly to develop the technician education system on a continuing basis, it is necessary for the technician education system to have effective interaction with the employing agencies and the community. Then only will it be possible to formulate purposeful schemes for the improvement of existing programmes, to introduce appropriate new programmes, and to make the usefulness or the polytechnic system felt by the employers.

The present status of interaction between the technician education system and the employing agencies is given below:

Interaction between the Directorate of Technical Education and employing organizations:

Only limited interaction exists between the Directorate of Technical Education and the public and private sector undertakings, Subordinate Service Selection Board, and the State Board of Apprenticeship Training. There is hardly any interaction with other agencies such as Employment Exchange, State public Service Commission, State Public Works Department (PWD), State Electricity Board and other government departments. The only mode of interaction is in the form of official correspondence regarding vacancies. There is no organisational structure or mechanism in the Directorate for promoting effective interaction.

Training and placement officers posted in the polytechnics arrange campus interviews with the employers for recruitment. Training and placement officers also liaise with the industry and community to a limited extent.

Feedback on the performance of diploma holders:

No mechanism exists at present in the Directorate for obtaining any feedback. This is primarily because of lack of proper infrastructure in the Directorate.

Sharing of resources between Technician Education Sytem and industry and community:

The industry in the state provides facilities for training students of sandwich programmes as part of curricular requirement, and for limited industrial exposure to students of other diploma programmes. The performance of students who undergo practicial training in industry is evaluated so as to obtain feedback about the usefulness of such training. However, there is no regular mechanism for a sustained sharing of resources of industry by the technician education system.

The community development centres in some of the polytechnics offer training programmes to rural artisans and unemployed youth to enable them to acquire knowledge and skills for gainful employment.

Involvement of industry and community in the development of polytechnics:

The industry and community cannot be said to be involved in the planning and

development of technician education in the state. This seems to be largely due to lack of sufficient initiative by the techniian education system in this direction.

Methodology used in formulating schemes:

Project proposals are no doubt prepared for all new schemes. However, such schemes are not formulated after assessing the requirement of the industry and community in terms of type of training needed,identification of target groups and resources, and plan of action for implementation. Hence monitoring and evaluation of such schemes becomes difficult. Often even the objectives are not clearly stated.

These shortcomings are the result of not providing appropriate manpower in the Directorate of Technical Education with needed professional expertise.

Input

Student:

About 80% of the students entering the polytechnic system are with matric qualification (after 10 years of schooling) which is the minimum prescribed qualification for admission. The remaining 20% students come with higher qualifications. Admission is done on the basis of merit judged from marks obtained at the qualifying examination. Seats are reserved for candidates belonging to Scheduled Castes (SC) and Scheduled Tribes (ST) as prescribed by the government.

Most students entering the polytechnic education system come from comparatively poorer socio-economic background.

Teachers:

Next to the student body, the faculty is the most important factor in assuring the success of any technician education programme. Technical competence, scientific understanding, creative ability and industrial orientation are required for teachers training the technicians. Unfortunately, competent teachers are not forthcoming. There is a large number of vacancies in teaching positions.

Physical facilities:

Adequate physical facilities such as well-equipped labouratories and workshops, instructional materials and learning resources are essential inputs needed for training technicians. Because of financial constraints, most of the polytechnics do not have physical facilities as per prescribed norms.

INSTRUCTIONAL PROCESS

Curriculum:

Some important issues concerning the curriculum are:

- relevance of the programmes and revision of curricula,
- offering programmes in new and emerging areas of technology, and
- providing flexibility in programme offerings.

Mechanism for developing and revising curricula:

The idenftification of new technician courses is done on the basis of general awareness of emerging areas of technology and not on any scientific data regarding manpower requirement. Except in a few cases, the selection of institutions for offering new courses is not location specific.

In the absence of a Curriculum Development Cell (CDC) at the State level, the Directorate has to bank upon the regional resource system such as the TTTI, Chandigarh for the development of curricula in new and emerging areas and for the revision of curricula of the on-going courses. At all stages of development and revision of curricula, the faculty of the polytechnics are involved in

providing feedback by participating in workshops conducted for development and revision of curricula.

Realising the importance and the need for creating expertise within the technician education system of the state and also to establish constant interation with the TTTI and the environment, the Directorate has recently assigned the responsibility for coordinating the projects on development and revision of curricula to the senior faculty of the polytechnics.

Presently, the state does not have a CDC of its own for curriculum design, curriculum development, curriculum implementation and curriculum evaluation. However, the Directorate is aware of the need to establish a state level CDC in the Directorate and a proposal for setting up such a cell has been placed before the State Government for its approval.

At the moment the Directorate has not formulated any specific scheme related to credit-based flexible course offerings with multi-point entry and such other innovations. However, the State has introduced a 'Part-time Diplma Course' in one polytechnic to enable working craftsmen to improve their qualification. With regard to taking care of the requirement of weaker sections of the society such as Scheduled Castes and Scheduled Tribes students, special coaching classes have been introduced in the evenings in some polytechnics.

The community wings of certain polytechnics are offerings skill development and training programmes for rural artisans and unemployed youth to enable them to have access to gainful development.

Infrastructure development:

The development of infrastructure in polytechnics involves providing various physcial facilities such as buildings, space, equipment, faculty and instructional material, etc. and ensuring their optimal utilisation.

Norms and Methods for meeting infrastructural requirement:

At present the State Directorate follows the AICTE norms for providing various types of physical failities in polytehnics. However, the State is experiencing difficulty to adhere to these norms because of financial constraints.

The Directorate ensures provision of infrastructural facilities by regulating funds under two distinct heads i.e. Capital Head and Revenue Head. the former is meant for construction and maintenance of buildings; the operation of this head being done by the State Public Works Department. The Revenue Head is operated by the Directorate and the Principals of polytechnics, and covers salaris, equipment and consumables. There is a defined procedue for effecting purtchase of equipment through the State Directorate of supplies and Disposals. Minor infrastructural development can be taken up by the principal himself for which separate funds are provided by the Directorate. The resources are optimally utilised by re-appropriating funds for maintenance of essential services such as maintenance of buildings, etc. and adopting economy measures wherever possible.

Scheme for infrastructure development:

Within the framework of guidelines issued by the Govt. of India, the directorate and polytechnics prepare schemes for infrastructure development. These schemes are finalised in consultation with the TTTI, Chandigarh, which has developed a philosophy of Integrated Development of polytechnics. During this process, the TTTI helps to ensure that all schemes under the Direct Central Assistance are a part of the 'Integrated Development Plan' for polytechnics. The requirements of funds under the 'Integrated

Development Plan' are spread over a period of five years.

Specific projects formulated for further development of infrastructure based on the National Policy on Education (NPC) 1986 include:

- strengthening of libraries,
- establishment of 'Book Banks',
- setting up computer centres,
- renovation of existing buildings,
- providing additional hostel facilities, and
- setting up new polytechnics.

Teacher Training and Staff Development:

The competemce of teachers plays a dominant role in the effective implementation of technician programmes and for undertaking projects for institutional development. For this purpose it is essential that teacher training and staff development programmes are formulated and implemented.

Policy and planning methodology for teacher training and staff development:

Although the state has had a progressive outlook regarding the sponsoring of polytechnic faculty at all levels for training and staff development programmes, there has been no systematic attempt to identify the needs and areas of training programmes required and to draw up a well formulated staff development plan on a long-range basis.

Recently, the principals of polytechnics have been directed to prepare profiles of individual polytechnic teachers as a part of the integrated plan for institutional development identifying each teacher's specific training requirements. This will then be consolidated at the Directorate level and teachers sponsored for various training programmes.

Mechanisms and methods for staff development and employment:

There is no mechanism at the Directorate to coordinate staff development programmes since faculty development plans have not yet been formulated. It is left to the principals to sponsor teachers to various education and training programmes as and when it is convenient to spare them. In spite of this, it has been observed that training programmes and opportunities available at the TTTI, Chandigarh and other institutions are not fully utilised.

As a follow-up of having undergone training programes, the teachers are required to give a seminar to their colleagues for dissemination of information and knowledge acquired through such programmes.

New schemes for teacher training and staff development:

The new schemes for teacher training and staff development include sponsoring teachers under Quality Improvement Programme (QIP):

- to undergo industrial training,
- to participate in summer/winter schools, and other short-term courses/workshops, and
- to acquire post-graduate qualifications (M.Tech.)

SYSTEM MANAGEMENT AND ORGANISATIONAL STRUCTURE

System management involves effectively administering various resource inputs at the Directorate level and instructional processes at the polytechnic level. In addition, management will be functionally effective if programmes and activities are planned, scheduled and implemented taking into consideration the quality and type of technicians to be trained. System management at the polytechnic level involves coordination within each department

and amongst the various departments to ensure effective functioning.

(1) MANAGEMENT AT THE DIRECTORATE LEVEL

Formulation of plans

The plans formulated by the state for the various technician education programmes as at present are not data-based. They are more-or-less ad hoc. Through the annual plans are prepared regularly for which funds are provided and expenditure incurred they are not based on a systematic analysis of needs and requirements.

However, the emerging trends in technologies and the need for expansion of technician education facilities are borne in mind while planning various schemes.

Methods of budgeting and financial allocation:

The state prepares FIVE year plans for development of technical education. From this, the annual plans are prepared showing approved outlays and anticipated expenditure. For the VII Plan period (1985-90) against an estimated requirement of about Rs.40 crores for different development programmes, the actual allocation was only Rs.15 crores. In view of this shortfall, the state had to considerably trim its developmental programme in technician education.

(2) MANAGEMET AT THE POLYTECHNIC LEVEL

Periodical meetings of the principals and Director are held on an average once in six months during which decisions concering key issues are taken through participatory discussions. For day-to-day management of polytechnics, sufficient authority has been given to the principals. Decisions regarding administrative matters at the Directorate level are taken according to laid down rules and regulations. Project proposals are formulated for various programmes of the polytechnics. Although bar-charts and detailed schedule of activities are not being prepared, the principals of all polytechnics are sending monthly reports, giving information under the following four heads:

- academic achievements,
- development of the institution including infrastructural facilities
- administrative actions taken, and
- miscellaneous activities.

These reports help to ensure some sort of coordination between the Directorate and the polytechnics for effective communication and implementation of programmes.

At the polytechnic level inter-departmental and intra-departmental meetings are held, to ensure more effective communication and implementation of various activities.

Management of students' affairs:

The polytechnics have a system of forming students' committees for various activities such as mess, hobby club, sports, cultural activities, etc. which operate under the guidance of Principal, Heads of Departments and senior faculty. The Training and Placement officer provides counselling and guidance for training and placement in industry.

All Scheduled Caste and Scheduled Tribe students are given scholarships to pursue their studies. Of the rest, 15% of students are awarded scholarships on merit-cum-means basis.

(3) ORGANISATIONAL STRUCTURE OF THE DIRECTORATE

The effectiveness of planning and implementation of various programmes related to technician education depends on the type and professional character of the organisational set-up available at the Directorate.

Prevailing organisational structure:

The existing organisational structure of the Directorate showing the different functional units and their areas of responsibility are shown in Fig.2. The Additional Director is the link between the different functional units and the director to ensure vertical integration and effective communication toward better performance. Coordination amongst the different functional units is also ensured by the Additional Director under the guidance of the director, thus ensuring horizontal integration. The Directorate has recommended to the State Government establishment of a separate State Level Advisory Committee for technical education under the chairmanship of the Chief Minister, with a view to promote and further develop technical education. The Finance Minister, Minister for Technical Education and the Secretary of the Planning Department of the State will be among the key functionaries of the committee.

State's perception of strengthening and professionalizing the Directorate of Technical Education:

The state Directorate has become aware that it should not be merely an administrative body, but a body involved in the professional management of technical education in the state. The importance of professionalizing the Directorate is now being realised. Accordingly the Directorate proposes to strengthen itself to undertake the following major activities:

- monitoring the performance of various functional groups and units more effectively;
- establishing a separate functional unit headed by a Registrar for the conduct of examinations (persently this work is entrusted to the Training and placement officer who has to perform this function in addition to this other duties)
- preparing realistic developmental plans for polytechnics based on the needs of industry and other user agencies;
- computerising data for quicker retrieval of information; and
- evaluating the schemes and programmes on a continuing basis.

MONITORING, EVALUATION AND FEEDBACK

Continuous monitoring of the various technician education programmes is necessary to ensure effective implementation. For maintaining proper standards, evaluation at different stages is required. Feedback from employers on the performance of technicians employed by them should also be obtained from time to time so as to effect improvements in the courses on a continuing basis.

Mechanism for monitoring, evaluation and feedback

The Directorate officials inspect polytechnics from time to time and hold discussions with teachers and students. Teachers are required to certify the extent of coverage of the curriculum and the lectures attended by students. However, a systematic mechanism for obtaining feedback for monitoring and evaluation of the various programmes does not exist.

The Directorate does not have a Curriculum Development Cell of its own for effective monitoring and evaluation of the different curricula. No functional group exists at the Directorate for monitoring and evaluation of the various programmes and schemes, and for identifying the academic issues.

Drawbacks in the examination system:

The following are the drawbacks of the present examination system as perceived by the Directorate which need to be looked into:

- lack of objective assessment of student's abilities,
- lack of reliability and validity,
- lack of relevance of the question papers to the world of work, and
- lack of administrative infrastructure to process the examination results quickly.

No specific scheme has yet been launched for the improvement of the present examination system; however, the Directorate intends to go in for computerisation of examination results.

Evaluating the performance of teachers:

Periodic monitoring of the instructional process during the session is not done. The pass percentage of the students in the examination is the sole criterion for evaluating the performance of teachers. However, reports of the Heads of Department and principals regarding the performance of teachers are obtained. Such reports hardly represent the profiles and the strenghts and weaknesses of teachers. Appropriate staff appraisal schemes are yet to be introduced.

Evaluating the performane of the polytechnic as a whole:

Inspection committees visit polytechnics from time to time and report about their performance. However, the percentage of students passing in the State Board examinations continues to be the major criterion for evaluating the performance of each polytechnic. The concept of 'Institution Evaluation'i.e. evaluating the institution in its totality has not yet become part of the system management.

Conclusion

The technician education system of the state though progressive in outlook is constrained by the following:

(1) Output

- Lack of mechanism for obtaining reliable data regarding manpower requirements.
- Lack of professional skill in the Directorate for manpower assessment.
- Lack of adequate administrative infrastructure to establish effective linkages and interaction with industry and other systems.

(2) Input

- Most of the students entering the technician education system come from comparatively poor socio-economic background.
- About 20% of students admitted have higher qualifications than the minimum prescribed. This as well as the mix of urban and rural background of students cause problems and at times indiscipline in the class-room.
- Remedial courses are required for students from weaker sections and backward areas. Such remedial courses are not provided in an organised manner.

(3) Instructional process

Programmes,curriculum development and innovations:

Because of inadequate organisational structure and lack of professional expertise in the Directorate for developing/revising curricula and to introduce innovations, the State is dependent upon external resource system, mainly the TTTI at Chandigarh, which in turn has to acter to several such requirements of the States in the Northern region. This causes delays in curriculum development and introduction of innovations.

Infrastructure development:

The state is finding it difficult to provide infrastructure as per the prescribed norms

because of inadequacy of funds. Although the state Directorate endeavours to ensure that basic infrastructural facilities exist before any new course/institution is started, yet sometimes due to political and social pressures, courses or institutions are started first and necessary infrastructure provided much later.

Teacher training and staff development:

There is need for administrative and professional infrastructure to identify individual training requirements of polytechnic teachers, to draw up a staff development plan, and to coordinate the various training programmes. Considering the obsolescence that is setting in because of the fast developments in technologies, continuing education and training of teachers is crucial. Unfortunately, this aspect has not been adequately attended to by the Directorate. The polytechnic teachers also do not seem to be motivated enough to volunteer for such training programmes.

(4) Management of the system

At the Directorate level:

- There is absence of adequate professional expertise for properly planning and implementing technician education programmes.
- There is no data base to ensure proper planning, scheduling and implementation of the polytechnic training programmes.
- There is lack of professional expertise for project formulation.

At the polytechnic level:

- Teachers need to be encouraged to produce instructional resources and make them available to students at reasonable cost.
- Vacancies in faculty positions are often filled up by ad hoc appointments till regular incumbents are recruited through Public Service Commission. Such ad hoc appointees are often not motivated because of insecurity of service and also because they are not given privileges and other benefits provided to the regular faculty.
- Adequate funds are not uniformly regulated throughout the year to plan purchase of essential equipment and other consumables required for training.
- Planning of staff development programmes is often not need-based and systematic. The approach is generally ad hoc.
- Facilities provided for education and training programmes are not optimally utilised by polytechnics.

Interaction with enviroment:

- Polytechnics do not have adequate interaction with the industry and the community around.
- There is lack of interaction with institutions of higher learning like engineering colleges and institutes of technology.
- Greater interaction of the technician education system with the State and Central Governments is desired so as to enlist their support to provide adequate funds for the various programmes and schemes.

(5) Monitoring, Evaluation and Feedback

- There is no state level Curriculum Development Cell for effective monitoring and evaluation of curriculum in respect of existing and new courses.
- There is no functional group at the Directorate to identify academic issues and problems.
- Periodic monitoring of the instructional process is not done. The pass percentage of the class in the examination is the sole

concern of the teacher, and he is evaluated on that basis. There are no well-designed staff-appraisal schemes.

- There is lack of awareness in the polytechnic regarding the need to monitor the progress of various schemes/ programmes.
- Expertise in the Directorate in 'evaluative research' is lacking. Such expertise needs to be built up to identity problem areas and suggest remedial measures on a continuous basis.
- The figures of student intake and out-turn show that the wastage in the system is as high as 30% to 40%. Some of the reasons for this wastage are: lack of necessary aptitude among the students, inadequacies of instructional facilities, ineffective teaching,non-selective admission of students, inadequate utilisation of existing instructional facilities, lack of adequate financial resources to meet operating and training costs, and inadequate employment opportunities.

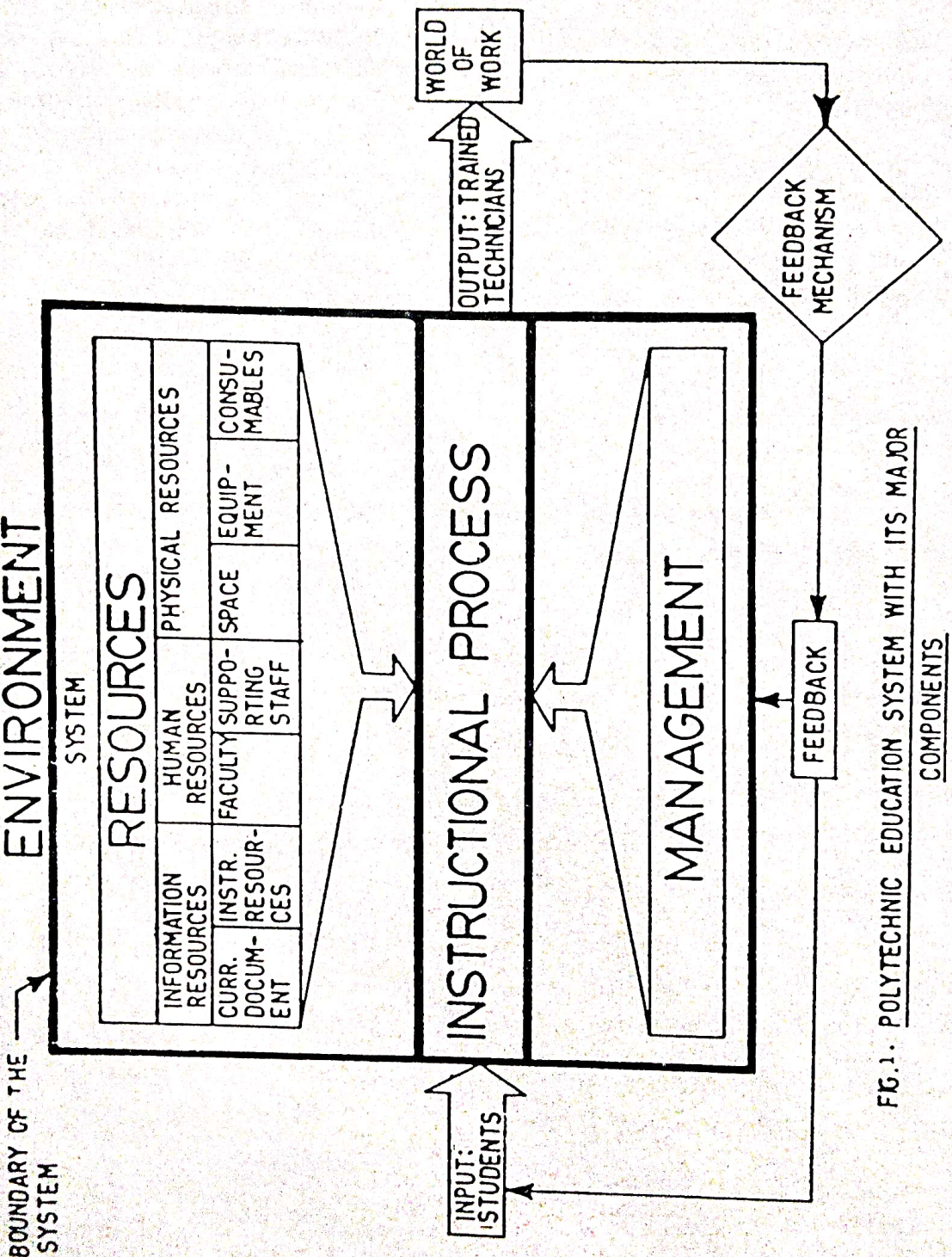

FIG. 1. POLYTECHNIC EDUCATION SYSTEM WITH ITS MAJOR COMPONENTS

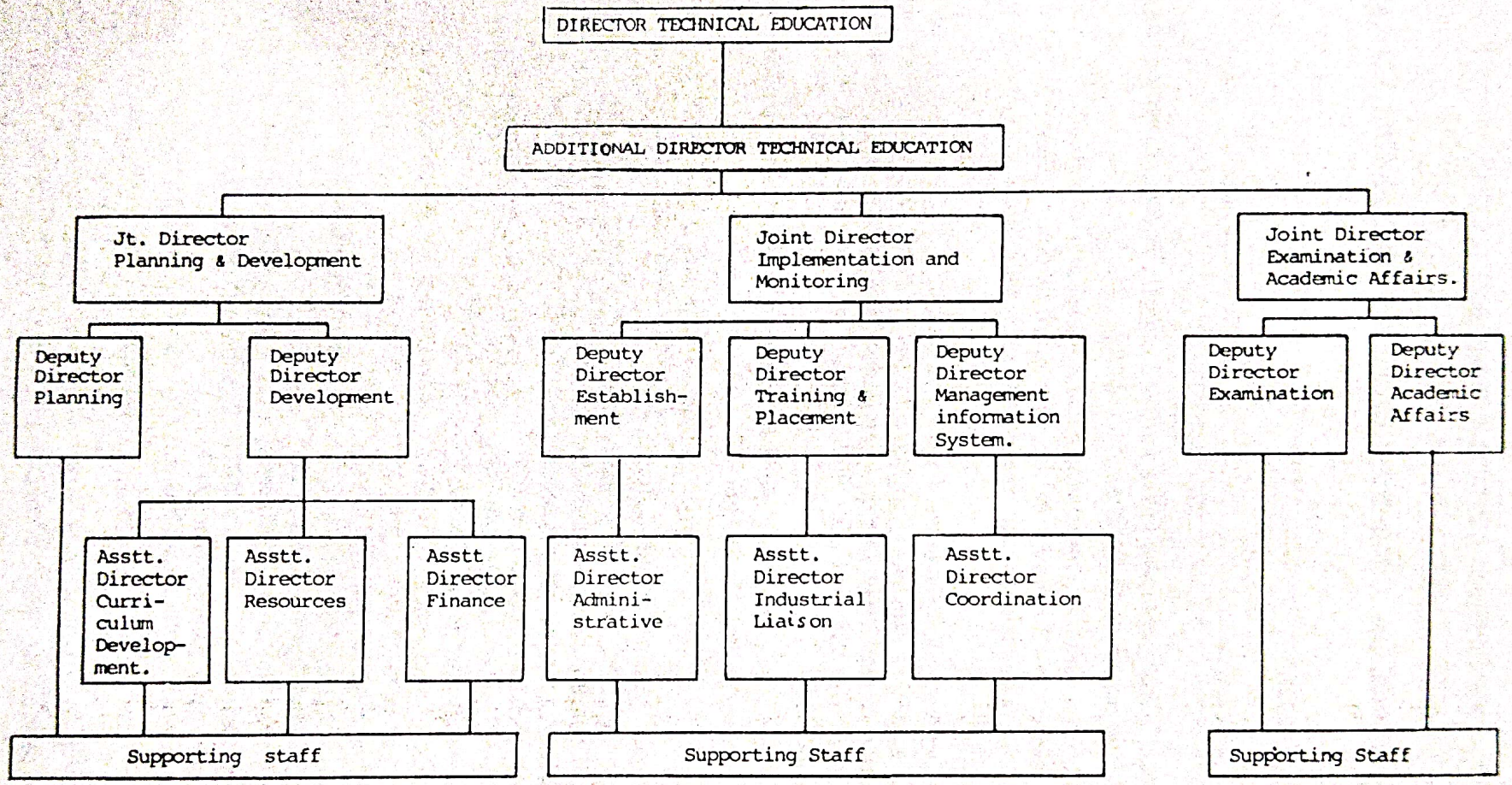

Fig.2. ORGANISATIONAL STRUCTURE OF THE STATE DIRECTORATE OF TECHNICAL EDUCATION

Is Practical Experience an Adequate Substitute for Building Education

AGBO THOMAS OGBODO

ABSTRACT

Most of the lower class employees in the building industry in Nigeria have practical experience without any bias in building education.

An indepth study on how this trend can be minimised and a method that can be used to inculcate or instil training in the form of education to these groups have been emphasised. The characteristics and problems of each of the groups have been identified.

A comprehensive analysis of educated and non-educated in the building industry was carried out, with a view to throwing into light how it can be carried out in real life. It shows among other things a detailed outline of how things should have gone in an ideal situation and also highlighting the faults and how they should have been connected.

Finally,it shows that despite having much experience you need much training to be able to tackle complex project of today.

1.0 Introduction

The above topic has generated a hot argument today in the Nigerian Building Industry, particularly amongst the lower class of participants. When one thinks of some issues involved, the question becomes really justified. For instance, the operatives on building sites believe that though not educated, they have no equals in their various trades, and are most important in the building process since they carry out the actual job execution. Further, the huge investments made by individuals, groups and governments on building education often raise an eye-brow. And most importantly the percentage distribution of the educated to the uneducated on building sites as shown in the cases below gives a lot of concern:

(a) Professor Kunle Wahab in a 1977 research project arrived at the following percentages for skilled workers in an average Nigerian construction site.

- Number with primary school certificates – 38%
- Drop-outs from primary schools – 19%
- Did not attend primary school – 36%
- Above primary six – 7%

Note: Workers here refer to labourers, artisans/craftsmen, and semi-skilled.

(b) The table 1 below is typical of most indigenous firms in Nigeria and shows the last school attended by workers on site. (Seminar paper presented by the student of UNIFE, Nigeria, Unpublished).

		Below Secondary School	Secondary School	Trade School	College/Polytechnic	University	Total
Labourers	A	✓					16
	B	✓					10
Operatives	A	✓					34
	B	✓					22
Group/Team	A	✓		✓			6
	B	✓		(Rare)			–
Foremen	A			✓			4
	B	✓		✓ (Rare)			1
Supervisors	A			✓	(OND) ✓		1
	B			✓			1
Site Agent	A				✓		1
	B				✓ (Rare)	✓	–
Manager	A				(Rare)		–
	B				(Rare)		–

Group A: Depicts typical large firm with some bigger medium-sized ones e.g. Adecentre Nig. Ltd. who has the total number of workers shown as at 20th June, 1985 at Institute of Agricultural Research and Trading site, University of Ife, Ile-Ife.

Group B: Typical small to smaller medium sized firms e.g. Adedeji Balogun Construction Co. with workers as shown for National Museum Complex, Ibadan on 16/6/85.

Considering all the above, it becomes necessary for one to ask whether practical experience can adequately be substitute for building education.

2.0 Practical Experience

2.1 Historical

Building activities are known to have started as far back as the time man started to live in caves. Bricklaying, carpentry and plastering were known to the ancient Egyptian and Babylonians. For instance, the Egyptian pyramids, tombs, aqueducts are living witnesses. No formal education is known to have existed by then. Thus, knowledge and skill were gained through practical experience.

2.2 Need

The importance of practical experience stems from the adage that practice makes man perfect.

Experience acquired through practice often takes care of particular and special problems of an issue, and there is generally an appreciation of the real life situation. This makes practical knowledge indispensable.

It is particularly necessary in Nigeria today when education has not got to grass roots. The uneducated have to contribute towards national growth by learning in this manner.

2.3 Process of Acquiring Experience

The process of learning by practice is basically the same for all categories of participants in the building process but with slight variations. The following categories are distinguished:

(a) Labourers and Operatives

The operatives, served/helped by the labourers, carry out the actual job execution e.g. masons, painters, carpenters etc.

The first step in learning here is observing the action. The learner or apprentice notes how the operations are carried out, the techniques and the use of tools. Next, when he feels that he has learnt enough he tries to do the job. He probably fails; then observes again, repeats, and compares with the master's output. He tries on and on until his work measures up to the master's standard. Finally, he tries to understand the effects of the action so that if exactly the same set of circumstances reappear he could anticipate what would follow from the action.

(b) Supervisory/Managerial Staff

These are the gang leaders, foremen, supervisors and the site agent/manager.

The process of learning starts with observing also, but here, it is not a conscious effort as in (a) above. Present leaders are watched, the way they behave and give orders. The experience is stored in the human brain, though the leader might not know. When eventually the worker is appointed a leader/supervisor in the same capacity, he tries to recollect his past experiences, evaluates them and decides how to set about his job. He gives orders and watches subordinates for their reactions. Based on these, he makes adjustments, and on this way until he is satisfied he has learnt the skills.

(c) Consultants and their Workers

The consultants involved in the building process include the Architect, the Quantity Surveyor, Structural and Services Engineers, Project Manager, Estate Valuers, Town Planners, etc.

The work carried out by these professionals and their workers could be divided into three, and the process of acquiring practical experience varies with each.

(i) *Executory Work:* This is concerned with physical performance of one activity or another e.g. drawing by architects and planners, estimating by the quantity surveyors, property valuation by the estate surveyor. The process of learning here is as in operator learning.

(ii) *Supervisory or Leadership Job:* This refers to the activity of the managerial personnel in each consultant establishment in supervising the work of the estimator.

The first knowledge is usually through formal education. Where this is not the case, like in the past, practical experience is gained as in the case of supervisory/managerial staff before.

(iii) *Advisory Roles:* Often, consultants are to advise their clients or even their fellow consultants e.g. the architect is to advise the client on design standards while the quantity surveyor is to advise him (architect) on choice of materials and building systems for example.

Here too, knowledge is usually acquired through building education, but where this is lacking, it is based on personal evaluation and feelings.

2.4 Characteristics and Problems

(a) The period of apprenticeship is fairly long, for example:

Mason	–	about 2-4 years
Painter	–	about 2 years
Carpenter	–	about 3-5 years

But the process of acquiring practical experience is relatively economical. Only the basic tools needed are purchased by the learner, hence he does not need many facilities to be provided. Besides, the learner is not completely dependent on his family for his daily bread. He could earn some money from jobs delegated to him.

(b) There is strong motive to learn as the need is immediately felt. Learning the skill places the worker on a higher scale of pay.

(c) Experience learned by practice appears to be less easily forgotten than theoretical learning.

(d) Often called "direct knowing", this learning is without basic principles. Most instructions given are with regard to how, not why, it should be done. Thus, it is difficult to transmit to others the knowledge gained this way.

(e) The learning process involves a lot of trial and error, thereby causing loss of time and much material wastage.

(f) The scope of knowledge here is usually narrow and limited to the work observed and practised. Coupled with the fact that the principles are missing, the worker seems to lack initiative. He finds it difficult to take wise decision when challenged.

(g) The worker tends to be conservative. He holds to the same method of doing the job even when a new condition is met. Hence, there is no adaptation to future changes despite the fact that the field experiences rapid changes due to improving technology.

(h) Since knowledge is limited to the area observed, there is poor mobility of labour within the organisation e.g. even in times of urgency, a block-layer cannot render, unless he specifically learns it too. This results in the proliferation of workers.

(i) Finally, attempts to pick up a skill without prior knowledge of theory may result in the formation of bad habits which may in fact prove fatal to any subsequent attempts to learn to perform efficiently.

3.0 Building Education

3.1 Need

The need for building education can be traced according to the different categories of workers.

(a) Labourers

Some activities of this group require an understanding of the properties of the affected materials e.g. mixing of concrete, mortar and plaster. To do this effectively, they need to know for example:-

properties of cement, particularly when water is added.

importance of water/cement ratio.

the effects of incorrect mix.

the need for cleanliness of constituents.

These cannot be acquired by any means other than teaching.

(b) Operatives

It is to be noted that most operatives judge job standard by how it is perceived by the eyes. They fail to realise that some internal

reactions could render an outwardly beautiful work ineffective. For instance, the distribution of stresses in block and concrete members is not understood. The iron bender also needs an understanding of the part played by each of the reinforcement systems. Furthermore, operatives need to know how to read and interpret the drawings. All these can be understood by learning the principles through building education.

(c) Supervisory/Managerial Personnel

Supervision and leadership are intricate activities/roles and they go a long way in determining the output. Though many argue that leadership skill is innate, a lot can still be acquired. To lead effectively, one needs to understand the psychology of the subordinates. He should be able to understand and appreciate emotions, feelings of depression on happiness and moods of individual(s). These skills are best acquired through management studies.

(d) Consultants

Whether they perform executory, supervisory or advisory roles, consultancy services require expert knowledge in their fields. They are also expected to be knowledgeable in the related field. These can only be obtained through formal education where the general training is given before specialisation. This is in contrast to practical experience where it has been observed that knowledge is restricted to the area observed.

Apart from the above, building education is particularly important today with clients, requirements becoming more complex and extensive. Improving technology brings about the use of entirely new materials and methods of construction, including sophisticated equipment. Thus, a knowledge of fundamental principles is necessary for a worker to cope effectively with this trend.

Forms of Building Education

(a) On-the - Site Training

When on-the-job training is formal, this becomes a form of building education. Here, instructions are given to learners in the form of lectures, seminars, hand-outs, etc. by knowledgeable superiors. They are taught the basic skills necessary for efficient performance of their jobs and the procedures to be adopted. Issues confusing them are clarified while questions are answered. The term "on-the-site" training is usually applied to the contractor's organisation. It is most suitable for training labourers, operatives and junior supervisory staff (team leaders and foremen).

However, a similar training could be organised within the consultants' organisations at their head or branch offices for junior workers.

Generally, on-the-site training, if practised at all is very poor in Nigeria even with large companies.

(b) Off-Site Training

Off-Site training could be occasional, part-time or full-time.

When occasional, the learner or worker is sent for studies, probably for one week in every six weeks or so, or he attends or is sent to attend lectures or seminars being organised by management or industrial institutions for that purpose. This is usually sponsored by the company. Part-time training occurs when the worker is still on the pay-roll, by attending evening classes for example. It is full-time when they leave work entirely during the period of the training. This could range from one year to about five years. He might be paid by the company (in-service training) or not.

(i) *Vocational/Technical Education:* The aim is to prepare people for useful occupation particularly for skilled trades and semi-professional careers. It may also increase the skills and

knowledge of those already employed in occupations of this kind. In the building industry, vocational training is provided via trade and industrial schools e.g. technical institutions, vocational and comprehensive high schools, junior colleges, extension education, correspondence schools, labour unions and industrial firms. This type of training is most suitable for operator and junior supervisory training.

(ii) *Colleges and Polytechnics:* This form of training is usually adopted for higher level supervisors/managerial staff (supervisors, site agents/managers) depending on the academic height attained. It is also sufficient for some consultants and their workers in Nigeria e.g. quantity surveyors, estate valuers, town planners, engineers, etc.

(iii) *Universities:* These provide the highest form of building education. Here knowledge could be limited to first or even higher degrees. It is most common for professional education (applicable to consultants) and top managers within the contractor's organisations e.g. site manager/agent, projects/contracts manager.

3.3 Process of Acquiring Knowledge

The sequence of learning under building education does not depend on the formal category of the worker. It is common to all, and proceed almost in a reverse sequence to the process under practical experience.

The first step is receiving information. This is transmitted through a symbolic medium e.g., lectures, books, where words are the symbolic medium.

The second step is assimilating and organising information so that the general principles are understood. Next, the learner tries to infer a particular application from the general principle.

The last stage is moving from the symbolic processing sphere to the sphere of action. Here, the knowledge gained is applied.

3.4 Characteristics

(a) Learning through this process with a symbolic medium can enormously reduce the time and effort necessary to learn something new. It is the embodiment of the experiences of others, and thus the crystallisation of inferences from a broad range of experience.

(b) Here, a large chunk of knowledge is acquired. The learner is trained not only in his own area but also in related fields. Besides, he acquires fundamental principles which enable him to extrapolate his knowledge.

(c) Because he knows the fundamentals, he can make use of initiative when he is free to do so, or when pushed to the walls. Also, there is the possibility of further training to keep up with current trends in the building industry.

(d) Since the educated worker has knowledge of related activities, he could be very useful in them when very necessary or urgent. Hence, there is lateral labour mobility. This might reduce the total number of workers employed, thus avoiding proliferation.

(e) There is generally the ambition to rise to higher levels as there is knowledge of the existing opportunities ahead.

(f) In addition to learning how an operation should be done, why it should be done is also explained.

3.5 Problems

(a) Building education depends very heavily upon a symbolic medium, ordinary language. Thus, when this set of symbols are learned poorly, learning itself must be poor.

(b) Academic tests of what is learnt are typically paper and pencil tests that ask the student to show in words/sketches his understanding of the general principles. Though students might be good in such tests, they may not be able to apply what they have learnt. When this happens, learning is incomplete.

(c) It must depend on artificial or extensive motivation. Because action, which is the rewarding act, occurs at the end, rather than at the beginning, there may be no incentive for learning until the connection between the information and the action becomes clear. Thus, motivation must be extrinsically supplied e.g. grades in schools.

(d) Moreover, studies tend towards an abstraction, an ideal situation. Usually, they are based on theories and models which lack practical application.

(e) Knowledge acquired is more easily forgotten when adequate experience is not yet gained.

So far, we have delved into the general qualities of knowledge gained through practical experience as well as building education. We now compare these two systems in relation to output of workers in a typical Nigerian site.

4.0 Comparative analysis of the two systems with respect to output

In order to compare the output, quality, and percentage waste on materials of an educated and an uneducated worker, a sample study of four masons on three project sites was made. The three firms are Winners Sports Ltd. working on Dick Tiger Memorial Gymnasium Fitness Centre, Enugu, for two of the masons and Ben-Jack Consolidated Ltd. and F. Oguegbe and Sons Ltd. working on Political Party Offices Buildings, Awka Zone, Aguata Local Government Area for the other two, all in Anambra State.

These operatives were observed for three weeks each and their task was as follows:

(a) Site 1: Dick Tiger Memorial Gymnasium and Fitness Centre. Contractor: Winners Sport Ltd.

Task: To complete the two wings of internal partition in the toilets of women's and men's sections within two weeks and complete all necessary rendering, where necessary. Start from oversite concrete to lintal level, $25m^2$ in area. Period on site - twice a week for two hours.

(b) Site 2: Political Party Office Building, Aguata L.G.A. Ben-Jack consolidated Ltd. and F. Oguegbe & Sons Ltd.

Task: To complete the toilet blocks near the Conference hall of the two contractors, projects and after the water tight roof covering to render all their section for observation. Period of the project is three weeks. Start from oversite concrete up to wall plate level. Area is $82m^2$. Period on site is three times a week for two hours.

All the four masons were given their own portions including the labourers to serve them. The Managing Directors of the three firms were told to provide all necessary materials to make the test a success. None of the four operatives knew what was all about except the site engineers and their employers, though they were conscious because they were the only people given a target work to do.

During their course of work, we normally check the following:

The way they apply the horizontal course of mortar.

Taking block (brought by labourer) and placing in position.

– Plumbing and levelling.

- Applying vertical course of mortar.
- Dressing.
- Plumbing to check alignment.
- Thickness of rendering or backing.
- Time taken to complete the block work and rendering.
- Percentage waste and tidiness of the area.
- Total number of instructions given by the engineer.

The result is tabulated below.

Site I: Dick Tiger Memorial Gymnasium and Fitness Centre

Table 2 (i): Comparative Analysis of Outputs, Quality, Waste Level.

	Item Checked	Uneducated Mason	Educated Mason (Technical School)
1.	Period of observation and completion of task work	A week and four days	A week and two days
2.	Total number of instructions given by team leader	10	None
3.	Thickness of rendering or backing	Average 20mm	Average 15mm
4.	Percentage waste to materials given	5%	2%
5.	Tidiness of the area	Very haphazard broken blocks and mortar droplets 80%	Fairly neat area 35%

Site II: Political Party Office Building, Aguata L.G.A.

Table 2 (ii): Comparative Analysis of Output, Quality, Waste Level.

Items Checked	F. Oguegbe & Sons Ltd. (Uneducated Mason)	Ben-Jack Consolidated Ltd. (Educated Mason).
Period of observation and completion of task work	Four weeks	Approximately three weeks.
Thickness of rendering and backing	Average 18mm	Average 14mm
Percentage waste to materials supplied	10%	3%
Tidiness of the area	The whole site is in a mesh, a lot of architects's instructions to remedy work and the area not satisfactory (85%)	Very neat size and well programmed (20%)
Total number of instructions given by team leader	15	6

With the ideas obtained from the study, we now compare output and performance according to the recognised levels of participants.

Labourers

1. Labourers with basically no educational background have been found to be less concerned with the quality of work, instead, they are more interested in the quantity. This is perhaps the result of the mode of payment on most Nigerian sites - concerned with the quantity of work done e.g. mixing of concrete.
2. Labourers with no educational background usually do not recognise the importance of dimensional accuracies, and sequencing of work, especially in some technical works e.g. trench excavation.

Operatives

1. Initially, the output of an educated operative is quite low; he is not yet acquainted with the use of basic tools. Thus, it is difficult to start off.
2. Educated operatives are found to be more conscious of and more accurate in dimensional measurements.
3. Educated operatives in some cases may go beyond their field of training e.g. a blocklayer with formal training may learn how to take levels with instrument or fix reinforcement on site.
4. Uneducated operatives with practical experiences are less conscious of the waste of materials.
5. Uneducated ones with experience are less productive. They take a longer time to carry out an operation. They are less conscious of the need to clean and maintain their area of work, tools and equipment on site e.g. the operator and hoist, the concretor and concrete mixer. They are more interested in the quantity of work done particularly where quantity is stressed in the method of payment.

Leaders
(Foremen/Manager/Employer/Director)

1. Educated leaders at the initial stage may not be conversant with practical problems because he is yet to face real life application of the theories learnt at school.
2. Leadership roles by the uneducated is usually by examples, whereas the educated ones often give instructions and orders instead of practicalising. The former is bound to be more productive as the worker groups the message better.
3. When educated, they have theoretical background of management principles. They therefore manage better, particularly when combined with experience.
4. Educated leaders are found to be more technical in their approach to practical problems on site e.g. they can apply the result of work study or motion study conducted.
5. They often understand human psychology and behaviour better and appreciate variances according to particular situations.
6. Uneducated leaders find it more difficult to tackle unusual problems, due to his narrow scope of knowledge.
7. The educated leaders are more efficient in their executory functions. They do a piece of work in a short time. They adopt a more logical sequence since they really understand what they are doing.

4.2 Limitation

It should be noted that this topic delves much into human behaviour. Besides, knowledge and output usually depend on hardwork and discipline. All these vary diversely with individuals.

Again, much information was obtained through interviews, and is thus subject to individuals' bias.

4.3 Deductions

From the analysis so far, it is observed that:

(a) Both systems are necessary for all categories of workers in the achievement of a desirable standard. Practical experience usually acquaints one with real life situations while building education furnishes the fundamental principles to be used in dealing with them.

(b) Though both systems have their relative advantages, each has its problems which are the advantages of the other.

(c) Building education ensures more efficient production, particularly when backed up with practical experience.

5.0 Conclusion

Thus, both systems have their virtues and vices, and neither is sufficient as the sole process for acquiring knowledge necessary for optimum production. Practical experience can therefore not be an adequate substitute but rather an adequate complement to building education. It should be noted that practical experience could be a substitute, as obtained in Nigeria today up to the operative level, it cannot be an ADEQUATE *substitute*.

Recommendations

I therefore recommend the following:

(a) Building education should be integrated with adequate industrial working experience. This should come up at regular intervals during the process of training. I recognise the efforts of Government in this regard by setting up the Industrial Training Fund (ITF) programme by Decree 47 (1971). But I still believe that more life should be injected into it. The various school authorities should grade the programme as a way of getting the students to be serious.

(b) Workers on site, particularly the labourers and operatives, should be regularly instructed on the basic rudiments of and procedures for their jobs. The frequency should depend on the nature of the job, *PROBABLY* once a week. The instructor should be knowledgeable.

(c) Besides on-the-site training, construction firms should send their workers out for in-service training or to industrial and management schools for occasional studies/lectures/seminar. This is most suitable for supervisory and managerial staff.

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Historical Development of Apprenticeship System and Nigeria's Experience

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ABSTRACT:

Apprenticeship system has been in existence for over 4000 years. And since then, it has contributed more to the training of manpower of various cadres, than any other method of training ever instituted anywhere in the world to train skilled workers. Since its existence, the system has changed from its humble beginnings to what it is today. It is on record that the changes it had undergone so far, has always been for the better.

In both the developed and developing countries of the world, where the system had existed in whatever form, it had always retained those same basic characteristics with which the system had always been known.

As old as the system is, it remains one of the most sound and effective means of training skilled workers, especially technical skilled workers. This paper will attempt to trace the system's historical development since inception, and then highlight its short existence so far in Nigeria.

Introduction:

The institution of Apprenticeship has been an important educational process since the beginning of history. Like any other human institution, it has flourished in one form or another. By definition, it is a voluntary system of training in trades that require a diverse range of skills and knowledge, as well as maturity and independence of judgement. It involves planned, day-to-day training on the job and experience under proper supervision, usually combined with technical studies in subjects related to the chosen trade. The concept of apprenticeship, according to Liepmann (1960) is characterised by the quality of its nature, in which the apprentice is both learning and earning, and the employer is both training and paying him or her for productive work. In this way, it forms part of the systems of education and part of the economic system.

Regardless of what the concept of apprenticeship is, experts agree that experience over the years has proven that there is still great demand for apprenticeship training. In the opinion of these experts, many kinds of ambitious schemes for quicker production of skilled workers have been devised in place of apprenticeship, and given a fair trial only to be discarded and discredited. It is on record that those with the most extensive and successful experience in meeting the trained manpower problems of their respective countries are just unanimous in strongly asserting that apprenticeship is still a sound and effective method of training skilled workers. Meany (1977) emphasized the effectiveness of apprenticeship as a sound method of training skilled workers, when he stated that "Nothing else can give workers so wide a range of skills, and so thorough a mastery of their trade as the combination of classroom study and on-the-job training, under the eyes of uncompromising master craftsmen

and demanding employers, that they get as they move through the progressive stages of apprenticeship training."

There is no doubt that in today's technological age, specific technical skills are required of our youths, and that those who enter and complete apprenticeship training, will contribute immensely to the economic development and growth of their respective countries, thereby becoming self-reliant.

The Federal Government of Nigeria must have recognized this fact, which was why in 1978 through one of its agencies, the Industrial Training Fund (ITF) has commissioned the study of the state of apprenticeship training in Nigeria. It was the result of the study, and the acceptance there of its findings, that led to the eventual establishment of the scheme in the country in 1983.

Historical Development of Apprenticeship Scheme

It is on record that apprenticeship scheme has been in existence for well over 4,000 years. As far back as 2100 B.C., the Babylonian code of Hammurabi recorded the existence of apprenticeship. The code according to Handcock (1920) stated that "If an artisan take a son for adoption and teach him his handicraft, one may not bring claim against him. If he did not teach him his handicraft, that adopted son may return to his father's house." This reference to the Babylonian code, according to Douglas (1968) was significant in two ways. Firstly, the fact of codification proved that apprenticeship scheme was at that time in an advanced state of development, and had already existed for a considerable length of time. And secondly, it appeared that the status of master (employer) and apprentice was that of "father" and "son" relationship.

In Europe, apprenticeship scheme was in existence as early as 12th and 13th centuries, and was under the control of the craft guilds at the time. During this period, no master was allowed to take more apprentices than he could properly train. The method of training was rigidly prescribed usually in a written contract or indenture. In America, apprenticeship scheme began when craft workers from Europe brought with them the old practice of indenture, and the system of master-apprentice relationship. During this period, only responsible masters, were permitted to take on apprentices, since the primary purpose of the apprenticeship was the adequate and proper training of the apprentices (ILO 1938). To make sure that young apprentices were not misused and maltreated, agreements were reached only with those masters who owned their own homes and shops. For the apprentices, whose average ages were twelve years or thereabout, were required to be of good behaviour, in good health and physically fit for their intended trade. They were bound by the apprenticeship contract, which was usually fixed at from four to seven years. The reason for the long period of apprenticeship was that if protected the existing craftsmen from an over supply of skilled workers in their respective trades. It was also that the apprentice will have thorough mastery of his chosen trade and of being able to be classified as a master craftsman.

The apprenticeship contract during this period established the relation of the master and the apprentice. The contract specified the trade to be taught, the length of the period of apprenticeship, and the agreed terms as to payment of any stipends or wages. The apprentice must agree to serve his master obediently and faithfully according to a carefully specified ethical code, throughout the period of the apprenticeship training. And the master must equally agree to teach the apprentice the trade, and to provide food, shelter and adequate clothing. The contract agreement often provided that the master teach

the apprentice how to read and write, and that on completion of the apprenticeship training, the master was to provide him with clothing, money and tools to start on his own the acquired trade.

The Effect of the Industrial Revolution:

The apprenticeship scheme changed with the coming of the industrial revolution. According to Mays (1927) not only was the old type apprenticeship scheme destroyed, but the whole system of social and economic organization was also affected. The early system of domestic apprenticeship in which the apprentice lived with the master and depended on him for food, clothing and shelter disappeared. The system of handicraft began to be replaced by the factory system and its consequent division of labour, in which an individual no longer made an entire article all by himself. The need for highly skilled help started to decline and in its place arose a need for cheap labour. The introduction of machinery during this period put an end to most of the craft guilds and equally a decline in apprenticeship training.

As a result of this decline, the previous compensation with board and lodging provided by the master was replaced by employers of labour with the payment of wages, which were very small compared to today's wages. The term "master" however was continued in some trades and "master - machinist" and "master - printer" were still familiar terms.

Apprenticeship Training in Nigeria:

The above was the state of apprenticeship, and the subsequent impact of the industrial development revolution which decidedly led to its decline, but not to its outright demise. Since then, the system has resurged in one form or another in both the developing and the developed countries of the world, including Nigeria.

In Nigeria, the idea of the first formal National Apprenticeship Scheme was mooted in 1978, in apparent recognition of the fact that apprenticeship is still a sound and effective method of training skilled workers. The Industrial Training Fund (ITF) is credited with this idea, when in 1978, it was commissioned to study the viability of apprentice training. The study identified training inadequacies in the few existing apprenticeship facilities, and therefore made a case for the establishment of the National Apprenticeship Scheme.

In 1983, the scheme was formally established to ensure a systematic approach to the recruitment and training of apprentices, which would be relevant to the job to be performed by the trainee; the integration of practical skills with theoretical content; the establishment of national standard that would be responsive to changes in the techniques, materials and methods of production; then the forecasting of manpower needs and supply, and training processes and procedures that are generally more employment - oriented.

The scheme according to the decree establishing it included policy statement with the following features:

(i) Recruitment and selection of apprentices

(ii) Contract of Agreement

(iii) Probationary period

(iv) Termination of contract after completion of probationary period.

(v) Extension of contract of Apprenticeship

(vi) Wages and conditions of employment

(vii) Modular approach of training

(viii) Progress reports by the training institution

(ix) Transfer of apprentices

(x) Progress reports by the employer

(xi) Training records

(xii) Employment oriented training programme

(xiii) Types of apprenticeship

(xiv) supervision and control of apprenticeship by the Industrial Training Fund (ITF) and Industry

(xv) Inspection

(xvi) Performance test,and

(xvii) Certification.

The above features conform to the basic standards typical of any formal apprenticeship scheme found in the other parts of the world. And when fully implemented would put Nigeria's scheme at par with those of the rest of the world.

Towards this end, the Industrial Training Fund (ITF) translated the policy statements on these issues into concrete actions and established the Vocational and Apprenticeship Training (VAT) Department in 1984 and charged it with the responsibility to:

(i) Establish national training standards for all craft apprentices employed in industries

(ii) Promote and develop systematic craft apprenticeship training programme in industry thereby strengthening the existing apprenticeship system;

(iii) Meet the present and future training needs for skilled workers in the country; and

(iv) Create more job opportunities for people possessing the minimum educational requirements to undertake training in industry.

In response to the above demands, according to available records, the vocational and Apprenticeship Training (VAT) Department has practicalized the policy issues as embodied in the following operational activities which it performs:-

(a) Institutionalized Apprenticeship

The Vocational and Apprenticeship Training (VAT) Department established and operated two institutionalized apprenticeship centres, one at Ikeja, Lagos, and the other at Kano. The one at Lagos, Ikeja Vocational Training Centre (ITC), recruits and trains apprentices for a three-year programme (including one-year job experience attachment), while the one at Kano, instructor Training Centre (ITC), recruits and trains foremen, supervisors and/or managers in the industry and prepares them to train their subordinates or apprentices on the job.

(b) Promotion and co-ordination of Apprentice and other Skills Training in Industry and Institution

The Industrial Training Fund (ITF) through the Vocational and Apprenticeship Training (VAT) Department promotes, co-ordinates and monitors apprenticeship by programmes in companies nationwide. The field work is accomplished by trained apprentice field officers who man VAT Units at ITF Area Offices. These apprenticeship experts appraise the training resources in existing apprenticeship outfits in companies to determine their suitability and make recommendations for improvement. In addition, they appraise companies, which have no apprenticeship programmes, to identify their potential for possible installation of viable apprentice training programmes. Thus they either appraise and harmonise existing apprentice training programmes for approval and registration by the Industrial Training Fund or install fresh training programmes in the industries.

(c) Instructional Techniques:

The Vocational and Apprenticeship Training (VAT) Department has developed a wealth of instructional packages and implements the same for the benefit of instructors, foremen, supervisors and managers

in industry and institutions. The most popular ones include:-

(i) Systems Approach to Skills Training (SAST)

(ii) Supervisory and Instructional Skills Course (SISC)

(iii) Instructional Skills Development Course (ISDC)

(iv) Metal Machining and Welding Skills Instructors Course (MMWSIC)

(v) Co-ordinating Instructors Course (CIC)

(vi) Electrical Engineering and Instructional Skills Course (EEISC)

(d) Vocational and Skills Development Activities

The Vocational and Apprenticeship Training (VAT) Department has also developed training packages in some specialized trade areas, geared towards skills upgrading/broadening for the apprentice labour force in industry. Some of the available packages include

(i) Electrical/Electronics Skills Course (EESC)

(ii) Auto Mechanical Course

(iii) Auto Electrical Course

(iv) Fitting/Machinery Course.

The above courses being offered by the Industrial Training Fund can be considered good, but not broad enough to cater to the varied interests of our youths, who may like to take advantage of the existence of the apprenticeship scheme to acquire some form of skill in one trade or the other. The best thing the fund should have done, would have been to increase the number of its apprenticeable trades, as is done in the other parts of the world, to create more chances for our youths and some of those adults who may be interested in acquiring some technical skill.

The National Apprenticeship scheme is old enough for its impact to be felt by now throughout the country. But from indications, it seems that only very few people are aware that it even exists, let alone take advantage of its programme. It may be because the Industrial Training Fund is saddled with other responsibilities that it hasn't got enough time to organize itself for proper and effective implementation of the programmes of the scheme.

Conclusion:

Apprenticeship system has come a long way since its inception many years ago. As old it is, the system remains one of the most viable means of training skilled technical workers. This fact is more so in the developed countries of the world than in the developing ones. But here in Nigeria, the Industrial Training Fund (ITF), the agency charged with organising and implementing the scheme has so far not given it the attention it deserves. In fact there is no indication to the best of my knowledge, that it is going to do more than it has already done, or it is presently doing to let people know that the scheme is in existence and what services it can render to them. This assertion is based on the fact that the newly established National Open Apprenticeship of the National Directorate of Employment (NDE) has gained more popularity than the National Scheme established since 1983.

Furthermore, if the National Apprenticeship Scheme was doing properly what it was supposed to do, I doubt whether there would have been need for the establishment of the National Open Apprenticeship Scheme (NOAS) by the National Directorate of Employment. This is because it is duplication of effort on the part of the Federal Government, but most importantly, a waste of Nigeria's scarce financial resources.

If the pace at which both schemes are moving, is anything to go by, I would suggest that one of them be scrapped entirely, or both be merged into one agency, and independent of either the National Directorate of Employment (NDE) or the Industrial Training Fund (ITF). The new agency would then be re-structured to effectively cater for our National Apprenticeship in all its ramifications. Once the new agency becomes operational there is no doubt that Nigeria would be on its way to realizing its dream of becoming a self-reliant nation by the end of this century.

In the opinion of this writer, Nigeria has reached that state of development that it can no longer afford to grope in the dark while other nations of the world forge ahead technologically into the 21st century.

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Three-Axis Cluster Curriculum Model for Displaying Scope and Sequence of Knowledge and Skill Components

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ABSTRACT

The study used a Three-Axis Cluster Curriculum Model for sequencing and depicting knowledge and skills of sheet metal skilled workers in Taiwan. Six sheet metal related occupations were included in the first phase; knowledge and skills are identified in the second phase; and skill or knowledge depth is depicted in the third phase. Each phase can be analyzed by statistical analysis between what is taught in schools and what is expected of employees and supervisors.

In Taiwan, industrial/vocational education is the main source for cultivating skilled workers for industry. Since 1953, Taiwan has had six terms of economic development plans. The purpose of these terms has been to change the economic structure of the country from an agricultural to an industrial emphasis. In order to supply the tremendous number of skilled workers needed to reform the country's economic structure, the United Trade Training Curricula were announced by the Ministry of Education R.O.C. in 1955 and implemented in Industrial/Vocational Senior High Schools. Since then, industrial/vocational education has played an important role in developing manpower resources in Taiwan. In 1980s, as a result of the second petroleum crisis and economic competition from other developing countries, Taiwan's economic situation changed rapidly. In order to meet the challenge of the international economic impact, the government attempted to improve the promotion of industries. According to the government publication "Long-term Economic Outlook for Taiwan, R.O.C." the development of heavy industry and high technology were emphasized from 1974.

In 1986, the Ministry of Education again amended the industrial/vocational education curricular standards in order to meet change in the economic structure of Taiwan. In the new curricula, there are five families of occupational clusters: mechanical, electrical and electronics, construction, chemical, and industrial arts, with the mechanical family being sub-divided into four departments: machine working, foundry working, auto repairing, and sheet metal working.

The question arises as to how the occupational clusters as well as departments within the clusters were decided. Comparing the job contents of sheet metal working to the job description listed in the Dictionary of Occupational Titles, it becomes apparent that many occupations are involved in the sheet metal industry. Among these are auto body repairing, sheet metal furniture manufacturing, ship building, air-conditioning, welding, cold metal working, and industrial piping. Since the sheet metal industry includes many occupations, is it necessary that it become one of the departments under mechanical cluster,or

should it become a cluster by itself? Or perhaps should it be only a training unit? All of these topics have been debated by teachers, industrialists, and curriculum specialists. This indicates that the curricula have some problems. The most significant of which are what knowledge students should study, what skills they should acquire, and what experiences they should have.

Since learning experiences must be put together to form some kind of a coherent program, it is necessary to organize learning experiences into units, courses, and programs. Tyler (1949) notes that "In considering the organization of learning experiences, we may examine their relationship over time and also from one area to another. These two kinds of relationships are referred to as the vertical and the horizontal relations" (p.85). In order to organize the curriculum for the sheet metal department in high schools, it is necessary to consider the vertical and horizontal relationships. Regarding the vertical aspect, different occupations in the same trade family may require different depths of skills and knowledge although they are concerned with the same operations. Regarding the horizontal aspect, during their limited time in school, what should students learn for the sake of obtaining employment? Johnson and Taylor (1974) indicated that there are three major categories of decision in educational planning: What is to be taught; why it is to be learned; and how it is to be taught. Newmann (1988) stated that most of the school curricula tend to focus on two general questions. First, are students studying the proper content? Second, what are the best ways to organize and teach a given body of content to certain groups of students? He asserts "regardless of what we teach or how we teach it, we try to teach too much" (p.346).

Curriculum concepts that deal with both vertical and horizontal relations and Balance and articulation. Hunkins and Ornstein (1988) indicated "Balance refers to assigning the appropriate weight to each aspect of the curriculum design" (p. 52). They said "A balanced curriculum is one in which students have opportunities to master knowledge and to internalize and utilize it in ways that are appropriate for their personal, social,and intellectual goals" (p.52).Ornstein (1988) recognized that the picture of irrelevant curriculum raises questions about the way we organize the curriculum. He emphasized that the educator should identify the context of the curriculum.

Three-Axis Model

The Three-Axis Model for depicting and sequencing knowledge and skill components was shown in Figure 1. Occupations under a specific cluster family can be described in the first level. Theoretically, each occupation needs specific knowledge and skills. Skills and knowledge under particular occupation can be analyzed as different items according to their difficulty. This study analyzed skill or knowledge differences among the occupations, and skill difficulty differences among occupations.

The Objectives

Based on the Three-Axis Model, the objectives of this study were:

1. To identify the occupations involved in the sheet metal industry in Taiwan and the relationships among them,
2. To identify skills and knowledge pertaining to the sheet metal industry that are taught in industrial/vocational senior high schools.
3. To identify occupations available for students graduating from the sheet metal departments of industrial/vocational senior high schools.
4. To identify curriculum development trends in the sheet metal department, and

5. To develop a research model for educational administrators of the government to use in investigating training needs of other industries.

The questions

The questions considered in the study were:

1. Between teachers, skilled workers, and supervisors in the sheet metal field, are there different opinions regarding skills and knowledge?
2. Are there different skills and knowledge requirements among sheet metal related occupations?
3. Are there different levels of complexity of knowledge among sheet metal related occupations?
4. Are there different emphases on particular skills and knowledge related to sheet metal industry that are taught among industrial/vocational high schools?
5. Are there different skills required by employees among the sheet metal related industry, compared to those that are taught in schools?
6. Is there different knowledge required within sheet metal related industry by employees, and what is taught in schools?
7. Is there any skill or knowledge trend within sheet metal related industry?

Data Collection

A questionnaire was developed for gathering data for this study. The instrument consisted of three parts. The first part was devoted to personal information which contains different items depending on the subjects. Second part dealt with the skill perception; and the third part was employed in order to measure the respondents' perceptions toward the value of items. Each response employed five scales. The subjects included teachers, supervisors, and skilled workers who were employed in Taiwan during the spring of 1990. The use of a mailed questionnaire was the method of data collection employed in this study. A sample of 263 respondents provided the usable data for this study. The composition of this sample included 69 teachers, 59 supervisors, and 135 skilled workers. Regarding the distribution of the respondents by occupations, 69 respondents (26.2%) were teaching sheet metal programs; 88 (33.5%) were working in the general sheet metal occupation; 35 (13.3) were working in the auto body sheet metal occupation; 12 (4.6%) were working in the sheet metal plastic forming occupation; 29 (11.0%) were working in the platemetal cold working occupation; 27 (10.3%) were working in the welding working occupation; and 3 (1.10%) were working in piping or plumbing occupation.

Data Analysis

The data from the returned questionnaires were coded. Using the computer program, Statistical Analysis Systems (SAS), each hypothesis was tested. An analysis of variance (ANOVA) was employed to test Null Hypotheses 1, 2, 3, 4, and 8. If there was a significance, the Scheffe's Multiple Range test was used to test differences between groups. Student's t test was applied to test Null Hypotheses 5 and 6. A correlation coefficient matrix of the response was employed in order to indicate the overall trend of curriculum development.

Finding and Conclusion

Null Hypothesis 1

No significant differences in skill breadth will be found among the occupations related to the sheet metal industry.

Conclusion 1

The findings indicate that the breadth of

skills are quite different among sheet metal related occupations. Regarding the skills needs for resistance welding, platemetal cold working, and sheet metal pressworking skills, the sheet metal industry can be separated into two industries: light gauge and heavy platemetal. The ratings of the means for soldering and brazing skills are very low as perceived by all occupations. Neither seem to be necessary skills in the sheet metal industry. The skills of auto body working occupation, which implies that auto body working skills are unique expertise skills and not necessary for other occupations. Arc welding skills are very important in sheet metal related industries. So emphasis on arc welding skills in the Curriculum Standards is appropriate.

Null Hypothesis 2

No significant differences in knowledge requirements will be found among the occupations related to the sheet metal industry.

Conclusion 2

The finding indicates that the presented knowledge in this study was not perceived to be different by all sheet metal industry occupations. Therefore, the Null Hypothesis was retained. On the other hand, knowledge of sheet metal plastic forming and piping and plumbing received relatively low means. The conclusion can be drawn that the courses provided in schools may be too broad.

Null Hypothesis 3

No significant differences in skill difficulties will be found among the occupations related to the sheet metal industry.

Conclusion 3

Based on the findings, there is sufficient evidence to reject the Null Hypothesis. The overall means of all item responses regarding the skill needed to perform the job show that the following items consistently received high scores from the respondents:

1. Sheet metal bending.
2. Parallel line development.
3. Thin plate butt gas welding.
4. Gas cutting.
5. Flat position arc welding.
6. Horizontal position arc welding.
7. Vertical position arc welding.
8. Corner joint arc welding.
9. Pipe arc welding.
10. Gas tungsten arc welding.
11. Gas metal arc welding.
12. Bending in press working.
13. Drawing in press working.
14. Heavy gauge metal layout and cutting in cold metal working.
15. Heavy gauge metal forming in cold metal working.

This evidence shows that the above 15 items should be emphasized in school programs.

On the other hand, the following items consistently received low scores from respondents:

1. Rivet working.
2. Advanced sheet metal stretching and compression wrinkling.
3. Submerged arc welding.
4. Heavy gauge metal complex layout and forming.
5. Soldering and brazing.
6. Spinning in press working.
7. Welding destructive inspection.
8. Welding x-ray inspection.
9. Welding ultrasonic wave inspection.
10. Other pipe inspection.

This evidence shows that the above 10 items can be de-emphasized in school programs.

Null Hypothesis 4

No significant differences in skill difficulties will be found among skilled workers, supervisors, and teachers.

Conclusion 4

Based on the results of the analysis, there is sufficient evidence to reject the Null Hypothesis. Scheffe's tests for all significant F-values indicate that the ratings of the teachers are significantly higher than those of skilled workers and supervisors. Teachers may teach all phases of sheet metal skills, and they may retain greater depth of skill proficiency. Two other reasons may explicate why teachers teach too broadly and too deeply: the curriculum may be too difficult, and teachers may not recognize precisely what the industry needs.

Null Hypothesis 5

No significant differences in skill breadth expectations will be found between the sheet metal industry and courses in schools.

Conclusion 5

Based on the results of analysis, there is sufficient evidence to reject the Null Hypothesis. Skills of general forming, development method, and soldering and brazing are overemphasized in the school curriculum. Skills of soldering and brazing were not perceived as necessary in all sheet metal related occupations, and could be, therefore, de-emphasized in the curriculum standards. The skills of arc welding are emphasized most among all skills for the sheet metal related industry.

Null Hypothesis 6

No significant differences in knowledge will be found between what is needed in the sheet metal industry and the course taught in schools.

Conclusion 6

Based on the results of the analysis, there is sufficient evidence to reject the Null Hypothesis. Respondents from the general sheet metal working and the auto body sheet metal working occupation believe that mechanics need not be emphasized. It is believed that the very small difference in knowledge among the needs of occupations does not present any problems for educators in terms of curriculum development.

Null Hypothesis 7

No significant opinion differences will be found in the correlation coefficients among different kinds of skills.

Conclusion 7

Based on the results of the analyses, the Null Hypothesis was rejected. Most sheet metal occupations have consistent skills, meaning that the sheet metal department graduates who want to find jobs in particular occupations, should attain some particular cluster of skills.

Null Hypothesis 8

No significant differences in knowledge opinion will be found among skilled workers and supervisors and teachers.

Conclusion 8

Based on the results of the analyses, there is sufficient evidence to reject the null Hypothesis. Scheffe's tests for all significant F-values indicate that the ratings of the teachers are significantly higher than those of skilled workers and supervisors. These results are similar to those found regarding Null Hypothesis 4.

The evidence also indicates that knowledge of automatic manufacturing and of

the use of appropriate materials received higher ratings from supervisors. These results may indicate future trends within the sheet metal industry.

Summary

It is critical that a curriculum in any occupational area is periodically updated by using primary sources of information input from both employees at the work place and what is being taught in schools. There should be a high degree of congruency between the knowledge and skills taught in schools. More sophisticated documentation and statistical analysis can be used to maintain a dynamic curriculum which is responsive to changing requirements at the workplace. It is the goal of all vocational teachers to keep their vocational programs relevant and appropriate through careful planning, revision, and renewal. Not only must teachers heed the priority identified by Bright (1990), when he stated:"A regular assessment of each program we offer should include input from the business we train workers for" (p.10). We also need to assess what we teach and how well aligned are the needs of industry with what is being taught in schools. This was the major goal of this study.

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Polytechnic Teacher Perception of the Worth of Polytechnic - TTTI Interactions

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ABSTRACT

The study reveals the opinion of teachers of polytechnic regarding the adequacy/appropriateness or otherwise in respect of interactions through specific programmes mounted by the TTTI for the quality improvement of polytechnic education and also interactions with the TTTI in respect of specific tasks and function of the polytechnic. It is observed that most teachers are positively satisfied in respect of long-term and short-term training programmes of the TTTI. They are also appreciative of the TTTI services in terms of polytechnic teaching and evaluations, self development programmes, curriculim development, Community Polytechnic work and Modernisation, but opine that such services coud be expanded. They also feel that the TTTI can render useful service regarding guidance and counselling of polytechnic students. There is a general lack of awareness of other areas of activity and services undertaken by the TTTI e.g., Research, Media Development etc.

The study suggests further investigation into the polytechnic realities and value perspectives so as to make the TTTI programmes and services more meaningful and acceptable.

INTRODUCTION:

TTTI Calcutta was established twenty five years ago with the main objective of training teachers for employment in polytechnics. Subsequently the programmes were converted to train in-service teachers. Other support services, e.g. curriculum development and resource development programmes were also instituted. Long-term programme were broken in modules, short-term programmes and inhouse programmes held at polytechnics became more popular. Consultancy and extension services in institutional planning, modernisation, community services etc., were demanded more frequently. Action Research became an inbuilt tool to improve programmes and services.

All these services have been taken up assuming certain needs in polytechnics, perceptions of officials and experts and experience of similar institutes in other countries.

Although the target population is mainly the teachers of the polytechnics, administrators and funding agencies are often involved in many of the activities of the TTTI. They too, like the professional staff at the TTTI, need to know to what extent such programmes and services are meaningful and effective at the operational level, i.e. the class rooms of the polytechnics.

Polytechnics are now increasingly being

asked to take intiative and responsibility for their own development, qualitatively and quantitatively. Modernisation of resources, addition of new programmes of instruction and enlarging its role beyond teching and training, e.g. interaction with the industry, community, development of learning resources etc. are some of the programmes planned by them for funding under the World Bank assistance project. All these developments indicate that the polytechnics are turning round the corner and a more mature relationship has to develop between the TTTIs and them, accepting mutual influence and understanding in shared goals. This means that the TTTI has to exhibit greater awareness and understanding of the issues and concerns, realities, contexts and values of the user organisation, so that the services are received and utilized with satisfaction and a sense of growth and well-being.

This study therefore aims to look into the self perception of worth of interaction with the TTTI at the polytechnic level. This will also help establish legitimacy and propriety of various types of interaction towards the development and quality improvement of polytechnics and suggest change/augmentation of programmes for greater acceptance/utility.

Earlier Studies:

Meaningful staff college roles have been suggested by Glatter (1972), and Havelock (1969) suggests models of meaningful interaction in the dissemination and utilisation for the purpose of innovation and development. Essentially they advocate a top-down Research, Development and Dissemination perspective (Scholar Science driven) linked at various stages with the bottom-up problem solving strategy (user-need driven).

All the activities of the TTTI are included in the scheme of things in a systematic manner. The Review Committee for the TTTIs (GOI, 1972) institutionalised modular programmes and various types of inservice courses of short duration with focus on extension work, so as to make the contribution of the TTTI programmes and services more relevant to the need of the time.

In an Inter TTTI research project coordinated by TTTI Bhopal (1980), impact of TTTI programmes in the quality improvement of polytechnics was studied. It was found that polytechnics having high collaboration with the TTTI (having greater interactions) did better.

The cause of high collaboration could however be the initial enlightenedness of the management which in turn resulted in better achievement. The effect of such other factors and possible collaboration with other agencies could not be investigated.

In another Inter TTTI study coordinated by TTTI Calcutta (1982) regarding the preferred competency needs of teachers, it was seen that the teachers were more interested to learn about preparation and use of instructional aids and media rather than improvement in the basic teaching-learning process, e.g. class room questioning, teaching-learning strategy development etc. However almost 94% from the Eastern Region preferred to participate in the in-service programmes of the TTTI and 71% preferred to participate in long-term programmes. The demand for programmes in educational management, research and industrial training was very low.

However, in another study jointly undertaken by TTTIs at Calcutta and Madras (1988) showed that significant transfer of competency from training to practice takes place in areas of competency such as classroom questioning. The gain in the practice situation is even higher than the indicated achievement shown by the pretest-post test measures during the training phase. However, such gains were insignificant

where additional external efforts and support services were needed, e.g. using assignments and class room testing. Another interesting finding in the study is that the teachers who made substantial effort to improve their performace and significantly gained during the programme, did not attribute their gain in competency to the training programme when interviewed four months later, although they opined that such programmes are useful for their other colleagues.

This indicates that opinions per se may be deceptive, unless supported by other objectives measures.

Research Questions

The teachers are the main agents through whom all the developmental and improvemental efforts are tested and implemented. Consequently, their satisfactions, frustrations, miseries and confusions in the process need to be accepted as a reality which influence the process. Often these are more important than the intrinsic worth of the programme or service for its acceptance in the first place. The TTTI, having institutionalised itself as a service organisation to provide what is necessary and what it can, in a user-friendly manner, must be alive to all such realities.

With this assumption, the investigators were interested in the following issues.

I. TTTI - Polytechnic Interactions:

a. To what extent the teachers are facourable to individual programmes of the TTTI ?

b. Which of the programmes are seen as useful but inadequate in quantity or quality ?

c. Which of the programmes are less visible and /or seen as not useful ?

II. Polytechnic - TTTI Interaction.

a. To what extent the service of TTTI is seen as useful and adequate in specific tasks/functioning of the polytechnic ?

b. In which tasks/functions of the polytechnic the service rendered by the TTTI is seen as useful but inadequate?

c. In which tasks/functions of the polytechnic the service rendered by the TTTI is less visible and/or not seen as useful ?

Method/Design of the study:

The plan was to use a mailed questionnaire addressed to all polytechnics with the request to the Principal for sending them back after these are filled in by the teachers.

To develop the questionnaire, elaborate lists of TTTI service roles and polytechnic tasks and functions were developed at the TTTI in consultation with the TTTI faculty and a few senior polytechnic teachers. However, further field tests in two polytechnics were undertaken to find out which of the categories of TTTI service roles and polytechnic tasks and functions were important to the group of teachers as a whole (so that they would like to report about them) and in what way they might react to them regarding the worth of interaction in these categories. The final form includes three level codes of positive satisfaction, two levels codes of unfavourable reactions, one (two for polytechnic tasks) response code regarding inadequacy and one response code for lack of visibility/not perceived as useful.

The date processing was done in an inhouse PC.

Limitations of the method:

The inherrent limitations of the mailed questionnaire method also apply to this study. The sample of respondents may be biased in that they feel more concerned. Teachers not responding may choose not to respond either

because of their lack of concern or felt it undesirable to give negative responses, of which there will be no way of knowing. However, as the programmes and services are invariably aimed at persons who volunteer on their own accord, the responses should indicate the preferences of these people who care to let the investigators know what they want. If the number of responses are adequate, this will yield useful information for the purpose of the investigation. Experience of similar studies in marketing research etc. also corroborates this view.

Results:

112 teachers from 18 polytechnics out of 65 returned the questionnaire. 54 of them were in 7 community polytechnics, 13 teachers were from 3 polytechnics having part-time evening courses. 44 from 5 polytechnics were exposed to inhouse programmes in pedagogy/resource development, held in their own institutes. About 8 polytechnics had interaction with the TTTI regarding modernisation and other centrally sponsored schemes. It is not known how many of them were actually involved in various programmes and services of the TTTI.

The state wise break up of the number of respondents is as follows:

Assam - 8, Bihar - 16, Manipur - 13, Meghalaya - 9, Orissa -10, Tripura - 3, West Bengal - 53.

Summary of the results of polytechnics teachers perceptions of the worth of TTTI - Polytechnic Interaction and Polytechnic - TTTI Interaction is shown in Table - 1 and Table - 2 respectively.

Interpretations and implications:

I. TTTI Service Roles - (TTTI - Polytechnic Interaction)

01. Long-term Degree/Diploma programmes:

84.8% marked codes 4 to 6. ($\bar{X}$ = 4.4375, S = 1.367), indicating a high consensus in favour of positive satisfaction.

It is to be noted that the percentage of Long-term trained teachers in the responding states are, Assam - 16%, Bihar - 5%, Manipur - 5%, Meghalaya - 10%, Orissa - 19%, Tripura - 7% and West Bengal 27% (Figures based on a TTTI study conducted in 1988). Although the present sample can not be taken as random, it is almost certain that the majority of the respondents did not personally undergo the long-term TTTI programme. This was confirmed by sample checks on the respondents of two polytechnics. In TTTI Calcutta Profile study (1982) which also used mailed questionnaire and had 165 responses from the eastern region, 60% of them did not have TTTI diploma and 20.6% did not attend any training programme/course, including short courses, summer schools etc. Therefore, the reason for such favourable response, must be the visibility and credibility of these TTTI programmes to the teachers of the polytechnic in general.

On the other hand if it is assumed that most of the respondents attended these programmes, so that they are commenting from their first hand experience, only about 15% say that these are either inadequate or unnecessary which is reasonable. It is known that perceptions of very senior and aged teachers may differ because of their higher level of competence/confidence, or fear of malevolence. Again, teachers who have performed poorly find the grapes as sour. These groups may influence others as well, who are indifferent. However, there is no way of knowing the characteristics of such respondents from the present study.

02. Short Programmes:

The responses are essentially similar to

long-term programme. However it can be assumed that most of the respondents have attended one or more of such programmes. Interactions in these programmes are most frequent as about 8000 participant - days per year (TTTI Calcutta Annual Report 1989-90) are involved in these programmes.

These programmes are specific content or skill based but there are no post-tests for the gain in competency, although a certificate of attendance is given. Since the number of courses are too many, not all courses are of the same quality. The demand for better quality could be increased if there is a post-test and associated recognition by their organisations for the career development of the participants. The experience of all course faculty at the TTTI is that end-of course feed back is always good for all courses and occasional disatisfactions mostly relate to claims of TA/DA, hostel conveniences etc. The profile study quoted earlier (1982) also finds a high demand for short programmes, although suggestions for suitable topics are rarely received when solicited. It appears that the popularity of these programmes is not necessarily due to their relevance to the need of participants/sponsoring organisations, or quality. Other reasons can not be inferred from the findings of this study.

03. Industrial Training:

The responses are widely varied ($\bar{X}$ = 2.75, S = 1.8233). Since the component of industrial training is only offered in one module as a part of the long-term programme, it can be assumed (vide 01) that majority of the respondents do not have personal experience of attending this programme, and they are responding from impressions they carry (developed through other interactions/experiences).

The TTTI is basically responsible for locating training places and programme development and the monitoring and supervision is left to the industry. Since the programme is less structured, it is found (through end-of programme feed back from participants) that the gain in competency and satisfaction are largely due to the individual initiative of the trainee and facilities for training available at the training organisation, which vary widely. In that context the responses seem reasonable.

Conventional wisdom suggests that a good background of industrial training/experience is necessary for becoming a successful teacher at the technician level, and nobody has ever disputed it. However, the profile study (1982) finds that about half of the teachers do not have any industrial training or experience. A study into the level of polytechnic-industry collaboration (TTTI Madras, 1982) shows that the index of collaboration for the eastern region is significantly lower compared to the national average. Therefore, there is a strong case for supporting/augmenting/improving this activity in collaboration with all agencies concerned.

04. Curriculum Development/Updating:

Majority of the teachers find that this activity is adequate. However many teachers feel that this activity is rather rare. This is reasonable because this is a client requested activity and such revisions are not demanded frequently. For West Bengal, the revision was undertaken in 1982/83. For Bihar and Assam, these were undertaken in 1978. A review of Assam curriculum was undertaken in 1987, and new curricula were developed recently for manipur only (in 1989). However, new curricula for specific courses, e.g., secretarial practice, librarian ship, electronic, instrumention, computer engineering, costume design etc. were developed during the period. This activity may become more frequent when polytechnic education takes to the path of development and growth through projectised support from the Govt/World Bank.

Even at the existing level of activity, it is gratifying to note that about 60% of the teachers find it useful and adequate though only a small section of senior polytechnic teachers and experts from indutry are involved at the TTTI in the preparation. It appears that other teachers as well, find this as a legitimate and worth while activity of the TTTI. Only about 10% (codes 1 and 2) find this activity as disturbing to them, which is reasonable, as curriculum change always requires updating of knowledge of teachers.

05,06 Instructional Materials and Media Development:

Ideas of teachers regarding usefulness and adequacy of these activities of the TTTI are varied. (05; $\overline{X}$ = 2.79, S = 1.816, 06; $\overline{X}$ = 2.93, S = 1.805). Contribution of TTTI Calcutta has been very limited in these areas in the recent past. The activities were at its peak in the 70's but it dropped because the products were not commercially successful, (except the text book on communication in English). The present activity is only limited to prototype development involving only a few polytechnic teachers. The production activities will be taken up by the Learning Resource Development Centres at the State levels as per plans submitted by them for World Bank assistance. From the study it is not possible to knwo as to what extent, the TTTI has been successful in developing such specific competencies in the polytechnic system. Perhaps special programmes for personnel engaged in this work at the state levels may have to be developed. Future TTTI based production will also have to be conceived in collaboration with the state level development centres to ensure the acceptability of the products. The All India Profile study (1982) finds that the competencies in the development and use of AV aids and learning materials have the highest demand. Therefore, there is a strong case for upgrading these activities including staff development.

07.08 Infrastructure Development/ Extension Service/Consultancy:

These mostly relate to specific needs regarding preparation of projects, selection of equipment, curriculum development etc., initiated through schemes of direct central assistance to individual polytechnics. Opinions of teachers in general vary regarding the adequacy and usefulness, as only a few senior teachers and administators are aware of such involvement of the TTTI. The TTTIs are however, not involved in the implementation of these projects, and as such it is difficult to assess the contribution of the TTTI in the outcome of the projects.

09. Facilitating Community Polytechnics:

7 polytechnics out of 18 in the sample have activities under the community polytechnic. Only a handful of teachers in each polytechnic are actually involved in the work and have experience of receiving TTTI services in this area. A recent All India Committee has evaluated the scheme and opined that total involvement of the polytechnic is needed, which is lacking at present. In that context it is gratifying to note that 47.3% of general teachers find the services as adequate and satisfying. This shows that this programme is quite visible and created an awareness in the entire polytechnic (48.2% of the teachers in the sample belong to community polytechnics). On examination of scores polytechnic-wise, it is found that teachers of polytechnics not having the scheme have mostly marked code-O, indicating absence of interactions, as expected. The impact of TTTI service in this area therefore exceeds expection. It may also indicate that there is a large need for help and support in this area in the polytechnics.

10,11 Research in Teaching/Media Development:

The fact that 38.4% and 24.1%

respectively have responded favourably to these areas of activity is surprising in the sense that only 2% of the teachers have some ideas in educational research activities through programmes conducted at the TTTI. Others are aware only as respondents to several studies like the present one. Results are often not disseminated at the level of the teachers and therefore reservations about the utility of such activities are quire reasoanble. Researchers in dissemination studies agree that all developmental activities in education should be supported by research base (Glatter 1972, Havelock, 1969). The fruits of research should therefore be widely disseminated so as to reduce uncertainty in the change and developmental activities. Research data should also be made available to policy makers.

12. Information Dissemination on Curriculua:

Here again, the general teacher at large has little interaction with the TTTI, since such materials are posted to the administrators only, often on demand. In that context, it is good to know that 36.6% of the respondents find such service as useful and adequate. Further studies may be needed to find the appropriate content and channel of dissemination, so as to create awareness and interest in the common teacher regarding availability of materials useful to them. Perhaps a news letter followed by information brochures will meet this need better.

II. Polytechnic - TTTI Interaction:

The results are shown in Table-2, summerising teacher responses regarding appropriateness/adequacy of the interactions with the TTTI regarding Tasks/Function of the Polytechnic.

13. Student Selection/admission/Norms:

The TTTI has been involved in developing selection tests for part-time students. 3 out of 18 polytechnics who responded (17% of the teachers) belonged to such polytechnics where these part-time courses are offered. Even so, 25% of the teachers find it adequate. Another 34% think the service is inadequate or want more of it. This shows that a significant number of teachers find the TTTI as a competent centre for undertaking this task. At the moment, the TTTI does not have adequate resources for a greater involvement in these tasks.

14. Student Teaching/Training/Evaluation:

Majority of the respondents are happy about such interaction. The TTTIs have conducted courses/seminars/in-house projects in these areas and it seems those were well taken in terms of converage and appropriateness. Only a few teachers doubt the competency of the TTTI in these areas.

15. Student Guidance/Counselling:

Interactions in this area is quite meagre, other than courses held at the TTTI. Yet, a large number of teacher either feel satisfied or want more of it. This is perhaps due to the fact that this is a real problem in the polytechnics and expertise is lacking in them. In the All India Profile study, this competency need ranks high (7 & 9 in a list of 35 competencies). TTTI has earned the credibility for rendering service in this area. This activity should therefore be strengthened and expanded, so that guidance and counselling cells in the polytechnic can be more effective in the context of autonomy of institutions as proposed under the World Bank Project.

16. Staff selection/Norms:

Very little has been done by the TTTI in this area, except working in committees appointed by apporopriate authorities in these regards. It is therefore reasonable to expect that the teachers are not mostly aware of such interations. Teachers may not be quite sure about the legitimacy/propriety of such services of the TTTI to the polytechnic. Even then,

there is some demand for such service (37.7%), indicating that there may be some dissatisfaction regarding the present situation and many teachers in distress look to TTTI for salvation.

17. Staff Training and Development:

Here again, (vide 01 & 02) teachers seem to be mostly satisfied in their interaction with the TTTI, but quite a few of them also demand more opportunities for such interaction. It can be concluded that the TTTI is seen as an appropriate and legitimate centre for staff development. In the All India Profile study also majority of the teachers (52.6%) desired to attend training programmes at the TTTI.

The TTTI has also from time to time, received representations/request for the training of staff other than teachers and there may be large demand for staff development of such categories, which has not been assessed.

18. Curriculum Revision/change:

The responses read with item 04, indicates that there is a large demand for such services and the teachers have a large measure of confidence about the competency of the TTTI in this regard.

19. Instructional Media/Materials:

The responses read with items 05 and 06 shows that there is a large demand for relevant materials. Whereas the TTTI initiated interactions did not always seem useful by many, majority of them want the assistance of the TTTI in their own programme of media development. The concept of learning resource development centre at the state level in collaboration with the TTTI, therefore seems more acceptable than strengthening the resources for production on a large scale at the TTTI.

20. Modernisation:

The fact that only 8% of the respondents question the utility of such interaction with the TTTI, shows that the TTTI has a large role to play in actively supporting such schemes of the polytechnics. This is a large component under the World Bank Project and the task is highly complex. Perhaps the four TTTIs should pull their resources together and collaborate with other agencies to make a meaningful contribution in this direction. Such collabortive action has already been initiated in working out the first phase plan of the World Bank assisted project for strengthening technician education in India.

21. Planning/Acquisition/Maintenance of Plant/Equipment:

The responses read with item 07, indicate that a large number of teachers do not feel that such interaction exists or would be useful. However, a significant number also feel that such interactions should increase. It is a fact that the TTTI has rarely been involved in such activities directly at the polytechnic level. Only a few requests for assistance of very specific nature were received from polytechnics regarding specification of items, source of supply, fabrication of experiemental set up etc., and the recepients of such advice seemed to have been highly pleased. Their number must be much less than 18.8%, who report that such services are useful and adequate.

22. Polytechnic Infrastructure Requirement/Norms:

The response pattern is similar to iterm 21, and the interpretations are also similar. The need for assistance in the planning and development of resources is frequently received and attended to. There is no instance, when such a service was demanded but could not be attended to. Therefore the response of 42.9% that more of such services should be

made available, is surprising. Perhaps, many of the intentions at the level of the teacher is not properly articulated and communicated to the TTTI, in the absence of policy support for such developmental activity.

23. Polytechnics' relation with Govt./AICTE etc.

Here again, there is a large demand for help, in addition to satisfaction expressed by a significant section. The TTTI is now strongly represented in the functioning of the ISTE, AICTE, State Councils, Governing bodies of polytechnics, executive and advisory committees of community polytechnics, QIP Centres, project Implementation units under the World Bank etc., and the teachers feel that the TTTI can bring to focus the reality at the polytechnic level and the cause of the teachers. Such a trust should be valued and preserved if the TTTI has to play its role effectively in the development of polytechnic education.

24. Polytechnics' relation with industries, parents, agencies, clients:

So far the contribution of the TTTI in this regard is very little, except for liaising with some industries on specific polytechnic based project of curriculum development, community development, establishment of industry-institute interaction programmes etc. Although many are not sure about the utility of such services from the TTTI, a large number (48.2%) again find it inadequate/want more of it. However, it is not possible to know to what extent the need for such services will expand in future.

Summary and Conclusion:

The TTTI has established its credibility most significantly in the area of staff development of polytechnics. The long-term and short courses are really popular and seen as useful.

As regards other service roles of the TTTI, the coverage has been rather limited. Yet, activities like curriculum development and facilitating community polytechnic were appreciated by many, although some of them did not have direct interaction in these regards.

In their own tasks, the teachers tend to want the services of the TTTI more frequently ($\bar{X}$ = 42.125%, S = 9.08, range 33.0% to 56.3%). It appears that the TTTI has aroused a large expectation among the teachers of the polytechnic regarding many aspects of their life and work in the institute. However, the TTTI should establish a more mature relationship at this stage and help the polytechnics to become responsible for many of the developmental tasks without being spoon fed by outside agents. Many of the support services, e.g. development of curricula, instructional materials and aids, should now be taken up by them to suit their own needs. The TTTI can also associate as a resource centre, as a consultant or in the process of staff development for such functions. This is a necessary condition for self reliant development.

It is gratifying to note that the teachers are very polite in their responses even where the TTTI did not perform, or where there is no way for the teachers in general to know about such services, e.g. research, media development, project planning, consultancy services, guidence and counselling etc.

Only about 6 respondents on an average (5.5%) indicated that the TTTI programmes and services to polytechnics are forced, one sided, had no substance or had a negative impact (codes 1 and 2).

Some teachers seem to report satisfaction even if they did not obviously have personal experience of that particular type of interaction. (The lowest is as high as 16.1% in one area). Perhaps, they are responding hypothetically on behalf of others

with the conviction that such interaction was useful. Are they the committed followers of the TTTI bandwagon?

The role of providing industrial training to polytechnic teachers is not seen as adequate although this is known to be very important. It remains an important issue as to whether the TTTI can improve it and to what extent.

Lastly, the dissemination role of the TTTI seems to be less effective, so far as the teachers in general are concerned. Teachers visiting the TTTI on specific purposes, do not really know what really goes on in other areas, except that they find most of the teachers are busy in work often other than teaching.

Periodic news letters, brochures for individual service roles, availability of and types of support services etc. may be brought out and widely distributed.

The benefit of research based knowledge in project planning and methods development should also be highlighted through publication of papers, monographs etc. and should be circulated to audiences who need to use them.

The study does not however reveal the realities and value perspectives of the polytechnic which determine their need priorities, and/or facilitate/hinder the acceptance of TTTI services and their utilisation.

Suggestions for Further study:

Further studies should be undertaken to find the extent of utilisation of the services received from the TTTI and to discover the factors which facilitate/hinder such utilisation. Many services have outcomes which are intangible, in the sense that an awareness or favourable attitude is intended to be created, by setting their realities in newer perspective. This is in essence the purpose of teacher education, the impact of which cannot always be measured quantitatively through the products. Ethno-graphic case study methods as is used in anthropology, may perhaps be used in such studies for an in-depth understanding of the processes involved.

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TABLE – 1

TTTI – POLYTECHNIC INTERACTION

	TTTI SERVICE ROLES	% POLYTECHNIC TEACHERS WHO FEEL IT IS (N = 112)		
		APPROPRIATE/ USEFUL/ ADEQUATE (CODES 4,5,6)	NOT ADEQUATE (CODE 3)	NOT USEFUL/NOT NEEDED/NON EXISTENT (CODES 1,2,0)
01	Degree/Diploma Programme	84.8	7.2	8.0
02	Short Programmes	83.0	11.6	5.4
03	Industrial training	36.6	33.0	30.4
04	Curriculum Development/updating	59.8	19.6	20.6
05	Media Development	43.8	19.6	36.6
06	Instructional Material Development	39.3	30.4	30.3
07	Infrastructure Development of Polytechnics	28.6	25.9	45.5
08	Extension Service/consultancy	33.0	29.5	37.5
09	Facilitating Community Polytechnics	47.3	14.3	38.4
10	Research on Teaching/Evaluation	38.4	25.0	36.6
11	Research on media/materials	24.1	21.4	54.5
12	Information Dessimination on Curriculum	36.6	26.8	45.6

	TTTI SERVICE ROLES	% POLYTECHNIC TEACHERS WHO FEEL IT IS (N = 112)		
		APPROPRIATE/ USEFUL/ ADEQUATE (CODES 4,5,6)	NOT ADEQUATE (CODE 3)	NOT USEFUL/NOT NEEDED/NON EXISTENT (CODES 1,2,0)
13	Student selection/Admission/Norms	25.0	34.0	41.0
14	Student teaching/training/Evaluation	55.4	25.0	19.6
15	Student Guidance/Counselling	31.3	44.6	24.1
16	Staff selection/Norms	16.1	35.7	48.2
17	Staff training & Development	53.6	33.0	13.4
18	Curricular revision/change	34.0	52.7	13.3
19	Instructional Media/materials	29.5	50.0	20.5
20	Modernisation	35.7	56.3	8.0
21	Planning/acquisition & maintenance of plant & equipment	18.8	40.2	41.0
22	Polytechnic Infrastructure Requirements/Norms	24.1	42.9	33.0
23	Polytechnics relation with Govt., AICTE etc	33.0	42.9	24.1
24	Polytechnic relation with industries, Parents, agencies, clients.	17.0	48.2	34.8

RESEARCH ABSTRACTS

MUKHOPADHYAY B., A study of Motivational Pattern and Emotional Maturity Level Prospective Entrepreneurs, TTTI, Madras, 1991.

Development of entrepreneurship among technical students is considered to be one of the important felt needs for which polytechnics in our country have been working. One of the popular ways of preparing future entrepreneurs in polytechnics is the organisation of Entrepreneurship Awareness Camp. It has been found that entrepreneurs possess certain attributes which make them different from the non-entrepreneurs.

Objective:

In the present study an attempt has been made to find out the motivational pattern and emotional maturity level of the prospective entrepreneurs.

Sample:

The study was conducted in an Entrepreneurship Awareness Camp which was attended by 150 final year polytechnic students. All these students (N = 150) were considered for the present investigation.

Procedure:

Four subtests viz. Self Perception of Entrepreneurship Traits, Organisation Ability and Management Skills, Executive Reaction Pattern and Human Engineering of A Comprehensive Scale of Entrepreneurship (Sharma 1978) were administered on 150 students. Fifty students were found to be coming under high and above average level of these subtests. This group of 50 students was chosen by the organiser of the camp for intensive training.

At test of Imagery (Atkinson 1958) containing six TAT Picture cards was used to find out the motivational patterns of those prospective entrepreneurs (N = 50). The Emotional Maturity Scale (Singh & Bhargava, 1977) was administered on the same group to find out their emotional maturity level.

Findings:

Among the prospective entrepreneurs (N = 50), 18 were found to be having high N Ach, 23 were having high N Aff and 2 were having high N Pow. Seven of them having two or three types of motivation at low level. A significant difference in dominance of a particular type of motivation among the prospective entrepreneurs were found. Further, it was observed that 12 prospective entrepreneurs were extremely emotionally stable and 10 of them were moderately stable. Whereas 17 were emotionally unstable and 11 were extremely unstable. The emotional maturity level among the prospective entrepreneurs was found to be quite alarming.

It was observed that though most of the students fulfil the motivational requirement to become successful entrepreneurs they lack in emotional maturity (56% of M) which is considered to be one of the important attributes of becoming a successful entrepreneur. It was suggested to include some training components for the development of emotional maturity in prospective entrepreneurs, in the programme schedule of the Awareness Camp.

PILLAI, S.S. and R. SRINIVASAN, A Pilot study on Unemployment and Underemployment among Technicians in the City of Madras, TTTI: Madras, 1991.

OBJECTIVES:

This study was undertaken to analyse the following:

1. The approximate number of years qualified technicians are on the live registers of employment exchanges;
2. The number of interviews/placements extended to them through employment exchanges;
3. The present employment status of these qualified personnel;
4. Their perceptions for renewing their registrations continuously; and
5. The average monthly emoluments received by them from their jobs.

METHODOLOGY:

As it was evident from one of the earlier studies that there was considerable gestation period between initial employment and suitable career development among technicians this study was completed to probe into the causes for maintaining their names in the live registers of employment exchanges. This descriptive study consolidated the opinions obtained from 29 qualified technicians within the city of Madras in the proforma designed by investigators.

FINDINGS:

The important inferences of this study were:

1. The problem of unemployment is common among technicians qualified especially after 1981 and there seems to be a common feeling among them that they find it difficult to get a solid position even after waiting for more than 5 years. The period of waiting for jobs as reported by them varied between 2 and 9 years and still they are optimistic.
2. Almost all of them unanimously expressed that they continue to renew their registrations with employment exchanges.
3. Nearly 69% of them are holding only temporary positions drawing a consolidated salary ranging between Rs.400/- and Rs.1,000/- per mensum.
4. 15 out of the 29 respondents opined that they were employed as apprenticeship trainees for about a year after their graduation from Polytechnics.
5. Only 3 of them (10%) are employed permanently getting all the allowances in the time scale drawing a salary exceeding Rs.2,000/- per month.
6. It was found that 22 out of the 29 respondents are unemployed or underemployed and are finding it too difficult to earn a living.

V. THANIKACHALAM, An Evaluation of the Existing Civil Engg. Technician Curriculum against job potential in Private Sector and Self Employment in Tamilnadu, TTTI Madras 1992.

OBJECTIVES

To evaluate the existing Civil Engg. Curriculum against the employability of the technicians in Private Sector and Self-employment.

To identify the balancing elements in the Civil Engg. Courses with respect to employability in Private Sector.

To identity the core courses, electives which are essential for the employment in Private Sector.

METHODOLOGY

Tamilnadu, one of the Southern States of India, has about 150 Polytechnic. 3 year diploma course in Civil Engg. is offered in about 120 polytechnic for about 4000 students. At present Govt. Departments are not planning to recruit technicians for want of new projects.

At present jobs in Private Sector also are plenty. Students often express that they were not provided sufficient training and instruction to meet the special job needs of Private Industry. The research design chosen is the survey type to explore the views of all concerned to study the balance, adequacy and relevance of the Civil Engg. Curriculum with the job opportunity in the Private Sector and Self-employment.

FINDINGS:

The pilot study shows that as much as 68% of the candidates aspire for the private jobs.

The major outcomes of this study are:

(i) Strengthening core curriculum in building technology and management.

(ii) Providing emphasis for the planning, design, drawing, estimation and surveying for the various construction projects in Private Sector.

(iii) Providing suitable electives like Town Planning, Architectural Design & Housing, Real Estate Management which will enhance the knowledge and skill in executing Private Sector Projects.

(iv) Providing adequate industrial visits, exposure, design and construction and training during vacations in housing complexes, flats and layouts.

(v) Providing construction oriented project work.

(vi) Providing exposure to architectural aspects of building construction.

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General

The authors are requested to note that the Journal aims at a wide international readership of varied societal and cultural backgrounds. They are therefore encouraged to point out in their contributions the relevance of their results and insights to technical and vocational education systems, other than their own. In the case of research reports, the emphasis should be on applicable research of national and international interest.

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