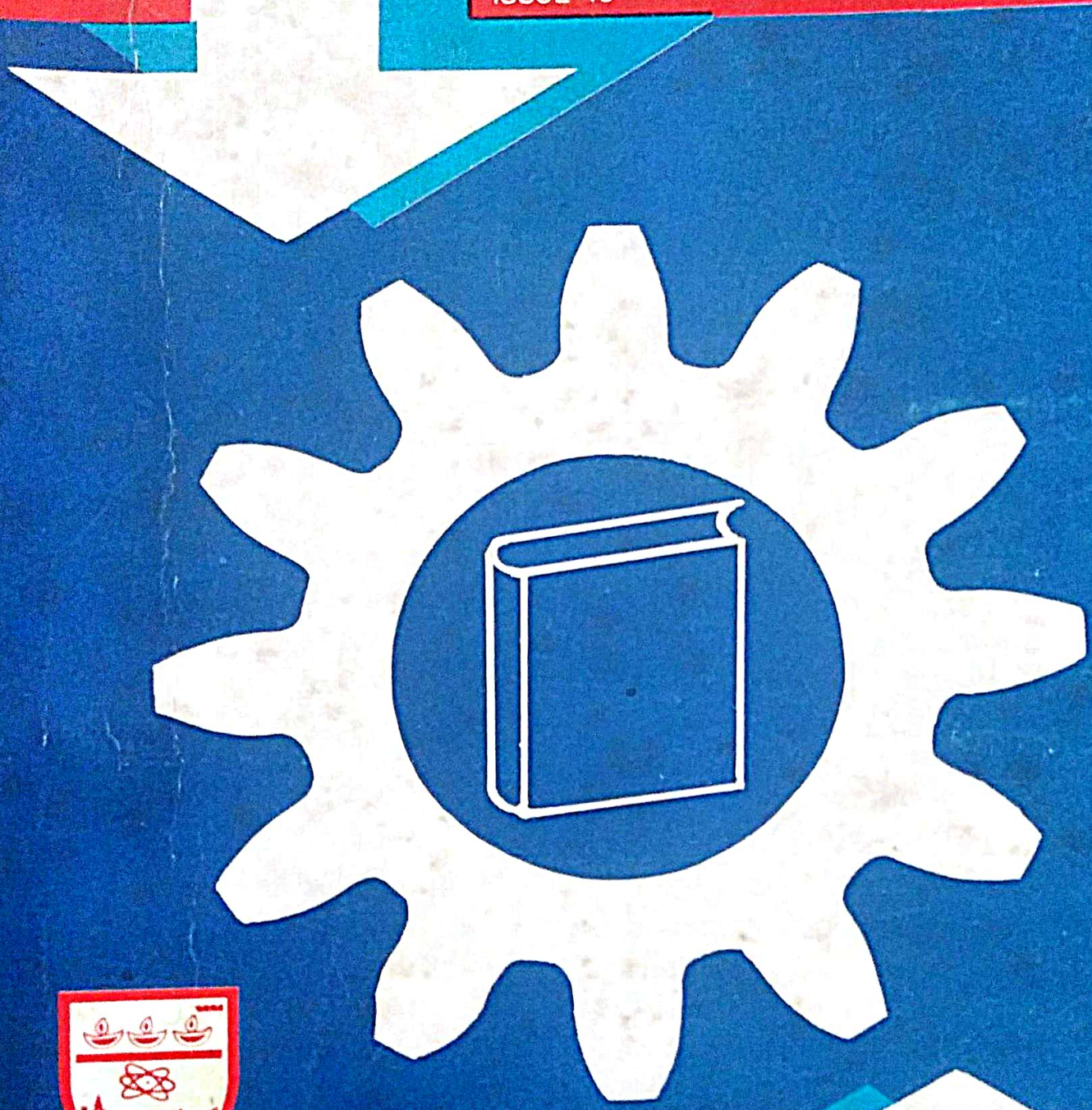
ISSN 0971-8508

JOURNAL OF

# TECHNICAL AND VOCATIONAL EDUCATION

ISSUE 15

1998



TECHNICAL TEACHERS' TRAINING INSTITUTE

CHENNAI 600113 INDIA

## EDITORIAL AND EDITORIAL ADVISORY BOARDS

**Editorial**

## CONTENTS

In a different type of paper, Prof. Dorothy C. Mbah has reported the Stress in Tertiary Institutions. A discussion has been made on causes and prevention of stress.

We are happy to receive a contribution from the polytechnic system for this issue. Mr. M. Nazimuddin has contributed a paper entitled "Futuristic Role of I.I.I. for Optimum utilisation of Diploma Holders." He observes that at present interaction between the industry and the institutes, which produce diploma holders, is not as per the desired levels. This can be achieved through the Industry Institute Interaction Cells.

Mrs. P. Malliga has come up with her ideas on open learning through her article "An Effort to Revolutionize Future Open Learning." Her paper proposes a new educational system, based on distance learning at all levels of learning and employing highly interactive multimedia learning material that allows an easy reach to everyone within the shortest possible time. Like earlier issues, Dr. R. Srinivasan has contributed once again an article on "Indian Work Participation Rate and Curricular Requirements of Technical and Vocational Courses." The article contains substantial data to analyze and support has views.

The present issue contains the paper on "Study of Occupational Choice among Boys and Girls." The study was conducted by Dr. T.J. Kamalanabhan and his colleagues who attempted to find out the pattern of occupational choice among boys and girls.

The Journal of Technical and Vocational Education issue 15 has come up with some new members in the Editorial Board and Editorial Advisory Board. I welcome Dr. David Brady, Senior Lecturer, Huddersfield University, UK as one of our new Academic Editors and Dr. R. Srinivasan, Asst. Editor-Administration. I am again glad to welcome Dr. George R. Maughan, Associate Professor, West Virginia University, USA, who has consented to be one of the members of the Editorial Advisory Board. I profusely thank all our distinguished members.

We deeply acknowledge the contributions of the authors from India and abroad for the present issue of this Journal. The Editorial Board appeals to the academics and readers to come forward and contribute by way of publishing papers, articles and best practices in this Journal for the benefit of the TVET community. We welcome suggestions for further improvement of the Journal.

Editor

# Integration of Environmental Components into Technician Curricula: a Global and Indian Perspective

M. NARAYANA RAO, DAVID B. BRADY, T. JAGATHRAKSHAKAN

*ABSTRACT*

*In order to prevent 'Environmental degradation' and promote 'Sustainable development', various tools like 'Environmental Law', 'Environmental Audit', 'Environmental Science and Engineering', Environmental Impact Assessment' and 'Environmental Awareness and Education' are being used widely now-a-days. 'Environmental Education' is a powerful tool which can impart the total awareness in the minds of all people. This tool can be operated through the formal and non-formal educational systems. Hungerford's infusion and diffusion models of curricular pattern define environmental education in two different ways.*

*This paper discusses the need for a change in the curriculum and objectives of Environmental Education and current global and Indian scenario of Environmental Education. It also compares the infusion and diffusion models and suggests the content areas for inclusion in the formal programmes of technician curricula and activities to be integrated in the functioning of the community polytechnics. The authors conclude that the infusion model that integrates environmental components into technician curricula is more relevant because it produces environmentally literate Engineers and Technicians for promoting Substainable Development.*

## 1.0 INTRODUCTION

'Developments' are contributed mainly by the industrial sector. Simultaneously the exploitation of natural resources and dumping the wastes and pollutants into natural media are also done by this sector. The 'Technicians', who are supposed to be the back-bones of industries and who act at the supervisory level linking the engineers and technologists on one side of the spectrum and skilled and un-skilled labourers on the other side contribute much to the industrial development. But, in order to make them contribute to 'Sustainable Development', these vital new concepts of Sustainable Development are to be in built into the 'Technician Education System' or the 'Polytechnic Education System' in the Indian context.

Therefore, in this study, an attempt is made to analyse the present scenario in the Indian Polytechnic Education System and to suggest a few recommendations for in-building the element of 'Environmental Education' into the Indian Polytechnic or Technician Education System.

## 2.0 ENVIRONMENTAL EDUCATION

### 2.1 Global Scenario

Public awareness of environmental issues was raised world-wide by the United Nations conference on 'Human Environment' held in Stockholm in 1972. An important outcome of this conference was the creation of a new agency called the 'United Nations Environment Programme (UNEP). In support of its declaration, some governments extended support to environmental protection agencies to reverse the trends that were leading to environmental disaster.

In this process 'Environmental Education' has evolved as a discipline. Its main characteristics as outlined in UNESCO's Tbilisi Conference on 'Environmental Education' are:

(a) a problem solving approach

(b) an interdisciplinary educational approach

(c) the integration of education into the community

(d) a life-long forward looking education

UNEP has supported environmental education work in several United Nations Agencies such as UNESCO and the 'International Union for Conservation of Nature and Natural Resources' (IUCN).

There is no specific mention of Science and Technology in UNESCO's outline, but no other specific disciplines are mentioned either. It is therefore, undoubtedly the task of the exponents of Science and Technology Education to invent new ways in which the concepts of Ecology and Sustainable Development which lie at the heart of environmental education, can be infused into education, as a whole and into Science and Technology Education in particular. Definitely Science should constitute the foundation on which proper ecological value - judgments are based and technology should provide the practical means of solving the ecological problems posed by industrial and other societies.

The Earth Summit (UNCED) Conference which took place in Rio de Janeiro, on 3-4, June 1992 was attended by about 120 heads of State and Government together with delegates from over 170 countries. The centre piece of the Rio agreements (agenda 21) is a major action programme setting out what nations should do to achieve Sustainable Development in the 21st Century. The 40 chapters of Agenda 21 cover topics ranging from poverty, toxic waste and decertification to youth, education and free trade. There are implications for environmental education throughout this document but of particular significance are chapters 25 (Children and Youth in Sustainable Development) and 36 (Promoting Education, Public Awareness and Training). One of the key outcomes of the conference for educators is the recommendation that environmental and development education should be incorporated as an essential part of learning within both formal and non-formal education sectors. A proposal is made that Governments should strive to update or prepare strategies aimed at integrating environment and development as a cross-cutting issue into education at all levels within the next three years. (Agenda 21, Chapter 36).

The World Commission on Environment and Development produced the report 'Our Common Future' (WCED 1987). This presented a 'Global Agenda' to reconcile environment with development. Education was seen to be the main focal point of this agenda. Debate arising from this report led to the U.N. Conference, i.e., the 'Earth Summit' in Brazil. Increasing awareness was found after the Brazil Summit and almost all countries started giving importance to 'Sustainable Development' and started feeling that these ideas have to be injected into the curricula at all levels.

### 2.2 The Indian Scenario

One of the important aspects of Environmental Education in India is its link with its long historical tradition. One of the stanzas of 'Isho Upanishad' says that 'This Universe is the creation of supreme power and is meant for the benefit of all; individual species must therefore learn to enjoy its benefits by regarding themselves as a part of the system in close relationship with other species; let not any one species encroach upon the rights of others'. These thoughts represent ideal concepts of ecological harmony.

The main objective of environmental education is that individual and social groups should acquire awareness and knowledge, develop attitudes, skills and abilities and participate in solving real-life environmental problems. The perspective should be, integrated, interdisciplinary and holistic in character. The important objective in environmental education and awareness, therefore, is not to introduce a new subject or a course, but a new approach to education, which cuts across various subjects as an underlying paradigm.

Essentially, 'Environmental Science' is not a single subject, but a conglomerate of both basic and applied sciences as well as engineering, socio-economics, politics, ethics and law. The fundamental idea is to bring environmental concern in all subject areas, so that an environmental bias permeates all facets of one's life and does not get compartmentalized in one area.

This concept is becoming quite popular in the international arena and India is not an exception. India has quite successfully introduced the environmental consciousness and awareness in the school curriculum both in the 'Standalone' pattern as well as in the integrated pattern also. A lot of work has been done successfully in this area as far as the school curriculum is concerned. But, only a very few attempts have been made to implement an integrated approach for environmental education in the technical or technician education system in India.

## 3.0 ENVIRONMENTAL EDUCATION CURRICULUM MODELS IN TECHNICIAN EDUCATION

Out of the various curriculum models, two models of Hungerford are very much talked about in this field. The first model known as Hungerford's 'Diffusion model' is otherwise known as 'Stand-alone' model. The second one, Hungerford's 'Infusion model' is otherwise known as 'Integrated model'. The essential features of these two models are discussed below.

### 3.1 Hungerford's Diffusion Model or Stand Alone Model:

From, Figure 1, it can be easily understood that the environmental inputs from various subjects mentioned there are diffused

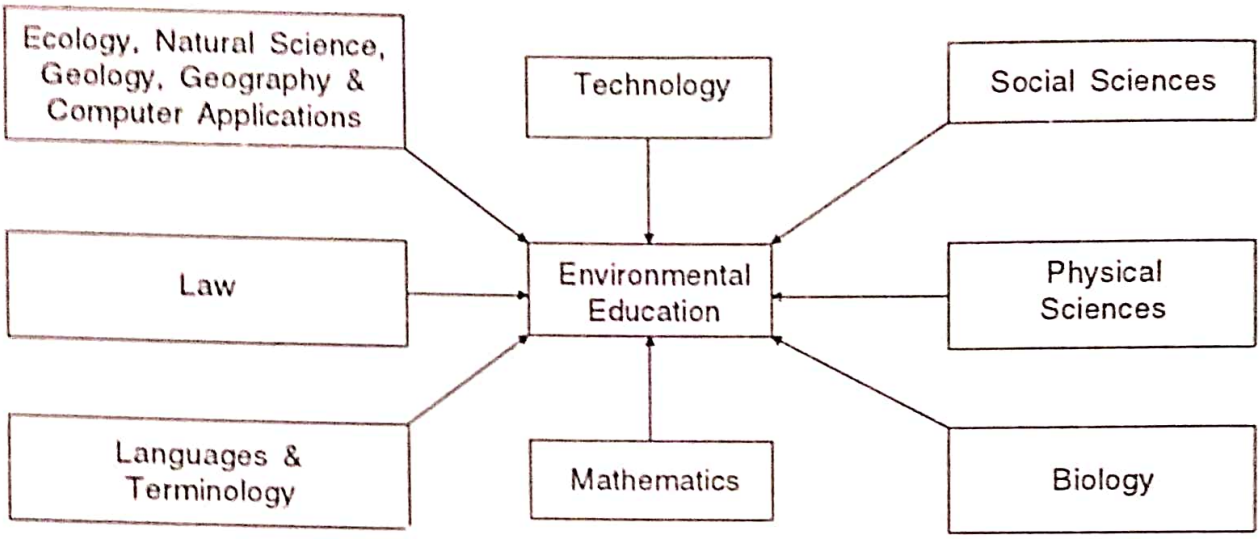



**Fig. 1:** Diffusion Model

or taken out from the respective subjects and commonly pooled into one area at the centre, viz, 'Environmental Education'. This could be offered in the technician education system either at the 'Macro Level' as a full diploma or post-diploma programme or at the 'Micro Level' as a full fledged subject in the three year diploma programme.

### 3.1.1 'Macro Level' of diffusion model: Examples of this model are:

- Post-diploma programme in 'Environmental Engineering' (One or one and a half year duration).
- Diploma programme in 'Environmental Engineering'. (Full three year duration).

In the above two patterns, it could be seen that the 'Environmental Engineering Education' is offered in an inter-disciplinary approach. This approach indicates the interaction between two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration or organising the concepts, methodology, procedures, epistemology, terminology, data and the organisation of research and education, over a fairly wide field. An inter-disciplinary group consists of people trained in different fields of knowledge (disciplines), each with its own concepts, methods, body of knowledge and language organised for a common attack on a common problem, there being continuous inter communication between them.

Full fledged diploma and post-diploma programmes on 'Environmental Engineering' have been started in a few polytechnics in a few states in the Northern and Eastern regions of India on an experimental basis under the massive 'World Bank Assisted Project on Technician Education'. One post-diploma programme is also envisaged in one polytechnic in the Southern region of India with the clearance from the statutory 'All India Council for Technical Education'. These programmes are on par with the conventional technical courses like 'Civil Engineering', 'Mechanical Engineering', etc. The main objective of these programmes is to produce

quality 'Environmental Technicians' who will be in-charge of 'Pollution-Control' processes and 'Energy-Efficient methods in the industry. Unfortunately, they may not be in a position to contribute to the 'Production' or 'Process' side of the same industry.

### 3.1.2. Micro Level of Diffusion Model

Here, the 'Environmental Engineering' is offered as a full fledged separate subject in the conventional diploma programmes, like 'Civil Engineering', 'Mechanical Engineering', etc. For instance, in earlier days in the Diploma in Civil Engineering course, the subject offered was 'Public Health Engineering'. This was primarily focussing on the 'Protected Water Supply' and 'Sewage Disposal' areas. Now, the same subject is replaced with the present day 'Environmental Engineering', normally offered in final year of the three year diploma course in Civil Engineering, which not only concentrates on the two conventional areas mentioned above, but also on a wider spectrum incorporating the newer areas like 'Air Pollution Monitoring and Control', 'Solid Waste Disposal Methods', 'Rural Sanitation Schemes', 'Global Environmental Issues and Problems', 'Soil Pollution', etc. Of late, similar stand-alone subjects of 'Environmental Engineering' are introduced in other conventional disciplines like Mechanical, Chemical, Mining Engineering, etc.

The above model of 'Hungerford', viz, diffusion or stand-alone model is a popular one and is being very widely followed in the technical as well as technician education systems in India, at present.

### 3.2 Hungerford's Infusion Model or Integrated Model

From Figure-2, it can be easily understood that the environmental concepts and inputs are injected into various conventional disciplines and subjects. No separate course or subject on 'Environmental Engineering' is created. Environmental concepts are introduced into the subjects of the conventional disciplines in an integrated manner.

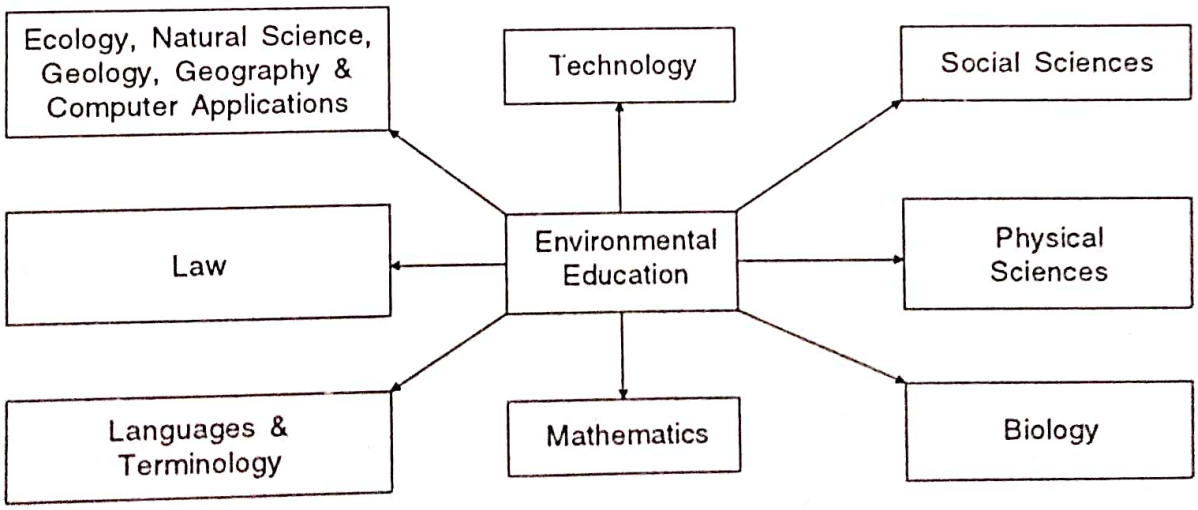



**Fig. 2:** Infusion Model

**A few examples of this model are given below:**

In India, in the Civil Engineering Curriculum of Polytechnics the topic on 'Cement Manufacturing' is offered in the materials and construction subject in the II year normally. Here the raw materials for cement, manufacturing process of cement, storing and transportation, physical and chemical properties of cement, tests on cement,quality control aspects, etc., are elaborately discussed. But the air pollution aspects in the cement industry are not at all discussed. It is discussed in a separate subject on 'Environmental Engineering' in the final year of the same programme. As the Civil Engineering student studies the production aspect of cement in the II year subject and the pollution aspects of cement industry separately later in the III year subject, a proper link is not established by him in his thought process between these two vital areas of 'Production' and 'Pollution'. Hence he cannot think of the 'Sustainable Development or Production' process of cement. The solution for this problem could be, the pollution aspects and the pollution monitoring and control aspects could also be discussed immediately after the discussion of production process, properties, tests, uses, etc., in the II year subject of 'Materials and Construction' in the 'Manufacture of Cement' chapter, rather than separately in the 'Environmental Engineering' subject in the III year. The advantage here is, the student could link the 'Production' and the 'Pollution' aspects immediately and that would lead to an understanding of 'Sustainable Production' process of cement.

Similarly, the 'Environmental Chemistry' aspects and the 'Global Environmental Issues' aspects could be discussed in the I year 'General Chemistry' subject itself rather than discussing them separately in the III year 'Environmental Engineering' subject. This would lead to an integral approach.

In the same way, the topic of 'Noise Pollution', the cause, the measurement of its intensity and the abatement techniques could be discussed in the I year 'General Physics' subject in the 'Sound and its Measurements' chapter rather than discussing them separately in the 'Environmental Engineering' subject in the III Year.

Two specific advantages are there in this process of such an integral approach. The first one is that the stand alone subject of 'Environmental Engineering' could be eliminated and its ideas and contents could be infused into other subjects. The time saved in eliminating this subject could be distributed to other subjects to cover the additional content infused now, so that separate subject teacher for teaching the subject on 'Environmental Engineering' could be dispensed with. Secondly, as the student studies the production process as well as the aspects of pollution, its monitoring and control methods due to the production process at the same time in an integral way, he can get a total picture of 'Sustainable Production Process' and that avoids getting information in piecemeal or in the 'Stand-alone' manner.

### 3.3 A Comparative Study of 'Infusion' and 'Diffusion' models

The 'Merits' and 'Demerits' of the above two models are discussed below:

### 3.3.1. Hungerford Diffusion Model

**Table-1**

| MERITS | | DEMERITS | |
|---|---|---|---|
| 1. | Relatively easy to design a new subject or a full course rather than infusing the environmental issues into the existing subjects. | 1. | Additional time is to be allocated into the time-table schedule to accommodate this new subject. The time allocated for other subjects is to be reduced in the schedule, as the total teaching time remains constant. |
| 2. | Teachers of the already existing subjects need not be trained in these new areas, as specialist teachers would be appointed for teaching this subject. | 2. | New teachers specialised into this area are to be appointed separately. This would increase the total budget of the Institution. |
| 3. | The Curriculum of the existing subjects need not be disturbed at all. | 3. | As the 'Production'or 'Development' process and the 'Environmental Protection' are studied in different subjects, the student may not be able to link these two concepts. This may not give the idea of 'Sustainable Development' to the student, as there is no integral approach in the study. There is only 'Compartmentalised' approach. |
| 4. | This type of model is already in vogue in the Indian Technician Education System. Hence more familiarity is already there. | 4. | Curriculum designed as per this model will lead to the generation of 'Production' or 'Process' technicians who will be looking after 'Production' process in the industries separately and 'Environmental Technicians' separately. Hence, these two types of technicians have to work hand-in-hand in the industries to promote 'Sustainable Development'. |

### 3.3.2. Hungerford Infusion Model

**Table-2**

| MERITS | | DEMERITS | |
|---|---|---|---|
| 1. | Additional time need not be set apart in the schedule, as the 'Green Ideas' are infused into the existing subjects in the respective places. No additional subject or course need to be designed. Total burden on Curriculum Design is reduced. | 1. | Relatively difficult to design the technician curriculum as per this model, as the environmental aspects are to be infused into the existing subjects at the respective places. Time consuming process of Curriculum Design. |
| 2. | No additional or specialist teachers need to be appointed separately. Existing teachers will do these areas as well. Total budget of the institution will not rise. | 2. | The teachers already teaching the existing subjects have to be trained completely in these new areas, as they may be unaware of these new areas. |
| 3. | As the 'Production' aspect and the 'Environmental' aspects are studied by the student in an integral manner at the same time, the student gets the clear picture of 'Sustainable Development'. | 3. | The curriculum of the existing subjects need to be disturbed. As these new areas are to be infused into the existing subjects, some content areas of the existing subjects have to be removed to cope up with the overall course time available. This has to be done with utmost care. |
| 4. | Same technician looks after both 'Production' as well as 'Environmental Issues' in an industry. This will lead to the 'Sustainable Production' process. No need to appoint separate technicians for 'Production' and 'Environmental Protection' separately. That would bring down the establishment cost of the industry. So they prefer the technicians produced by this model. | 4. | This model is not in vogue in the Indian Technician Education system. Hence 'Unfamiliarity' is there. It takes time for the system to get familiarity with this new approach. |
| | | 5. | Industries prefer technicians who are produced by this integral model approach, as they can easily contribute to the 'Sustainable Development' process. |

### 3.4 Industrial Scenario

Industries were mainly concerned with the 'Production Processes' and 'Marketing'. They did not show any concern towards the environmental impacts of their projects in earlier days. But in the present day situation, the 'Society' and the 'Law' exert enormous pressure on industries to make them move towards the 'Sustainable Development'. As such, they have to design and operate 'Effluent Treatment Plants' for treating the effluents and disposing them off finally. Due to the additional investments on these plants, the industries were reluctant to establish them. Now, according to the Law, these plants have to be established and operated on par with the production plants, which is mandatory.

From the data collected from various Indian industries (Small Scale, Medium Scale and Large Scale categories) and also from entrepreneurs, it was found that they prefer single type of 'Sustainable Development' technicians who can look after both the 'Production' process as well as the 'Effluent Treatment and Disposal' process together in an integral way rather than the two types of technicians. In order to tune the technician education system in harmony with the present day industrial requirements, the ideas of the 'Infusion Model' have to be adopted in our curricula.

## 4.0 SOME SUGGESTIONS OF CONTENT AREAS IN THE CONVENTIONAL ENGINEERING DISCIPLINES TO MOVE TOWARDS THE 'INFUSION MODEL' APPROACH:

The following list is a suggested sample of contents which can be infused into the various subjects at the appropriate places in the conventional engineering disciplines. The list is only suggestive and not exhaustive.

### 4.1 I year 'Basic Engineering' subject

- Global Environmental Issues.
- Concept of Sustainable Development
- Ecology and Ecological balance

### 4.2 I year Chemistry

- Ecological balance
- General aspects of environmental chemistry
- Protected Water supply

### 4.3 I year Physics

- Noise Pollution, its Monitoring and Control

### 4.4 Civil Engineering subjects

- Protected Water Supply and Water Quality Testing
- Sewerage Treatment
- Air Pollution Monitoring and Control
- Solid Waste Management
- Rural Sanitation
- Water Supply and Sanitation in Buildings
- Environmental Impact Assessment of Civil Engineering projects.
- Use of G.I.S. for solving Environmental problems.

### 4.5 Mechanical Engineering subjects

- Environmental Impact Assessment for Industries
- Vehicular Pollution Monitoring and Control (Automobile Engineering)

- Waste Water Analysis and Treatment from Industries
- Air Pollution Monitoring and Control from Industries.
- Pollution Monitoring and Control in Refrigeration and Air-conditioning
- Environmental Law and Audit for Industries.
- Sustainable Technologies
- Non-conventional or Alternative Energy Sources.

**4.6 Electrical Engineering subjects**

- Alternative or Non-conventional Energy Sources
- Conservation of energy

**4.7 Electronics Engineering subjects**

- Design, Fabrication and Maintenance of Electronic or Digital Instruments for Pollution Monitoring

**4.8 Computer Science or Engineering**

- Development of packages for Environmental Pollution Monitoring and measurement
- Development of Data-base for Environmental Pollution Monitoring and measurement and use of G.I.S. (Geographical Information Systems) packages for subsequent analysis.

**4.9 Commercial Practice course**

- Environmental Law
- Environmental Audit
- Energy Audit

**4.10 Chemical Engineering**

- Environmental Law and Audit
- Environmental Impact Assessment
- Waste Water, Air Pollution Monitoring and Control Methods for Chemical Industries
- Hazardous Waste Management, Treatment and Disposal
- Environmental Toxicology
- Sustainable Chemical Technologies.

**4.11 Mining Engineering**

- Environmental Impact Assessment
- Soil Pollution and Reclamation Methods
- Air Pollution Monitoring and Control Methods.

**4.12 Textiles Technology**

- Environmental Impact Assessment
- Air Pollution Monitoring and Control Methods
- Waste Water Treatment and Disposal
- Sustainable Textile Technologies

The above suggestions are very broad. They are the subtopics to be added to the various subjects of the above disciplines. The detailed contents and objectives for these subtopics have to be worked out for the infusion model approach.

## 5.0 NON-FORMAL EDUCATION THROUGH COMMUNITY POLYTECHNIC SCHEME:

'Community Polytechnic Scheme' is an experimental scheme started by Govt. of India in the Indian Polytechnics throughout the

country, to promote 'Rural Development' as 'India lives in her villages'. This scheme was started way back in 1978 and it has successfully completed 20 years. This wing is an additional one in the selected polytechnics.

These polytechnics operate in six areas under this scheme. These areas are:

- Socio-economic Survey.
- Man Power Development
- Transfer of Technologies
- Technical Services
- Support Services
- Information Dissemination.

Normally, activities are undertaken by polytechnics in these six areas without an accent on Sustainable Development. It is very much felt that the concepts of 'Environmental Sustainability' have to be integrated into the activities of the scheme, leading to the adoption of the 'Infusion Model' now.

Socio-economic survey concentrating on degree of environmental degradation, market-survey of environmentally - friendly products, advocating sustainable rural technologies, rural protected water supply and sanitation, low-cost housing technologies, re-using and recycling concepts, training of youth in the sustainable technologies, developing the data-base, analysing and decision making using the packages of GIS are a few recommendations for inbuilding the'Green Concepts' into the present activities of these community polytechnics, as per the concept of 'Infusion Model'.

## 6.0 CONCLUSION AND RECOMMENDATIONS

A comparative study of Hungerford's Infusion - Diffusion models of Curriculum Development for 'Environmental Technician Education' has been undertaken and analyzed and discussed. At present in the Indian context, 'Hungerford's stand-alone model' is being followed, both at the macro and micro levels. However, industries generally feel that the engineering technicians should be in a position to handle the production or developmental work and also the environmental aspects in an integral way. It is felt by the industries that this situation would lead to the much wanted 'Sustainable Development' rather than having two different sets of technicians, one to look after the production processes and the other to look after the environmental aspects like pollution monitoring and control, effluent treatment processes, etc. If that is the case, the polytechnics or the technician institutions should move to the 'Integrated model' approach rather than the 'Stand-alone' model approach. At present it would be very difficult for these institutions to change from one end of the spectrum to the diametrically opposite end of the spectrum. The integrated approach has to be injected into the curriculum in a gradual manner so that the required change can be effected over a period of time. The ultimate goal is to produce 'Environmentally Literate Engineers or Technicians' rather than the conventional 'Environmental Engineers or Technicians'. This would lead to a 'Green Society' and a 'Green Globe'.

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# Technical and Vocational Education (TVE) for Women Development in China

MIN LI

*ABSTRACT*

*The present paper has analysed the current situation of women in technical and vocational education of china. Pre-employment technical and vocational education in China is mainly conducted at secondary school level which includes secondary schools, skilled workers schools and vocational schools. It was observed that for the past few years, technical and vocational education and training for rural women has also developed considerably. Certain things which need further improvement include effective concern for women affairs, improvement of released laws and policies, to open new channels for women's improvement and employment.*

## 1.0 CURRENT SITUATION OF WOMEN IN TVE OF CHINA

The female population constitutes about half of the 1.23 billion Chinese population in China. Women are a great force in the social and economic development. They are carrying the heavy responsibilities for human development. However, almost no society in the world provides women with equal status as men. It is well established that women have limited opportunities as compared with men in most spheres of economic and social activity. Anthropologists have found that while women have been given considerable social recognition and power in some societies, no society has publicly recognised women's power as exceeding that of men. Thus, without equality and emancipation of women, there is no real equality and liberation of the whole of humankind. For this purpose, one important precondition is for them to take part in social labour. In order to be able to do so, women should have education and possess labour skills.

Since the founding of the People's Republic of China in 1949, the Government has input great efforts in liberalising pressures and constraints on gender development by providing equal employment opportunities and equal education to the women society.

In the past few years, the principle of gender equality has been gradually carried out in technical and vocational education with conspicuous results. The number and percentage of women being educated in secondary technical and vocational schools in both urban and rural vocational institutions have been considerably increased. Women's knowledge and technical qualities and their competitiveness in socio-economic development have been raised. The social and

economic benefits derived from this are immense.

1.1 It is the key that the implementation of the principle of gender equality in TVE. It is the attention given to it by leadership at all levels and the good co-ordination and co-operation of different authorities.

There exists in vocational education -- in enrolment and employment policies as well as in the school structure and the selection of course -- the issue of protecting women's lawful rights and interests and of implementing the principle of gender equality. This however is a rather complex problem which requires joint effort from all walks of life for its solution.

Therefore, leader's attitude and understanding of the issue are extremely important, because they directly affect the work of the responsible departments, which further affects the implementation of related policies at grass-roots level. Experience shows that where the leaders have a deep understanding of the issue, have a resolute attitude and have taken effective measures, much will be accomplished. To ensure smooth progress in every step and in every aspect, inclose cooperation of the departments of planning, education, personnel and labour, etc., as well as the employers and their departments is also required. The party and government organisations give special attention to this project. In his speech to mark the March 8th International Women's Day in 1991, Generally Party Secretary Jiang Zemin asked Party and Government Leadership at all levels to listen attentively to women's complaints, safeguard their problems. He also said that all related circles in society should do their best to help women in a concrete and practical way. Provincial and municipal leaders such as those in Tianjin have shown great concern for this. They have included on their agenda and have set goals and measures for their fulfilment. They have also called all related departments together to discuss such issues as the male and female ratio in the enrolment of vocational school and job assignment for female graduates so as to ensure equality between the sexes and to protect women's rights and interests.

1.2 It is the guarantee that in the implementation of gender equality in technical and vocational education, certain laws and regulations must be made, and policies formulated, and these should all be strictly enforced.

The Chinese government has devoted much attention to the protection of women's right and interests, which have been clearly defined in the constitution and in other related state and regional laws, regulations and documents. For example, the constitution stipulates that "Women in the People's Republic of China enjoy equal rights with men in all aspects of politics, economy, culture, society and family life". In April 1992, the fifth session of the Seventh National People's Congress approved "The Law of Safeguarding Women's Rights and Interests in the People's Republic of China". This law specifically and clearly

defines women's political and personal rights, rights to education, work, property and in marriage and family. It is the first special law in China that provides all-round protection for women's rights and interests.

Further rules and regulations have also been issued by the State Council, among which one important aspect is to implement the principle of gender equality in enrolment and employment. For example, "The Provisional Regulations for State-Run Enterprises in Employing Workers" (July 1986) and "Regulations and Labour Protection for Female Employees (June 1988)" stipulates that "where jobs are suitable for women, women should be employed".

Based on the concerned state laws and regulations, the State Education Commission has stipulated in directives on secondary specialised school's enrolment that "there should be no fixed ratio of male and female students in enrolment except for those specialitieis that have been approved by education departments of provinces autonomous regions and municipalities directly under the Central Government".

The Ministry of Labour also has made it clear in the enrolment regulations for skilled workers' schools that jobs and professions which are suitable for women should enrol women, and that in enrolment, all specialties in vocational schools, with a few exceptions, should treat males and females as equals, and should enrol students on meritorious basis. It has also been decided that there should be no discrimination against women, and assignment or employment of graduates should be based only on accomplishment in school. Based on the state laws and regulations, many local governments have also worked out related policies. For example, the Beijing Municipal Government has laid down the rule that for specialities which are suitable for both sexes, students should be enrolled according to their merits regardless of sex ratio. For specialities which need a certain percentage of male students, a reasonable male-female ratio should be worked out in enrolment. For professions which are too strenuous and hazardous for women, only male students should be enrolled; and for those which are more suitable for females, only females should be enrolled.

These laws and policies have provided us with the basis for our work and guidance for our action. When differences and problems arise, these laws and regulations can be useful to help people find a common ground and co-ordinate their actions, thus achieving a better result. These laws and regulations have greatly speeded up the progress of this work.

1.3 It is implemented that the principle of gender equality in TVE. We must adopt vigorous measures and work with sustained effort.

To enforce related state and local laws and regulations, and to ensure women's equal rights and interests in receiving technical and vocational education, local governments have taken many effective

measures. First, they have decided that their leaders should give concentrated and personal attention to this issue during enrolment and job assignment while paying constant attention to it on a routine basis the rest of the time. Secondly, they have to exercise strict supervision over enrolment. Knowing that there are more female students at secondary level, the Changzhou Municipal Government has made it a rule that the ratio of female students whose files could be submitted for the recruiting process should be 1 : 1.2 higher than that for males, which is 1 : 1.1, thus giving female student as better chance to be enrolled. Thirdly, they have worked out a way to keep an appropriate sex ratio in enrolment and employment taken as a whole. To ensure the employment of more female students after their graduation, schools have signed contracts or arranged to jointly run the school with the employers. Fourth, they have offered for the time being, pre-employment training. Fifth, they have formulated policies to encourage enterprises to employ more females.

## 2.0 TVE FOR WOMEN IN CHINA

Pre-employment technical and vocational education in China is mainly conducted at secondary school level. This includes secondary schools (including secondary normal schools), skilled workers' schools and vocational schools whose purpose is to train various kinds of technical personnel at secondary and elementary levels, management personnel, skilled workers and other labourers.

**Number and Percentage of Female Students at Various Levels and Types of Schools**

| Time | University | | Middle School | | Specialised Secondary School | | Vocational Secondary School | | Primary School | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Highest No. and % before 1949 | | 17.8 | / | 20 | / | 20 | / | / | / | 25.5 |
| 1980 | 26.8 | 23.4 | 2108.1 | 39.6 | 39.2 | 31.5 | 14.8 | 32.7 | 6517.4 | 44.6 |
| 1985 | 51.1 | 30 | 1893.1 | 40.2 | 60.7 | 38.6 | 95.4 | 41.6 | 5986.2 | 44.8 |
| 1987 | 64.7 | 33 | 2018.6 | 40.8 | 52.2 | 45.3 | 116.3 | 43.5 | 5821.8 | 45.4 |
| 1989 | 70.2 | 33.7 | 1887.3 | 41.1 | 98.8 | 45.4 | 125.7 | 44.5 | 5676.7 | 45.9 |
| 1991 | 68.3 | 33.4 | 1997.6 | 42.7 | 103.8 | 45.6 | 143.6 | 45.5 | 5654.6 | 46.5 |
| 1995 | 102.9 | 35.4 | 2407.5 | 44.8 | 187.1 | 50.2 | 218.2 | 48.7 | 6241.1 | 47.3 |

**Number and Percentage of Female Teachers: Staff and Workers at Various Levels and Types of Schools in 1995**

unit: 10,000

| | University | | Adult Higher Education Institutions | | Specialized Secondary Schools | | General Secondary Schools | | Vocational Schools | | Primary School | | Pre-Primary Education | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Teachers, staff and workers | 40.2 | 38.6 | 3.8 | 38.3 | 21.8 | 41.2 | 147.6 | 34.4 | 15.5 | 35.6 | 282.0 | 44.6 | 108.8 | 93.7 |
| Full-time teachers | 13.2 | 33.0 | | | 10.5 | 40.9 | 119.2 | 35.7 | 10.8 | 37.0 | 264.0 | 46.6 | 82.7 | 94.6 |

In 1995, there were altogether 4,049 professional secondary specialised schools, 4,507 skilled workers' schools and 10,147 vocational schools in China. Among the 3.72 million students in secondary specialised schools, 50.2% (187,100) were female students; among the 1,885,000 skilled workers school students, 48.7% (2,182,000). The percentage of female students in secondary technical and vocational schools was the highest among all schools above the junior high level. It was also higher than the percentage (43.7%) of women in the labour force. In 1995, secondary technical and vocational schools provided society with 2.76 million qualified female graduates. And these females students with all their intelligence and knowledge, have made great contributions in various fields in our economic construction. In many professions or jobs, they have indeed been playing the irreplaceable part of human resources and the labour force.

For ore than 40 years since the founding of the People's Republic, the number and percentage of girl students in various schools have considerably increased and are still increasing year by year, especially in technical and vocational schools (See attached table).

There are many vocational schools that mainly enrol girls. These schools offer specialties in which the women's position is relatively strong at present such as weaving and knitting, secretarial work, financial accounting, business and trade, nursing, tourism, garments, cosmetology, hair-dressing and pre-school teaching, etc. All these have had a positive effect on improving women's social status and labour qualifications, and on increasing the enrolment and employment rate for girls and young women.

In the past few years, technical and vocational education and training for rural women has also developed considerably and won preliminary success. China is an agricultural country, 80% of her 1.23 billion people are in rural areas. Among the nation's total labour force of 650 million, 74%, ie 480 million are in the countryside, of whom 200 million are women, representing nearly 42% of the total labour force. Women have become a main force to be reckoned with in rural

economy. However, the overall quality of rural women is rather low. It cannot meet the needs of rural economic development and restructuring. Therefore, it is extremely urgent for us to develop education for women in literacy and practical labour skills and provide them with the means of improving their conditions. In recent years, local education departments and women's organisations have conducted various forms of vocational, technical and practical skill education for rural women at different levels and through all possible channels. Organized by the education departments in counties, townships, and villages, these education programs have tried to combine short-term training with systematic education, with emphasis on the former. The short-term training aims at enabling women to master one or two advanced labour skills useful for local applications, whereas the long-term courses offer women chances to learn systematic specialized knowledge of management.

Technical and vocational education and training have made rural women more capable, more productive and more knowledgeable, and have played an increasingly greater role in the development of agricultural production. Take rural women in Gansu province, for example. The number of households whose courtyard economy has increased their income by over Y500 (RMB) in the immediate year after training, has surpassed 1 million. This has greatly upgraded the status of rural women in both society and family.

## 3.0 FUTURE PROSPECTS

### 3.1 Problems to be Addressed

In the recent years, women have made much progress in achieving equal rights in technical and vocational education. But there are still problems. For example: 1) Influenced by the traditional concepts that men are superior to women, sex discrimination still exists; 2) Some leaders in the government departments, enterprises and schools are still short-sighted, and do not want to employ females; 3) There is uneven development in different regions and fields. Many poor and remote areas in the countryside lag behind; 4) Some women do not have the right attitude in their choice of careers. All these problems still remain to be solved in our future work.

### 3.2 Problems to be Solved

#### 3.2.1 Effective Concern for Women Affairs

To deepen people's understanding is still the key to implementing the principle of gender equity.

Women, who constitute half of the population, are one of the most important forces. Only when our women can really and fully play their role as the holders of "half the sky" can we successfully fulfil the strategic task. This understanding should guide not only those engaged in women's affairs, but also people in all walks of life.

To encourage women's enthusiasm, we should care more of their benefits and protect their most important rights and interests. And one of the basic rights and interests is to treat women equally in enrolment and employment. To achieve this equality, and to raise women's status and quality is not only the need and pre-requisite for women's liberation, but also a great cause affecting our overall national quality and the progress of our civilization. It is a cause that will bring happiness and well being for our country and for our future

generations. Any short sightedness, misjudgment, or error will have an accumulated result that is harmful to our nation and our country; and that will have grave consequences not only for this generation but for many generations to come.

The deplorable traditional remnants of gender discrimination still exist to a considerable degree today. Often women find it difficult to be enrolled or employed. In order to solve this problem of gender inequality, it is important for people, especially leaders at all levels to understand the issue better and improve their work on women's affairs, taking it to a new and higher plane.

### 3.2.2 Further improvement of Related Laws and Policies.

Although our Constitution has provided for women's equal rights with men in five aspects, there are still not enough related laws and policies. For example, in recent years, with the change of economic systems, enterprises have adopted such reform measures as the optimization of labour combination, and the contract responsibility system for the enterprise director. But due to the implementation of certain reform policies, these measures have induced some enterprises to act only on short-term basis, thus creating a situation which is unfavorable to women's employment. This is also one of the reasons why female students find it so difficult to get into schools. Apart from these, there is the problem of inadequate and poorly coordinated work assignment or employment and enrolment policies. Therefore, the government should improve the existing policies and formulate new policies and laws, especially those that will encourage enterprises and schools to give equal opportunities to females in their recruiting policies, so as to guarantee women's lawful rights and interests.

### 3.2.3 Actively develop TVE so as to Open Up New Channels for Women's Enrolment and Employment

Women have apparent employment advantages in the service industry. And with the rapid economic development and gradual improvement of people's living standard, the service industry will see even greater development. This will surely create many new job opportunities for women. Meanwhile, technical and vocational education can effectively enhance women's labour quality and competitiveness in seeking employment. Large number of specialties (types of work) are now provided by technical and vocational schools for the service industry. And in these years, about 70% of all the students trained in specialized secondary schools and vocational schools are employed by the service industry. Urban vocational schools have presented even higher percentage, like that in Beijing, which is over 80%.

And over half the female students now studying in specialties and for the service industry. Therefore, the rapid development of the service industry and vocational education will greatly increase opportunities of enrolment and employment, and to enhance women's labour quality and occupational competitiveness. And based on the needs of society and physiological characteristics of women, technical and vocational schools have readjusted their specialtes (types of work) greatly increasing those for the service industry such as: hotel service, cosmetology and hair dressing, business service, garment making, embroidery, secretarial work, accounting, pre-school teaching, library

information and so on. We should continue our effort in this respect. In the future, the service industry and vocational education must further develop in order to open up more channels for women's enrolment and employment.

### 3.3 Future Development of Women in TVE

We have a very important role. It is to improve our guidance to women in choosing their occupations.

Influenced by traditional ideas, some female students and their parents do not know how to choose specialties and occupations. They usually throng to those offering easy and well-paid-jobs while paying no attention to those that are more suitable for women, though a little bit harder or more tiring. It sometimes happens therefore that on the one hand many female students find it difficult to get enrolled, and on the other some schools that have planned to enrol more girls cannot fill their quota. Similar things happen in employment. Therefore, it is necessary to tell these women that in choosing their specialties and occupations they should be realistic and should base their selection on the actual needs of the national economy as well as on their personal qualifications. In this way, the problem of structural unemployment existing today can be gradually solved, and the uneven distribution of students between "undesirable" and "desirable" specialties can be changed.

Double our efforts in safeguarding women's lawful rights and interests in poor areas and the remote countryside.

Concerning the issue of equal treatment for women in enrolment and employment, different regions have different situations. Relatively speaking, situations in urban areas are better whereas problems existing in underdeveloped areas, especially in the country side, are still not easy to solve. Therefore, this part of our country needs our special attention. Efforts on this issue should be made in our future work to narrow the gap between underdeveloped areas and relatively developed ones.

# Identification of Generic Skills

K. SITARAMA RAO

*ABSTRACT*

*In addition to job-specific technical competencies, technical personnel are now required to possess a set of generic skills which are generic to a cluster of occupations at the same level - in order to perform competently as 'Knowledge workers'. This is assuming greater significance in the context of restructuring/re-engineering of manufacturing and service organizations in the wake of increasing competition in a global market economy. This paper describes the emerging shift in the concept and meaning of 'work', concommitent generic skills needed, examples of such skills from some TVET systems and a methodology for identification of generic skills for use in TVET curricula.*

## 1.0 INTRODUCTION

1.1 Design of TVET curricula is expected to consider occupational, individual and societal needs and reflect them in the curriculum structure, content and delivery system adequately so that the curricula demonstrate continued relevance. They also attempt to produce technical personnel capable not only of meeting the immediate need for knowledge, skills and attitudes, but of adapting to the changing requirements of the jobs in the wake of developments in technologies and industrial practices, increasing aspiration for and access to further education and enhanced social status attached to higher qualification degrees in some countries. It is therefore a complex task for curriculum designers to know the details of all these first and then to accommodate them in the curriculum to the satisfaction of all the people concerned.

1.2 Methodologies and techniques for occupational or job analysis have been developed, perfected and somewhat standardized to identify the needs of specific or a cluster or related jobs in terms of knowledge, skills and attitudes for use in the design process. While difficulties in the identification of knowledge and psychomotor skills have been overcome with certain degree of satisfaction, identification of the details of attitudes and their specifications in the curricula continue to be difficult and less precise. Inspite of these difficulties, curriculum designers do specify some of the attitudes such as punctuality, discipline safety consciousness which are more or less common, or generic, to a given cluster of occupations at any

particular level. It is another matter whether and how well these generic attitudes have been handled by the instructional and assessment systems.

1.3 There is, thus a practice in the curriculum design to identify some generic skills (attitudes) and highlight their importance to the implementers. Globalisation of trade and economy, radical restructuring in manufacturing and organizations and consequent changes in the meaning and scope of work have made heavy demands on the curriculum designers to reflect on these changes and include in the curricula not only the job-specific technical competencies but also the generic skills of a different and higher order nature, as the conventional generic skills (mostly attitudes) are no longer relevant and sufficient. This paper discusses the details of the generic skills now in demand and methods that can be used for their identification.

## 2.0 WHAT ARE THESE GENERIC SKILLS?

2.1 As mentioned earlier, the meaning and concept of 'work' have been undergoing radical transformation. An understanding of these can lead to the generic skills that are now relevant. Colin Symes has indicated the following transformation taking place in the concept of 'work'.

| From | To |
|---|---|
| Division between conception and execution | Unity of execution |
| Hierarchical | Non-hierarchical |
| Individualised work | Team work |
| Prescribed tasks | Stochastic tasks |
| Autocratic | Democratic |
| Mass production | Specialised production |
| Single-skilled | Multi-skilled |
| Maximal division of labour | Minimal division of labour |
| Fragmented | Integrated |
| Rigid | Flexible |
| Supervision | Coordination |
| No learning | Ongoing learning |
| Monotonous | Task Variety |
| Deskilled | Reskilled |
| Unimaginative | Innovative |

**Table: SHIFT IN 'WORK'.**

2.2 An analysis of this shift in 'work' and other developments indicates the following:

- The technical and vocational personnel will be 'knowledge workers' belonging to 'symbolic - analytic services' who have to be:
  - — flexible and adaptable; multi-skilled;
  - — creative and resourceful; and capable of thinking creatively.
- The levels of hierarchy in organizations are collapsing and flatter organizations are emerging

demanding from workforce capabilities for:

— taking responsibility for one's own actions and work based on acquiring, analysing, interpreting relevant information.

— adopting participative management wherein information flow from operational level to upwards will have a dominating role.

— working in and with teams.

- rapid changes in technology, management and manufacturing configurations demanding the workforce to be

  — willing and ready for continuing education throughout the career for updating/upgrading, de-skilling /re-skilling at periodic intervals.

  — possessing the learning to learn skills.

- the possible reduction in actual proportion of the workforce due to restructuring of industry, automation and information-based management systems in some countries and possible unemployment in some other countries owing to mismatch between demand and supply situations requiring the technical and vocational personnel to

  — possess entrepreneurial skills so that the challenges in various sectors of economy can be converted to profitable opportunities.

2.3 A detailed examination of the above mentioned trends and developments provides a reasonable framework for identification of generic skills required by technical and vocational personnel. Efforts are being made in most of the countries to identify and incorporate such generic skills in the respective TVET programmes.

(a) For example, Mayer's committee setup by the Australian Education Council proposed seven key competency strands, which can be viewed as a spectrum of generic skills - in their report **Putting General Education to Work (1992)**. The committee felt that technical skills are no longer adequate for the modern work place. Employees also need, at all occupational levels, generic skills such as the ability to communicate effectively, to work in teams, to take full responsibility for quality, to solve problems and to work with advanced technologies. The seven key competency strands based on the above considerations are:

**Collecting, Analysing and Organising Information**

The capacity to locate information, sift and sort information in order to select what is required and present it in a useful way, and evaluate the information itself and the sources and methods used to obtain it.

**Communicating Ideas and Information**

The capacity to communicate effectively with others using the range of spoken, written, graphic and other non-verbal means of expression.

**Planning and organising Activities**

The capacity to plan and organise one's own work activities, including making good use of time and resources, sorting out priorities and monitoring one's own performance.

**Working with others and in Teams**

The capacity to interact effectively with other people, both on a one-to-one basis and in groups, including understanding and responding to the needs of a client and working effectively as a member of a team to achieve a shared goal.

**Using Mathematical Ideas and Techniques**

The capacity to use mathematical ideas, such as number and space and techniques, such as estimation and approximation, for practical purposes.

**Solving Problems**

The capacity to apply problem-solving strategies in purposeful ways, both in situations where the problem and the desired solution are clearly evident and in situations requiring critical thinking and a creative approach to achieve an outcome.

**Using Technology**

The capacity to apply technology, combining the physical and sensory skills needed to operate equipment with the understanding of scientific and technological principles needed to explore and adapt systems.

(b) Another example is the identification of these generic skills under the broad categories of **Personal Development Domain, Social Development** and **Life-long learner** evolved by the Curriculum Development Centre, Board of Technical Examinations, Maharashtra State, Mumbai (formerly known as Bombay), India in designing the curriculum for general Diploma in Civil Engineering (1995). This curriculum is designed to produce technicians in the stated discipline. Details of these are:

**Personal Development Domain:**

The diploma holder technician should value.

1. Maintenance of personal health
2. Initiative
3. Creativity
4. Leadership
5. Honesty
6. Alertness
7. Punctuality
8. Safety Consciousness
9. Hard and systematic work

**Social Development**

Core skills related to social development are identified as:

1. Recognizing the importance of role of social group (social responsibility) like family, community and industry
2. Recognizing the importance of his role in improving the productivity of the social group's activity
3. Skill in cooperativeness.

4. Skill in communication.
5. Skill in dealing with human resource with sympathy and empathy.
6. Recognizing the impact of his as well as social group's activity on environment.

**Life-long learner**

Core skills related to lifelong learner are identified as various components of independent learning skills as

1. Defining a problem
2. Searching for information
3. Acquiring information
4. Analyzing and synthesising information
5. Design solution
6. Reporting solution

The curriculum structure incorporates provisions for development of these core or generic skills.

(c) Another example is the Employability Skills Profile (ESP) developed by the Corporate Council on Education of the Conference Board of Canada. It describes these skills under three categories. Academic Skills, Personnel Management Skills and Teamwork Skills. Details of this profile are:

| Academic Skills | Personal Management Skill | Teamwork Skills |
|---|---|---|
| **Those skills which provide the basic foundation to get, keep and progress on a job and to achieve the best results.** | **The combination of skills, attitudes and behaviours required to get, keep and progress on a job and to achieve the best results.** | **Those skills needed to work with others on a job to achieve the best results** |
| Canadian employers need a person who can:<br>**Communicate**<br>• Understand and speak the languages in which business is conducted.<br>• Listen to understand and learn.<br>• Read, comprehend and use written materials, including graphs, charts and displays.<br>• Write effectively in the languages in which business is conducted. | Canadian employers need a person who can demonstrate<br>**Positive Attitudes and Behaviours**<br>• Self-esteem and confidence<br>• Honey, integrity and personal ethics.<br>• A positive attitude toward learning, growth and personal health<br>• Initiative, energy and persistence to get the job done. | Canadian employers need a person who can:<br>**Work with others**<br>• Understand and contribute to the organization's goals<br>• Understand and work within the culture of the group<br>• Plan and make decisions with others and support the outcomes. |

| | | |
|---|---|---|
| **Think** | **Responsibility** | |
| • Think critically and act logically to evaluate situations, solve problems and make decisions | • The ability to set goals and priorities in work and personal life. | • Respect the thoughts and opinions of others in the group. |
| • Understand and solve problems involving mathematics and use the results. | • The ability to plan and manage time, money and other resources to achieve goals. | • Exercise "give and take" to achieve group results |
| • Use technology, instruments, tools and information systems effectively. | • Accountability for action taken. | • Seek a team approach as appropriate |
| | **Adaptability** | |
| • Access and apply specialized knowledge from various fields (e.g. skilled trades, technology, physical sciences, arts and social sciences) | • A positive attitude toward change | • Lead when appropriate, mobilizing the group for high performance |
| | • Recognition of and respect for people's diversity and individual differences. | |
| | • The ability to identify and suggest new ideas to get the job done - creativity | |
| **Learn** | | |
| • Continue to learn for life | | |

2.4 While there could be differences in the nature and details of generic skills that needed to be included in TVET curricula among the countries in the context of the development stages, policies and priorities in technical and vocational education, there cannot be a divergent opinion on the need for and importance of appropriate generic skills to be included in TVET curricula together with the respective technical and vocational skills.

## 3.0 A METHODOLOGY FOR IDENTIFICATION OF GENERIC SKILLS

3.1 It is difficult to indicate the methodology for identification of generic skills in view of a number of variables involved. It could form an integral part of the methodology used by the TVET systems in identifying occupational needs for design of TVET curricula. As the generic skills, as the name implies, are common to a given cluster of occupations at any level, it becomes necessary for the curriculum

development teams for specific occupation/trades/disciplines to work together for this area. Alternatively the TVET system can constitute a Task Group specifically for the identification of generic skills for the cluster of occupations and the output can then be utilized by the respective Curriculum Development Teams for incorporating them in the specific TVET curricula. Details of a methodology for identification of generic skills are briefly described:

**(a) Formulation of a Task Force/ Group:**

This group may consist of 5-6 senior teachers and professionals from the TVET system preferably of inter-disciplinary nature. The mode of functioning of this group - full time or an agreed release schedules will have to be decided. Availability of relevant support services needs no highlighting.

**(b) Action Plan for identification of generic skills:**

The Task Group will have to prepare an action plan which may include the following:

- Study of related literature
- Identification of sources of information
- Deciding techniques of data collection.
- Adopting or adapting instruments for data collection.
- Collecting relevant data
- Analysis of data and identification of generic skills.
- Validating the list of generic skills.

Details of these are briefly described:

**(c) Study of literature and sources of information**

The following sources are suggested for collection of data:

(i) Available literature such as curricula, research studies, special reports relating to generic skills both from within and outside the country.

**(ii) Organizations like**

- Chambers of Commerce and Industry
- Association of professional bodies.
- National Technical Human Resource Information System
- Industries where global trends are really taking place.

**(iii) Experts from**

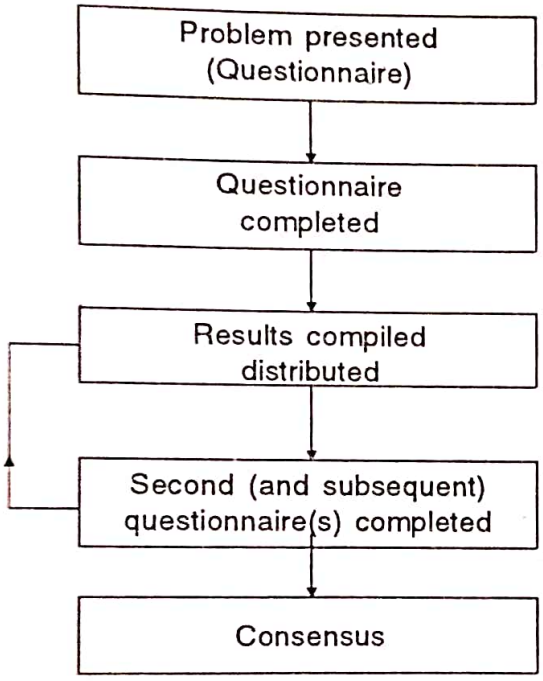
- Industry, Institutes of Higher Education; Research and Development Organizations; Professional bodies.

**(d) Data Collection Techniques:**

Unlike technical aspects of the job where related data is relatively easy to obtain, data collection on generic skills may pose problems in terms of opinions and views which may be divergent and often unsubstantiated. Some of the following techniques may be adopted: Delphi Technique and Nominal Group Technique.

**(i) Delphi Technique:**

The Delphi Technique is a formal procedure for obtaining consensus among a number of experts through the use of a series of questionnaires. In this procedure, participants do not meet. In fact, ideally, the experts do not know who else is involved. The steps in the Delphi Technique are **shown in figure and** discussed below.




**Steps In The Delphi Technique**

- The problem is presented to group members through means of a questionnaire that asks them to provide potential solutions.
- Each expert completes and returns the questionnaire.
- Results are compiled and provided to the experts, alongwith a revised and more specific questionnaire.
- The experts complete the second questionnaire. The process continues until a consensus emerges.

The Delphi Technique prevents the respondents from being influenced by the personalities of the other participants and at the same time allows for the sharing of ideas. It can be expensive and time consuming.

Delphi is very useful in instances where

- The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis:
- The individuals needed to contribute to the examination of a broad or complex problem; have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.
- More individuals are needed than can effectively interact in a face-to-face exchange;
- Time and cost make frequent group meetings infeasible;
- The efficiency of face-to-face meetings can be increased by a supplemental group communication process;
- The heterogeneity of the participants must be preserved to assure validity of the result; i.e. avoidance of domination by quantity or by strength of personality ("bandwagon effect").

**(ii) Nominal Group Technique:**

Nominal grouping represents an attempt to move towards a structured approach, which encourages individual creativity. Nominal refers to the fact that members, acting independently, form a group in name only. An important feature of this technique is that it allows the members to meet face to face but does not restrict individual creativity as traditional group discussions do. Nominal grouping, then, is an approach to decision making that involves idea generation by group members, group interaction only to clarify ideas, member ranking of ideas presented, and alternative selection by summing ranks. The steps are **shown in figure and** discussed below:

**(1) Statement of problem:** After the nominal group is assembled, the group leader states the decision problem clearly and succinctly. No discussion is allowed, although group members may ask questions to clarify the problem.

**(2) Idea generation:** Group members silently record and number their ideas for solving the problem.

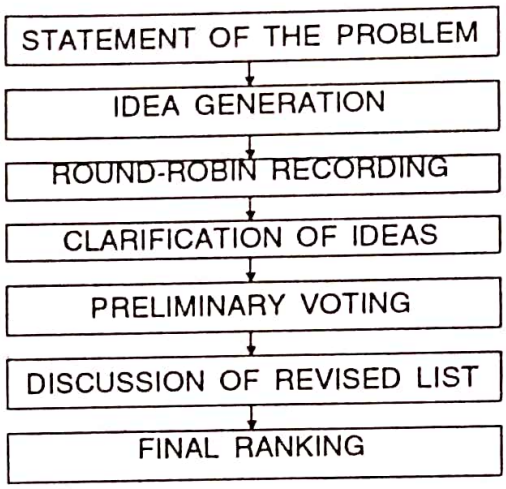
**(3) Round-robin recording:** The group members alternate in presenting their ideas while the group leader lists the ideas on a flip chart or chalkboard. The process continues without discussion until all of the ideas have been recorded.

**(4) Classification of ideas:** Under the leader's guidance, group members question one another to clear up any confusion about what each idea means. No evaluation is allowed yet.

**(5) Preliminary voting:** Each group member independently ranks what are considered the best several of the decisions presented. The ideas that receive the lowest average ranks are eliminated from further consideration.

**(6) Discussion of revised list:** Individual group members question one another to clarify the ideas that remain. The purpose is not to persuade but to understand.

**(7) Final ranking:** Group members rank all of the ideas. The one with the highest total ranking is adopted.




**Steps In Nominal Grouping**

**(e) Designing instruments and collection of data:**

Appropriate instruments such as questionnaires, statements of issues and hypotheses relating to generic skills will have to be designed appropriate to the techniques mentioned above.

**(f) Identification and validation of generic skills:**

The details of relevant generic skills will be available as the output of the techniques used such as Delphi or

Nominal Group Technique. The Task Group may examine these details and organize them in a way for use in the design of TVET curricula. It may be necessary to validate these lists of generic skills before they are agreed upon and adopted. This can be done through a validation workshop comprising the Task Group, senior professionals from TVET system and institutes and experts from curriculum development and professionals from other sectors of education and training.

## 4.0 SOME MAJOR ISSUES

- Generic skills of the type now found relevant call for a higher general educational background from the entrants to TVET programmes.
- Instructional design and delivery systems will have to bring in substantial modifications in terms of learning experiences which, in most cases, have an integrated composition of technical and related generic skills. This in turn involve
  - different varieties of instructional materials and media.
  - flexible scheduling of activities
  - change in attitudes and competencies of faculty
  - different performance assessment systems.
  - TVET institutes will have to, a greater extent, model themselves on the patterns of industrial restructuring in terms of organisational procedures, decision-making, communication, resource deployment and utilization and role clarifications and responsibilities.
- If some of these issues are not addressed suitably, it may be possible for the generic skills resting in the curriculum documents with varying degrees of translation to action in the classrooms and learning places.

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# Futuristic Role Of I.I.I. for Optimum Utilisation of Diploma Holders

M. NAZIMUDDIN

*ABSTRACT*

*At present interaction between the industry and the institutes which train diploma holders is not as per the desired levels. This has resulted in training which does not meet every requirement of the industry. This paper is an attempt to suggest solutions to overcome this glaring shortfall. This can be achieved through the Industry Institute Interaction Cell (I.I.I. cell).*

There is need for diversifying the activity of I.I.I. department for training students in three groups. These are (i) production, processing and quality control, (ii) sales, marketing research and development, (iii) maintenance, which can be (a) task oriented (b) role oriented, (c) service oriented, during the period of studying by different branches with the collaboration of big industries, for achieving maximum employability of students. At present only 10% employability is in existence with the present passout.

The activities of Industrailisation Interaction can be summerised in two main groups.

1. Conventional and
2. Non-Conventional

## 1. CONVENTIONAL ACTIVITIES ARE

### (a) Student Oriented

(i) Student's placement through campus interview

(ii) Students' placement through apprenticeship under B.O.A.T.

(iii) Students' placement for implanting practical training

(iv) Student's industrial visit, excursions etc.

(v) Entrepreneurship Development Programmes for self employment

(vi) Maintaining records of passed students through Tracer Study/preparation of database.

(vii) Obtaining feed backdata from industry regarding performance of passed out students.

### (b) Teacher Oriented

(i) Industrial Training of Teachers,

(ii) Industrial Visits of Teachers and Staff,

(iii) Exchange of Faculty,

(iv) Arranging of expert lectures by industry personnel for faculty members

**(c) Curriculum Oriented**

(i) Supporting Curriculum Design Activities of the B.T.E./G.P. Nagpur

(ii) Industry survey for identification of job profiles for diploma technicians.

(iii) Interaction with the industry in curriculum design and implementation process.

(iv) Collection of data from industry for preparation of competence based curriculum.

**(d) Industry Oriented**

(i) Continuing Education Programme

(ii) Industrial Consultancy

(iii) Industry Project Management,

(iv) Industrial Survey

(v) Testing/Inspection for Industries

(vi) Extending Library Services to Industries,

(vii) Extending Support to R and D activities of the Industry

(viii) Extending other infrastructural services to the industry

**(e) Technical Manpower Analysis:**

(i) National Manpower Analysis

(ii) Microlevel Study for Technical Manpower Requirements for the future

## 2. NON-CONVENTIONAL ACTIVITIES COMPROMISE OF

**(a) Formation of cell of industrial development, where:**

(i) Industries should register with the college with comprehensive information about their problems and projects. These will be solved by the staff and students of the college

(ii) Utilisation of machines and specialised machines of the college laboratories by industries and vice-versa.

**(b) Training of students in three sectors.**

(i) Sales, marketing and marketing research

(ii) Production, process and quality control

(iii) Maintenance and servicing

(c) Development of prototype video cassettes of industry for structural industrial visits for the use of staff members and students.

(d) Arranging joint work-shops for faculty and industries on emerging technical areas like CNC machines, E-mail, Internet, Quality control, B.P.R. Quality circles, disaster management. etc.

(e) Arranging a monthly meeting of every industry H.R.D. section of industries with T.P.O. and V.I.A.

(f) Managing and operating of video cassettes, films, printed and non-printed materials,

(g) Preparing of question papers by the industry personnel for the students as per syllabus for optimum output.

(h) Collection of competence and skills required in the students as per the expectations of industries for:

(i) Supervisorship

(ii) Salesmanship, Marketing at, Managers

(iii) Maintenance purpose

## QUALITIES REQUIRED FOR PASSING-OUT STUDENTS

It has been found from the industry personnel that quality required by passing out students should be as follows: (as per survey conducted by T.O.O. Nagpur).

(a) Good technical knowledge of subject.

(b) Good Personality

(c) Good Confidence

(d) Communication skills

(e) Flexibility/adaptability

(f) Task master

(g) Managerial skills

(h) Result oriented

(i) Physical energy

(j) Role oriented

(k) Ability to solve problems.

(l) Analytical skills

(m) Physical fitness

(n) Ability to learn skills

(o) Time management

(p) Team work

(q) Risk taking capacity

(r) Commitment towards the organisation

(s) Dedication towards the organisation

Considering what has been stated above it is suggested that further a workshop with the help of industries of a similar nature should be arranged for the students, for training them in three groups, branchwise as there are no such programmes with the institution for training the students. These programmes are:

1. Role oriented
2. Task oriented
3. Service oriented

The students should be classified as per their choice, branchwise and industry wise for the above programmes by the institute and then they should be forwarded to the industries as per the requirements of the industries categorywise.

## CASE STUDY FOR ROLE ORIENTED COURSE

For example the roles that are to be performed by Mechanical/Metallurgy/ Electrical diploma holders (as per survey done by T.P.O., Nagpur) in a big casting manufacturing unit are as below:

Types of roles performed by technician diploma holder:

Mechanical/Metallurgy: (In casting based Industry)

| Sr. No. | Roles. | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 1 | Production planning and productivity planning | | | |
| 2 | Co-ordination with marketing | | * | |
| 3 | Co-ordination with maintenance | * | | |
| 4 | Rejection analysis and coordination action needed | * | | |
| 5 | Generation of resources for work improvement | | * | |
| 6 | Waste reduction | * | | |
| 7 | Production | * | | |
| 8 | Customer satisfaction | * | | |
| 9 | Inventory control | | * | |
| 10 | Cost reduction | * | | |
| 11 | Manpower management | * | | |
| 12 | System improvement | | * | |

**Electrical**

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 1 | Preventive maintenance | | * | |
| 2 | Breakdown maintenance | * | | |
| 3 | Scheduling shutdown maintenance of | * | | |
| 4 | Cost reduction in maintenance | | * | |
| 5 | System improvement | | * | |
| 6 | Planning preventive maintenance | | * | |
| 7 | Energy auditing and energy conservation | * | | |
| 8 | Co-ordination with production and process | * | | |
| 9 | Inventory control | | * | |
| 10 | Co-ordination with purchase department | | | * |
| 11 | Meter reading and consumption report | * | | |
| 12 | Checking of blower, charges crane, sand plant | * | | |
| 13 | Welding M/c coil fixed on core insulated wood | * | | |

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 14 | Panel main switch | * | | |
| 15 | Maintenance TCS format | * | | |
| 16 | Maintenance of A6-7, GQ-4, coal grinder, KPT | | | * |
| 17 | Attempt to minimise consumption of material | | * | |
| 18 | Energy conservation | | * | |
| 19 | Minimise breakdown | * | | |

Additional knowledge required by Mech/Elec/Metallurgy students. Future changes anticipated for job spectrum (For Diploma Holders).

He will be required to work in future on:

- ISO 9000 based activities
- TQM concept
- Kaizyne based management
- On paperless management
- On automation based process of working
- Cubic space utilisation project and its control.
- Computer based operation

Similarly, role performed by civil diploma holder in Railway Sleepers Manufacturing Co. (as per survey done by T.P.O. Nagpur)

List of activities performed by Civil Diploma Holders in Railway sleeper Mfg. Co.

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 1 | Mixer design | * | | |
| 2 | Construction of plant | | * | |
| 3 | Elongation of HGS wire | * | | |
| 4 | Maintenance of machineries and production | | * | |
| 5 | Boiler operation and its maintenance | | * | |
| 6 | Plant and machineries of operation | * | * | |
| 7 | Mould repairing work | * | | |
| 8 | Preventive plant maintenance | | * | |
| 9 | Laboratory test maintenance | | * | |
| 10 | Dozer maintenance | * | | |

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 11 | Drinking water and plant water pipe line and motor maintenance work | * | | |
| 12 | Quality control of P.S.C. sleeper | * | | |
| 13 | Achievement of targets | * | | |
| 14 | Training to labour, supervisor | | | * |
| 15 | Control of manpower | * | | |
| 16 | Proper utilisation of space | | * | |
| 17 | Periodical maintenance of materials | * | | |
| 18 | Quality control and optimising cost | | * | |
| 19 | Minimizing breakdowns | | * | |
| 20 | Maintenance of records | * | | |

Roles to be performed by an Electrical diploma holder in the plant are as follows:

**Types of roles performed by technician diploma holders:**

**(in M.S.E.B. dept.) Mechanical/Electrical:**

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 1 | Achieving production targets with good quality and quantity | | * | |
| 2 | Optimum utilisation of Man/Machine/ Material | * | | |
| 3 | As a line Asst. Manager handling Production department with respect to time and motion study | | * | |
| 4 | To monitor 40 subordinates and reporting to higher authorities | | * | |
| 5 | Maintain work of auxiliaries of boiler department, vehicle sections, all type vehicles, and coal handling plant auxiliaries on priority as per emergency | * | | |
| 6 | During stable condition controlling the turbine auxiliaries | * | | |

| Sr. No. | Roles | High Level | Medium Level | Low Level |
|---|---|---|---|---|
| 7 | Minor maintenance work during production and reporting of major problems during production process to higher authorities | | | * |
| 8 | Controlling turbine auxiliaries during abnormal conditions | * | | |
| 9 | Handling emergency during grid failure | * | | |
| 10 | Reporting to LD about daily plant report | | | * |
| 11 | Isolation of 3.3 KB auxiliaries of turbines and boilers | | | * |
| 12 | Isolation of station board auxiliaries of 415 v. etc. | | | * |

In this way all industries of same nature will come together, like rolling mills, Panels.

(Electrical) Manufacturing Co., etc. These will arrange training programme in the institution.

Similarly, programmes for task maintenance and marketing oriented will be arranged by the industries in the institution.

**Conclusion:**

This will ensure

(a) 100% employment of passing out students

(b) Training period of candidate in the industry will be reduced

(c) Expenditure of the industry on training will be reduced

(d) Industries will get students as per their requirements and vacancies.

# Human Resource, Vocational Technical Education and the Economy

AMECHI N.F.

*ABSTRACT*

*This paper makes a case for human resource development as the key to technological, industrial and economic development. The role of vocational education in human resource development as well as some strategy needs of vocational education, with particular reference to human resource development will also be highlighted.*

## INTRODUCTION

No nation can meaningfully talk about development without a sound scientific and technological infrastructure. It has been found that there is a positive co-relation between state of economy and the state of technology, consequently, countries with high level of economy usually have a high level of technology and vice-versa. Economic growth rate of any nation is a reflection of its technological awareness and development.

## DEFINITION OF TERMS

A few terms that would feature prominently in this paper include human resource, manpower, labour, vocational education and economic development. It is necessary to provide contextual definitions of these terms because of the possibility of their being misconceived.

### Human-Resource, Manpower and Labour

The term 'human resource', is usually used as a synonym of manpower and labour. Technically speaking however, these three terms have different connotations. The human resource of a nation refers to all people, resident in the nation, who are not incapacitated beyond the possibility of contributing to the social and economic well-being of the nation.

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

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

Labour on the other hand is usually perceived as a collection of all individuals in the country who are under wage employment. In other words, it refers to those members of the nation's manpower who are employees.

### Vocational Education

Vocational education is a term that is very often misused and misunderstood. In this paper, Olaitan's (1986) broad definition of vocational education as "that part of the total experience of the individual whereby he learns successfully to carry on a gainful occupation", will be adopted. This definition covers both vocational education and vocational training.

### Economic Development

Aghanta (1988) showed that the term 'development' can be applied in various ways; technologically, political, social and economic. Economic development can simply be defined as growth in the level of goods and services produced by country which results in improved per capita income, standard of living and general well-being.

## HUMAN RESOURCE AND ECONOMIC DEVELOPMENT

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

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

1. exploit and utilize the raw materials, power, labour and financial resources available;

2. provide the framework for the country's industrialization by determining its methods, trends, scale and growth rate;

3. design, construct, operate, manage and maintain enterprise;

4. Plan and implement workable development strategies for the nation;

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

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

Even in the face of economic adversities, a nation with well developed human resources can always be confident that it would tide the storm. Such economic problems would only ginger up the skilled manpower within the country to be more productive and creative. Perohance an article of great economic values in the international market would be developed or discovered and the end to the economic adversity would have come. Imagine what would happen, for instance, if a renowned botanist in Nigeria discovers a rare

species of plant that can cure AIDS or if a Nigerian Pharmaceutical Company is able to develop such drugs? Imagine that diamond is suddenly discovered in large quantities in the country, the Structural Adjustment Programme (SAP) would come to an abrupt end and economic prosperity, would smile in Nigeria once again.

## VOCATIONAL EDUCATION AND HUMAN RESOURCE DEVELOPMENT

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

(a) The promotion of the dignity of labour, and

(b) Preparation of individuals for the world of work.

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

The national policy, in its section b, stated six aims of technical education. A close look at these aims shows that they are actually human resource development functions of vocational education. These functions are:

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

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

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

(d) Giving an introduction to professional studies in engineering and other technologies.

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

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

Effective vocational education is the key to the production of skilled manpower who would be able to utilize the resources available in the country for national development. The development in Japan and Denmark are attributable, not to natural resource endowment, but to the highly effective manpower in these countries. Vocational education also makes people intelligent consumers of products of technology in a world of unbriddled commercialism.

## VOCATIONAL EDUCATION AND THE ECONOMY

Man is the prime mover of the economy, and if economic growth is the result of the effectiveness of the productive process, then man is the primary catalyst of that growth. Humans are needed in the production process to provide physical labour as well as managerial control over men and machines. The economy of a nation at any point in time therefore, depends on the prevailing work behaviour patterns of its human resources. For economic growth to take place, the work behaviour patterns of man must necessarily change for the better.

Education is the process of bringing about behavioral changes that are worthwhile in individuals. These behavioural changes include the acquisition of new knowledge, attitudes, skills and abilities. As individuals acquire new knowledge, attitudes and skills, they become more effective in their work roles and may even be creative enough to develop newer methods. In realisation of this fact; the National Policy on Education (1989:8) states inter alia:

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

The questions that cannot be avoided at this stage are, if education is such a trusted catalyst to economic and other forms of development, how come that with so many 'highly' educated men and women, Nigeria economy has spent almost a decade in limbo without hope of immediate salvation? How come the nation's natural endowments are still yearning to be tapped? How can many supposedly skilled high level manpower waste away from unemployment and its concomitant frustration and dejection?

The answer to these questions is simply that majority of the human resource development programmes in the country are not job-oriented and the knowledged structure of the nation's educational system is largely to blame. Vocational education prepares people for specific occupation roles and such people stand to be useful to themselves and the nation's economy after training. The training received enables the trainees to improve their economic well-being and that of the nation they graduate. The first three aims of vocational/technical education stated in the National Policy on Education (1981), reflected this consciousness of the importance of vocational/technical education in human resource development and its indirect influence on the economy. A final question must then be posed: Why are there some products of vocational/technical training institutions who are unemployed and as such could not make ends meet? Again, the answer to this question is that they have not received job-oriented education. Job-oriented training does not only mean training people for specific jobs. More importantly, job-orientedness means training people, for jobs of the moment. That is, for jobs that are available at the time of existence of the trainee and within reach.

We live in a world of constant industrial and technological changes. The past few years of the 20th century are called the Jet age not because jets were developed in our time, but by our observation, it is because the rate at which the novelties of yesterday become

obsolete can be compared to the speed of a jet. The implication this has for vocational/technical education is that as new pieces of equipment and technologies are introduced, new skills are needed to man them. In some cases a new range of occupations too can become obsolete. (Yes! occupations too can become abolete.) Vocational/technical education must therefore, be able to keep pace with changes in the world of work and manpower demand so as to remain relevant to national economic development.

Where vocational/technical education fails to dove-tail itself into the actual work setting it demands, it becomes a pain far worse then general eduction in the neck of the nation. This pain is felt or experienced in the form of vocationally skilled unemployed citizens. These people become unemployed because the skills imparted to them are irrelevant to current needs. This is very dangerous because people who have been equipped with technical skills that are not useful to them may decide to put the skills into undesirable uses.

## SOME STRATEGIC NEEDS OF VOCATIONAL/TECHNICAL EDUCATION FOR EFFECTIVE HUMAN RESOURCE DEVELOPMENT

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

1. The training environment is the working environment itself or a replica of the working environment. This implies that for every occupational training programmes, care must be taken to ensure that the environment in which learners are trained resembles the working environment for which they are being prepared. Consequently, a programme that trains people on manual typewriters when most offices now use IBM and computers may not be preparing people for the world of work of new era technology.

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

3. The instructor is himself a master of the skills and knowledge, he teaches. This principle explains why many vocational educators are hired into the industrial sector. As masters of the trade, employers realise that their products can hardly do better than them. Vocational training programmes must therefore, offer sufficient motivation and (emolument) in order to retain their good quality staff. If nothing is done to prevent a drain of master-trainers, from vocational programmes, in no time the quality of training given will be affected.

4. Training is carried out to the extent where it gives the trainee a productive ability with which he can secure employment or hold employment. In addition to this, is another principle that says training offered must meet market demands for labour. These two principles emphasize the need for manpower surveys to guide training programmes. Where manpower information are not available, a vocational education programmes may not know the occupational areas where more trainees are needed and those where employment opportunities are limited.

## CONCLUSION

In this paper, a deliberate effort was made to establish links between human resource, vocational education and economy. In a nutshell, it can be concluded that human resource is the major catalyst of economic development and that vocational/technical education is one of the most successful ways of developing human resources.

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OLUTOLA, A. (1986): Some Relationships between Manpower and Educational Planning in Folayan Ojo et al (Eds) Manpower Development and Utilization in Nigeria: Problems and Policies, Lagos University Press.

# The Approach to Practical Work in the Teaching and Learning of Science and Technology for Technological Advancement

C.N. IKEAGU (MRS)

*ABSTRACT*

*The Nigerian educational scene is changing fast in response to socio-economic and technological demands within Nigeria and the world over. One of such changes is in the area of teaching techniques and methodology. In Nigeria, this aspect in science and technology instruction leaves much to be desired.*

*This paper therefore, tried to suggest the approach to practical work in the teaching and learning of science and technology for technological advancement. This approach/modality includes the pre-lab, lab and post lab stages. Each of these stages has specific characteristic skills so that during assessment, these discrete skills will be looked for. This is because, it is the acquisition of these unique skills that will classify one as a scientist or technologist who will in the end help in improving the scientific and technological base of the nation in the area of indigenous technology.*

*Negligence of these unique skills in the teaching and learning of science and technology will ever put Nigeria in the dark ages as far as scientific and technological feats are concerned. It is time to do away with 'talking teachers' and emphasis on certificate acquisition because they are coy in the wheel of progress of functional and utilitarian education for technological liberalization.*

## INTRODUCTION

Education in developing countries has been described as suffering from 'narration sickness' because most of the teachers spend too much time in explaining, familiarising and teaching students through verbal means. Such teachers deprive the students the vital opportunity to learn for themselves. It is on this ground therefore, that the conventional chalk and talk method of instruction has been found ineffective and therefore questioned. Suffice it to say that technology and science educators either at policy formulation or implementation level have paid-lip service to practical work in science and technology in Nigerian schools despite the fact that practical work is 'gem' of science and technology. For instance in Nigerian schools adequate and appropriate or no tools of trade cum enabling environment exist thus, teaching of science and technology is done purely in abstraction and this is a negation for technological and

scientific achievements. As a consequence, the products of these courses do not acquire the needed skills to match with every-day realities in science and technology since they are not tutored in practical work during school days. Hence in their work places these products most often start to learn on the job, that is, training the trained has been accepted as job culture in Nigeria due to this ugly situation apparently occasioned by poor funding. Thus the principle of computer operation applies-garbage in garbage out. Currently, alternative to practical forms the basis of teaching and assessing which in essence popularize 'expo', rote learning and certificate acquisition. The outstanding implication of this situation is that practical work which is the hall-mark of science and technology education which the learner is expected to transfer into actual practice in his work place is thrown over board because the skills, knowledge and know-how which are the yardsticks for practical work have not been inculcated. This assertion is a clear evidence that something more fundamental is lacking in Nigerian science and technology curriculum. In short this, critical missing link has rendered most of the Nigerian scientists and technologists very inferior (second rated) to their foreign counterparts in areas of job execution such as oil exploration, mining, road and bridge construction in their own fatherland.

This setback has made science and technology teaching in Nigeria to have degenerated simply to story telling. Based on this therefore, WASC syllabus (1983) stressed categorically that with respect to science and technology subjects, practical work should form the basis of teaching their syllabuses.

Research evidence abound to support the view that when science and technology are taught through the medium of practical work, a lot of enjoyable learning takes place. Besides, recall of information has been found to be easier when the information to be recalled had initially been presented through a practical approach because the students see things in concrete forms. Ironically, in the face of these glaring advantages, science and technology teachers in Nigerian schools still neglect this all an important approach to science and technology teaching. To buttress this fact, Bajah (1983) hinted that the reasons for this educationally sad situation in Nigerian schools have been attributed to such factors as: lack of laboratories, lack of adequate supply of apparatus, large classes, over-loading of assignment of teachers, lack of laboratory assistants among others.

It is to be pointed out that the above bottle-necks are of common occurrence in all developing countries where there is the frantic effort at rapid development. Taking the issue of science and technology teaching in Nigerian, it has been shown that even when the above mentioned impediments have been relatively controlled, the teachers still revert to the lecture method of teaching because of the following merits as stated by Azubike (1984):

1. The teacher is able to present the lesson in a clear and orderly manner.

2. The teacher covers a lot of materials because he is able to talk uninterrupted by the students asking questions.

3. It is convenient for handling a large number of students because he will cover a lot of grounds easily.

4. It makes a new teacher confident because he does not have to face a lot

of questions from the students and his ignorance is thereby hidden.

5. Lecture method exposes the students to wider knowledge because more content is covered.

6. This method is chosen because of the teachers lack of confidence in handling science and technology equipment and apparatus.

7. The teachers lack of technical-know-how on improvisation of equipment is hidden by this method.

8. Teachers prefer lecture method because of their lack of adequate professional preparation during the pre-science and technology years.

9. It lacks field work which constitutes a lot of problems during preparation.

Based on these, the need then arises on how best to overcome these erstwhile educational set-backs if the much desired functional and utilitarian education for technological and scientific emancipation are to be meaningfully realised.

## MODALITIES FOR PRACTICAL WORK IN SCIENCE AND TECHNOLOGY FOR TECHNOLOGICAL ADVANCEMENT

One of the unique features of science and technology is their characteristic technique of exploring nature. The abilities which enable both the science and technology teachers and students to engage in meaningful practical investigations include: ability to observe, communicate, identify problems, ask questions, formulate hypotheses, control variable, analyze data, make inferences and predictions. However, it is one thing to emphasize and advocate the practical approach to the teaching and learning of science and technology in schools, it is still even more difficult to assess practical work meaningfully because assessment is usually based on the qualities to be tested. Be that as it may, the writer is of the opinion that practical work which is the gem of science and technology should form the basis of teaching, learning and assessing whether or not it is for final examination. To this end therefore, science and technology apparatus and equipment should be made available for everyday use in the schools so that both the teachers and students should show familiarity with these materials in their laboratories.

In the main stream of science and technology teaching however, there is an urgent need to understand the various forms of desirable practical work strategy in schools. These forms the writer presented in two categories, but, either can be used since they still point to a common goal.

Category one includes:

1. Teacher demonstration

2. Whole class activity in groups

3. Individual student activity

4. Group project work in out of school scientific activity.

5. Individual project work.

**Category Two Comprises**

(a) Pre-lab stage

(b) Lab stage

(c) Post-lab stage

For comprehensive assessment of practical work therefore, either of the two categories can be employed because in them are embedded diverse practical skills to be tested; manipulative skills, skill in observation and accurate recording, skill in ability to interpret results and ability to plan and carry out experiment. Besides, assessment instruments should be developed and made available for use in assessing all of the above aspects of practical work because practical work is based on proficiency in basic and useful skills.

## PRACTICAL WORK IN SCIENCE AND TECHNOLOGY FOR TECHNOLOGICAL ADVANCEMENT

Practical work is based on the idea that science and technology instruction is composed of laboratory investigations out of which concepts evolve. Any science and technology teacher who wants to use this method for teaching and learning must lead his students to accomplish their tasks by beginning the study of each unit with laboratory investigations rather than from a textbook assignment. This is because it is easier to teach what happens in a lesson topic than how it happens. Therefore, all practical work in science and technology is to be conducted in three stages viz - prelab, lab and post-lab.

## PRE-LAB STAGE

During the pre-lab stage, the teacher discusses the basic techniques which the students will use in the learning activities. In this preliminary stage too; the necessary hard and software equipment and materials to be used are also discussed. The main aim of the lesson/investigation is expressed in such a way that the conclusion is not revealed or implied. The importance of this last point is that no student will be tempted to manoeuvre his laboratory activities or equipment to arrive at the required conclusion.

## LABORATORY STAGE

This is the investigation proper. The students are guided by the teacher to work on the problem. The teacher merely acts as a guide and does not in any way assist the students in gaining insights to solve the problem. It is also important at this stage not to assist students in preparing their materials. In addition, the setting up, operation and dismantling of the necessary apparatus are left entirely to the students so as to test their understanding and dexterity in the use of the apparatus. Each student must prepare a comprehensive report in the scientific method of the procedures used in the practical work as well as his observations and conclusion before the post-lab discussion. This is because the stage is where the students exhibit the learnt practical skill which is always synonymous with science and technology.

This implicates that the manipulative skills as well as skill in observation and accurate recording are highlighted for assessment. Therefore, during assessment, the teacher should look for:

1. Manipulative skills which is based on direct observation during the experiment and embrace the following:

   (a) Efficiency of the student in using the work time.

   (b) Use of operational sequence

   (c) Ease of operation

   (d) Correct handling of apparatus

(e) Successful completion of an experiment and

(f) Orderliness.

2. Skill in observation and accurate recording should emphasis the following:

(i) ability of students to record observations correctly including drawing actual as against textbook specimens and

(ii) ability to observe and use instruments correctly.

## POST-LAB STAGE

Here, the students are expected to discuss the scientific and technological importance of their observations. Every discussion must be relevant to the activities carried out during the laboratory stage.

Discussion of laboratory activities and observations at this stage may lead to the development of assumptions, questions, theory, understanding, interpretation and application of new knowledge. As a consequence, assessment should be on the:

1. ability to plan and carry out experiment
2. and skill in ability to interpret results.

In the former, assessment should be on the

(a) ability to choose appropriate equipment and apparatus.

(b) ability to organize apparatus/ equipment chosen and

(c) suitability of experimental techniques.

In the latter, assessment should be on the

(i) students ability to understand theory underlying generalizations/ principles he is investigating and

(ii) ability to draw logical conclusion from the findings of his experiment.

It is to be emphasised that at the post-lab stage all the discussion must be accomplished by the student with minimum interference by the teacher so as to identify the students strengths and weaknesses.

## CONCLUSION

The contemporary approach to practical work in science and technology in Nigerian schools leaves much to be desired because from this negative relation, one can therefore say that the resources spent on science and technology education has both direct and indirect bearing with Nigeria's backwardness in science and technology. As a consequence, it needs to be urgently overhauled if the scientific and technological skills needed for scientific and technological breakthrough will be materialized. Again, certificate acquisition which is being pursued with all amount of vigour in Nigerian society should be de-emphasised because it has made students to be examination conscious and this has constituted a problem in skill acquisition as students seem not to be interested in elaborate instructional activities involved in science and technology practicals rather in few things they can memorize for examination.

It is only when the Nigerian students involved in science and technology education are taught and assessed on the practical skills in science and technology can Nigeria then

boast of seasoned scientists and technologists who can keep pace with the current trends in science and technology and therefore savour for peak performance in science and technology as the industrialized societies the world over because practice makes perfect.

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# An Effort to Revolutionise Future Open Learning

Mrs. P. MALLIGA

*ABSTRACT*

*True teaching and learning are more than information, and its transmission. Education is based on mentoring, internalisation, identification, role modeling, guidance, socialisation and group activity. New approaches are needed; learning materials, schools and universities in their current form must change greatly.*

*This paper proposes a new educational system, based on distance learning at all levels of learning and employing highly interactive multimedia learning material that allows us to educate everyone in the world. Voice input will be probably be the mode for interaction between the student and computer. Delivery methods are initially through CD ROM Student will also work with other students and human tutors, locally or through the computer networks. All materials can be directed toward encouraging everyone to live happily with other people, increasing problem solving and encouraging creativity.*

## 1.0 INTRODUCTION

In most of the world, higher education is mired in a crisis that mixes three issues: access, cost and flexibility. Unless we resolve this crisis, billions of people in the coming generation will be denied the intellectual liberation of the academic mode of thinking. Current educational systems throughout the world are inadequate for our present or future needs. Distance learning based on interactive technologies is most likely going to be the future education system.

## 2.1 PROBLEMS IN LEARNING

We need to understand current learning problems to start with the discussion of future learning. The problems occur in all countries, at all levels of education, in both public and private institutions.

**Key problem:** There will be a marked increase in the clientele of future education.

- We have an exploding **world population** and soon will reach six billions, mostly uneducated.
- With our present learning strategies, many do not learn
- Many students learn only incompletely.
- Not all learning is available for all students.
- All over the world equal opportunity is a major problem with education. The children

of the wealthy receive much better education than the children of the poor, increasing the gap further. Other undesirable factors are race and gender bias

- Most learning today is not individualised to the needs to each student.
- Most learning today is not interactive.
- We often confuse supplying of information with learning
- Learning today unfortunately often emphasises memory, rather than higher order thinking skills and creativity.
- The current evaluation and testing, which often is based on multiple choice is inadequate. Mostly we test, even in national and international tests, are based on memory only,
- Many students do not like to learn. Many students view the current learning institutions as not fully useful. Motivation should be intrinsic, not from loud music, puppets, cartoons, violence and other similar devices.
- Many students are not motivated to lifelong learning.
- Learning seldom addresses the major problems of our society.
- Learning is becoming too expensive for the individual learner. This also leads to resource crunch for the society.

The creation of an effective learning institute, of the future order should include these problems, and see they are overcome or dealt with.

## 2.2. Present Status of Schools and Universities

Many schools and universities have grafted the powerful technologies onto the existing infrastructure. The technology in schools is like a kind of junk-food people love it but there is no nutrition to speak of. Computer Communications have brought a new dimension to distance education. The Internet will make dramatic changes in distance education as it has the technical capability to transmit written words, audio and video.

A major problem in today's learning is the confusion created between information **and learning**. This is particularly true with the use of World Wide Web in learning. Textbooks and lectures are primarily sources of information, rather than learning media. This confusion of information and learning is particularly large in the areas that deal with problem solving.

Conventional teaching emphasises the use of structured instructional materials and systematic presentation. The hypertext and web based learning materials are basically unstructured information and the presentation is normally driven by the user i.e., the student. Though, the retrieval is based on the needs of the student, there is no assurance that such need based searches will lead to **systematic learning and good cognitive mapping**. The cognitive psychology needs to take a look into the learning from unstructured materials and its effect on cognitive mapping.

There are differences between the learning styles of student, professional and the non-student/professional population. Internet is not integrating all the styles. It is not suitable for all age groups of students.

## 3.0 GOALS AND VISIONS OF INTERACTIVE DISTANCE LEARNING

The goals and visions of Interactive Distance Learning are the first to be defined and examined. This will improve the learning process particularly as they are applied to new, open and distance learning institutes. These goals are closely related to the problems just mentioned.

- Focus on students
- Focus on Learning
- All learning at all levels should be available for everyone.
- Learning should be possible at any location.
- Everyone should enjoy learning. Learning units should motivate the students to learn.
- The needs for Learning vary from student to student, depending on many factors.
- A student should be able to join a course at any time, and a student should be able to complete it at any time.
- The pace of learning should be left to the individual student's choice.
- Learning can take place at any time.
- Wide range of subjects should be available for learning.
- All learning should be active.
- Learning should be individualised to the needs of each student, perhaps on a moment by moment basis.
- Every person should believe that she or he could learn. All learning process, hence should have a positive attitude, encouraging learning.
- Everyone should be able to afford to learn. No one should be barred from learning because of economic restrictions.

Current systems often favour the wealthy, even in most of the developed countries. In developing countries the situation is even worse.

## 4.0 DISTANCE LEARNING INSTITUTES

The distance learning of the future order should have a new structure for education. Although the existing examples are mostly at the university level, distance learning could be at any level.

Some key factors about the Open University are noteworthy

- Degrees are offered in several areas;
- Over 2,00,000 students are enrolled;
- Much of the learning is done in the student's home;
- Larger "classes" have a capacity closer to 10,000 students each;
- Study centers are available for providing individualised human attention;
- Non-degree courses are also available
- Cost per student is far less than that of traditional Universities; and
- Graduates compete well with those from traditional Universities.

Although distance learning of today is mainly restricted to the university level, other levels are likely to become more important in the future.

**Combining distance learning with highly interactive computer-based learning units** will definitely solve almost all the learning problems.

## 5.0 HIGHLY INTERACTIVE DISTANCE LEARNING

Existing distance learning institutions do not make major use of highly interactive learning materials. Print and video are the major learning media in the present day universities. Both these media are non-interactive. Recent attempts to put courses on the World Wide Web only will differ slightly from books, as their main form of interaction is a pointing technique.

The potentialities of a highly interactive distance learning institution are very high. This needs a careful consideration. The Open University and similar institutes show that we can provide quality education to large number of students at lower costs than what is available now. Technology will enhance these factors, allowing as to respond more adequately to individual student needs. Highly interactive material will allow individualization of learning, which is not possible with current class sizes.

### 5.1 More Help to Individualization of Learning

Our present grading system, in which many students receive poor grades, only indicates that we are mostly unsuccessful in helping the individual student. Learning would be no longer passive, listening to information or reading it from books and computers. At each moment, the computer program would be playing very close attention to the individual student. Highly interactive computer material will make this individualized attention possible. We need programs that continually probe the student, finding out at each instant what the student could and could not do. Then, based on this knowledge the program might offer individualised assistance.

This approach combines learning and assessment into one seamless activity, not separating them as seen in current courses. Assessment may be used to determine what learning material could be presented next.

### 5.2 Groups of students, local and Remote

The interactive program could find which students are at the same spots in learning and thus possibly could bring them together. A physical group of people living in a given region might be formed around a computer or in other environments. Other might be an electronic group formed by the computer, interacting through a chat group, a bulletin board, electronic mail or a web site.

### 5.3 Full and Interactive Computer based Courses

We require full courses, at all levels, capable of using by large number of students. This is possible if we make major improvements in our learning systems. A small amount of new learning material added to a conventional course, no matter how successful this material would be, will only make a small change in student learning. Learning Delivery Methods could be initially through CD ROMs, possible through Internet and the World Wide Web, through cable and satellite or it could be designed to allow different delivery methods.

### 5.4 Speech as Major Mode of human - Computer Communication

The keyboard is the most bizarre, ridiculous, non-designed monstrosity foisted on the public. The keyboards are odd and unnatural to think of each word as a collection of letters and keystrokes. Most of them feel shackled to an inappropriate finger -busting of the mechanical age.

The dominant mode of interacting with computers is still the keyboard, and the even more limited interaction with the mouse. The keyboard is an unpleasant device, except for a few experts in its use. For many students, especially for pre-school children, the keyboard is bizarre.

But for many years in science fiction, people TALK to computers, just as they talk to people. Such fiction suggests the **Voice** is the most natural way for humans and computers to interact.

We have adequate voice recognition software now, produced by several vendors. But almost no such software is currently in use for education. Voice-recognition software is improving rapidly. It is easy to predict the replacement of the keyboard in the near future general computer usage.

### 5.5 Systems for Developing Highly Interactive Software

We need new tools and new systems to carry out this new task because the current software tools available do not stress the creation of highly interactive software. Production of effective highly interactive learning units is a large and complex project. Hence careful management will be essential. One of the first activities of a project is to form the **management team.** A typical such team will include a project manager, a pedagogical design manager, a graphic design manager, an implementation manager and an integration manager.

The professional organisations could be formed just for this task, working either with a single distance learning institution, or with groups of such institutions. The organisations might be called **Curriculum Development Factories** analogous to recently formed software factories. In addition to creating learning material, the factories would also examine and improve the systems for producing materials.

It is not known until now that any substantial development has taken place. However one **Irvine-Geneva System:** A One set of such tools emphasising the production of highly interactive software has been developed as a joint work of the Information and Computer Science Department, the University of California and the University of Geneva in Switzerland. A similar system has been developed in Japan by Fujitsu.

## CONCLUSION

The key factor in the system suggested is that highly interactive material can be widely used all over the world. So high development costs may correspond to very low costs per student. Individualized help will be offered to all students. The learning units will be eventually available in many languages.

For the first time in human history, we have the possibility of everyone learning within economically reasonable limits.

Education is the industry of the future and where the hottest people will want to be, which is in extra ordinary exciting prospect. It's a mind boggling hike in the status of education. - Dale Spender

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*Paper presented at 3rd International and 34th IAAP Conference held at TTTI, Chennai in Dec. 1997.*

# Stress in Tertiary Institutions: Causes and Prevention

MBAH DOROTHY CHINYERE

*ABSTRACT*

*The concept of stress is a common phenomenon all over the globe and yet whose definition has been as many as the number of people that studied the subject. Hans Selye, one of the earliest persons to research into the topic simply saw it as the wear and tear of life. Lecturers in tertiary institutions face multiple stressful situations in their everday routine at home and at work. Lack of motivation, poor working environment, conflicts between themselves, among others were seen as causes of stress which leads to many medical diseases. Many methods were preferred as ways of dealing with stress. These include ego defence mechanisms, hard work by lecturers as well as financial and material motivation by governments and the institution where the lecturer works.*

## INTRODUCTION

Stress is a term used by nearly everyone but whose definition and concepts have been subjects of controversy among people. Hans Selye (1956), the first widely recognised person to have done an indepth study of stress defined 'stress' simply as "the wear and tear in the body caused by life at any time". Other authors have given their own concepts of stress: For example, Martin and Prange (1962) defined stress as "any internal or external influence that interferes with satisfaction of basic needs or disturbs or threatens to disturb homeostasis. Rapoporty (1962) yet described stress as just "a burden or load under which a person survives or cracks". Joe (1985), has suggested that stress can be looked at as "a perceived substantial imbalance between demand and response capability under conditions where failure to meet demand has important consequences". All the definitions summarise the subject as problems which the individuals tackle in life. The life of academic staff in tertiary institutions is filled with efforts to satisfy the school administration, efforts to satisfy the students and efforts to produce materials necessary for recognition in the academic world. The non-academic staff are not exhonorated from problems, although less than that of the academics. This paper is an attempt to x-ray stressors in tertiary institutions and offer preventive measures so as to reduce the incidence of stress-related problems faced by these workers.

## CAUSES OF STRESS AMONG ACADEMIC STAFF OF TERTIARY INSTITUTIONS

Different professional groups encounter different problems recognised as causes of

stress in their place of work. For the academic his place of work contains fellow academic staff, non-academic staff, students as well as the work itself. All these factors contribute in different degrees to the stress a lecturer experiences. Many people have carried out studies on causes of stress among workers. In his study, Obi-Keguna (1985) stated that work motivation posed the major cause of stress and frustration among workers in Nigeria, Lecturers inclusive. In her study on stress induced hypertension among lecturers at University of Nigeria (Enugu Campus), Iwenobi identified many causative factors.

It was discovered that the following were causes of stress

1. Lack of financial and material reasons.
2. Poor working conditions
3. Poor interpersonal relationships between lecturers
4. Difficulty keeping up with academic work.
5. Poor office accommodation and
6. Domestic/family problems.

A simple line chart in figure one elaborates this fact. Number one to six on x-axis signify the stressors as enumerated above.

The information above reveals that eighty five of the subjects were frustrated and under stress due to poor financial and other forms of motivation. Number two stressor was poor working conditions with 60 respondents, 58 people (number three) expressed that poor interpersonal relationships was a cause of stress. Forty replied that the academic work load put them under stress. In number five, thirty seven people said that poor office accommodation caused stress for them while

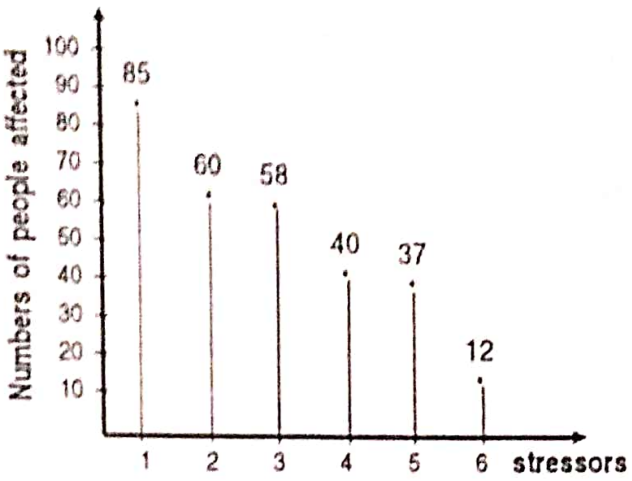


Fig. 1 Simple Line Chart

in number six, twelve (12) people said that domestic problems caused stress for them. The study allowed the candidates to tick more than one factor. In a similar study, the author, worried about frequent sudden deaths among workers of Federal Polytechnic, Oko, was stimulated to take blood pressures of senior staff randomly picked in the institution, and circulated questionnaires to be answered (Mbah 1995). She discovered a staggering 15% of them hypertensive, and most of them ignorant of this fact. Other stress-induced diseases were also observed among the staff.

## COMMON STRESS-INDUCED DISEASES AMONG ACADEMIC STAFF

Apart from hypertension, many other stress induced medical conditions were reported by the staff as deduced from the questionnaires respondend to by such lecturers. Some of these problems include:

(a) Bronchial Asthma: A condition of difficulty in breathing resulting from contraction of the air-way. This condition is often precipitated or worsened by stress (Ayorinde, 1983).

(b) Depression: Simply referred to as "feeling low. Angst (1998) described the condition as a disabling psychiatric disorder in its severe form."

(c) Stress-induced Diabetes Mellitus: Diabetes that occurs at the most stressful moments of the person's life.

(d) Intestinal Ulcers were also noticed among the staff from answers to questionnaires.

(e) Tension headache and Migraine: Many people under stress discover that they have headache most of the time. This tension headache may progress to a more severe form of headache known as 'Migraine'.

## ADAPTATION TO STRESS

Every human being on earth has to face stressful situations in the journey through life. Great psychologists like Selye, Rapoport etc. recognised this fact, hence their different definitions of stress as earlier pointed out (Selye, 1956, Rapoport, 1962). But the ability of the individual to cope or adapt to the stressful situations determine how long he lives on earth and how successful he is in life. When Rapoport said stress "is a burden under which a person survives or cracks," she was specifically alluding to the fact that a person could over-come stress or be overcome by stress, depending on the person's inherited and acquired abilities to cope. We shall review some methods open to lecturers to cope with everyday stress.

Murray (1980) described adaptation to stress as the "process whereby an individual defends his individuality, retains his integrity and wholeness within the realities of his environment. Altschul (1976), Mckeachie et al (1976), and Onwuegbuna (1995), all agreed that the use of ego defence mechanisms help integrity. Some of the ego defence mechanisms listed by them include: projection, rationalization, regression repression, displacement, reaction formation, compensation etc."

It is however, not sufficient to sit down the use ego defence to ward off stress at all times. The individual has to work hard to ensure that most of the stresses do not occur observed Obi Keguna (1985) and Joe (1985). A lecturer in a tertiary institution who does not prepare his lecturers before going to class will invariably teach badly and will have no respect from students. This will lead to embarrassment and stress. If he doesn't carry out research and publish some work, he will remain static on one position and become frustrated. He must also be tolerant both at home and at work so as to avoid conflicts in these places. Having done all these, it does not mean that his life will be completely stress-free. But it will reduce the incidence so that he doesn't live everyday of his life coping with one stress after another as it is easy to succumb under the burden of the stressors, Okpara (1985), Auld and Birum (1973).

## CONCLUSION

Stress is an integral part of life; it is impossible to completely remove it from any person's life. It is even necessary to a reasonable extent for optimum performance, but in excess becomes a big problem that can lead to many medical conditions. It is therefore necessary that the academic who lives in a potentially stress-filled environment must design ways to avoid most of the stressors and to deal with the unavoidable ones. It is relevant to point out the necessity

for lecturers to avoid unnecessary rivalry, conflicts and bickering which characterise their relationships with one another. Instead everyone should work hard and complement one another's efforts. The institutions and governments have roles to play. They should motivate workers adequately so that having solved most of their financial problems, there will be no cause for frustration and irritability.

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# A Study of Occupational Choice Among Boys and Girls

T.J. KAMALANABHAN, V. VIJAYA, PAUL PRATHAP JAYARAJ

*ABSTRACT*

*This study attempted to find out the pattern of occupational choice among boys and girls. The sample consisted of 80 boys and 80 girls from a private English medium school in the age range of 14-15 yrs. The tool used for the study was the Occupational preference test schedule. The data was analysed with the 't' test to compare the differences in occupational choice between boys and girls. It was found that significant differences existed in preferences on eight of the fourteen occupations classified. Boys seemed to show a greater preference for science skilled and linguistic occupations. On the other hand, girls show a greater preference for business professional and skilled outdoor, aesthetic skilled, service professional and skilled occupations.*

## INTRODUCTION

There has been considerable interest in recent years in developing and testing models of occupational preference. An interest has evolved in developing models that can provide a better understanding of the processes that affect differences in occupational preferences for males and females (Wheeler 1983). Occupational choice has been studied looking at sex differences and the influence of various variables that contribute to such differences have been explored. According to Reeb (1979), jobs can be adequately represented by interpretable cognitive maps which are approximately the same for both sexes. He went on to study occupational perception from a cognitive-perceptual consensus of more general application than from purely an affective dimension. Consequently, he went on to stress the importance of the query "How do you think of this occupation in relation to others?" compared to the query "How much do you like these occupations?". He went on to find out that there is a close resemblance of the perceptual structures of boys and girls. However, as found by him, under multidimensional preference mapping, prestige was not found to be an overall dimension for girls. He went on to conclude that job perceptions can be adequately represented by interpretable cognitive maps which are approximately the same for both sexes.

Hackett and Betz (1981) have emphasized on a self-efficiency approach to understanding sex differences in occupational preferences. Personal expectations of self-efficacy in relationship to performance requirements in an occupational area are a major determinant of interest in entering in to

an occupation. Self-efficacy perceptions could be acting as artificial barriers to entry in relatively high status, high paying jobs due to socialization experiences and modelling behaviour that results in females underestimating their own capacities to perform in such occupations. In a study it was found that high school pupils, of both sexes ranked the prestige of various occupations in the same way, but boys tended to choose the occupations or school subjects with the highest prestige, while females tended to avoid them (Barnett 1975).

The sex-type of an occupation interacts with the sex of the subjects and affects a host of dependent variables including choice and interest in an occupation (Heilman 1979). In a study it was found that males and females perceive a similar hierarchy of sex-relatedness of tasks and occupations. Sex relatedness was defined as either association or expected performance on tasks or presented as 'desirability for' or 'qualification for' an occupation. (Chewing and Walker 1980). Panck, Rush and Greenwalt (1977) investigated the sex stereotyping of various occupations and found that certain occupations are considered 'male', 'female' or 'neutral' occupations. Osipow (1976) quotes studies which show that sex sterotyping occupations starts at an early age of 7 years and influences occupational choice and career development. However, it was found that sex-role orientation was unrelated to occupational choice (Kanter and Ellerbusch 1980).

Differences were found between the sexes on the preferences of 14 years olds, on the aspirations of 12 and 16 years olds and the choices of 17 years olds. Boys tend to make a greater range of choices, a slightly greater range of preferences and an almost similar range of aspirations to girls suggesting that females do not feel they have a great range of jobs open to them that they will actually have a chance of doing (Hoult and Smith 1978). Bloch (1980) found that some interests showed the traditional trend with girls scoring higher in aesthetics, humanities, literature, outdoor, people and secretarial and boys scoring higher in business, military, politics, physical sciences and sports. The interest field showing the largest difference between the sexes in technical.

## OBJECTIVES OF THE STUDY

This study attempted to find out the sex differences in occupational choice among high school students, boys and girls, aged 14-15 years.

## METHODOLOGY

### Sample

The subjects of the study were 80 boys and 80 girls taken from a private English medium school from the city of Chennai.

### Tools

The scale used to study the occupational preferences was the 'Occupational preference test schedule' developed by T.J. Kamalanabhan (1989). The scale contains 168 items measured on a four point Likert scale. It measures preferences for fourteen occupational classifications like science professional and skilled, business professional and skilled, technical professional and skilled, linguistic professional and skilled, aesthetic professional and skilled service professional and skilled, outdoor and clerical. It has been widely used (Kamalanabhan and Sunder 1993)

TABLE shows the mean, standard deviation of boys and girls, degrees of freedom, standard error and the 't' value indicating the significance level

| Occupational Preference | Mean of Boys | SD of boys | Mean of Girls | SD of girls | df | SE | 't' |
|---|---|---|---|---|---|---|---|
| Science professional | 17.36 | 9.19 | 17.11 | 11.44 | 158 | 1 635 | 0.153 |
| Science skilled | 26.50 | 7.19 | 18.21 | 9.48 | 158 | 1.326 | 6.252** |
| Technical professional | 13.40 | 8.20 | 15.81 | 8.20 | 158 | 1.292 | 1.865 |
| Technical skilled | 18.45 | 7.57 | 16.36 | 7.55 | 158 | 1.192 | 1.754 |
| Outdoor | 12.76 | 7.53 | 19.05 | 8.14 | 158 | 1.236 | 5.090** |
| Business professional | 15.83 | 6.84 | 23.30 | 7.41 | 158 | 1.124 | 7.091** |
| Business skilled | 15.97 | 8.66 | 24.04 | 8.72 | 158 | 1.370 | 5.892** |
| Clerical | 16.26 | 7.66 | 13.99 | 8.12 | 158 | 1.244 | 1.825 |
| Linguistic professional | 15.95 | 7.88 | 12.26 | 7.95 | 158 | 1.248 | 2.958** |
| Linguistic skilled | 21.84 | 7.95 | 21.36 | 8.98 | 158 | 1.337 | 0.359 |
| Aesthetic professional | 16.75 | 8.57 | 17.43 | 7.76 | 158 | 1.289 | 0.528 |
| Aesthetic skilled | 13.30 | 7.58 | 17.94 | 7.60 | 158 | 1.196 | 3.879** |
| Service professional | 16.18 | 7.58 | 24.56 | 9.18 | 158 | 1.327 | 6.316** |
| Service skilled | 12.31 | 7.40 | 16.88 | 8.08 | 158 | 1.221 | 3.742** |

** Significance at .01 level

in the Indian context and the instrument was found to be reliable. Test-retest reliability coefficient was found to be 0.71.

## ANALYSIS

The 't' test was used to find out the differences in occupational choice between the boys and girls.

## RESULTS AND DISCUSSION

The TABLE shows the results of the 't' test to compare the strength of occupational choices of boys and girls.

From the table, it can be seen that there are significant differences with regard to eight of the fourteen occupational preferences. Preferences for the occupations classified as science skilled, outdoor, business professional and skilled, linguistic professional, aesthetic skilled, service professional and skilled, show significant differences. The differences are found to be significant at .01 level.

Observing more closely, boys have a higher mean than girls indicating greater strength of preference for the science skilled occupations involving scientific research and extensive study. This finding falls in line with that of Tyer Edwins (1979) who found careers involving mathematics, chemistry, and physics being primarily chosen by men. The linguistic

professional occupations involves teaching, writing, editing, law etc. It can be seen that boys have a greater preference for these occupations as against the findings of Bloch (1980) who writes of the traditional trend with girls showing more literary interests than boys.

The girls have a greater preference for outdoor, business professional and skilled, aesthetic skilled, service professional and service skilled occupations. It is interesting to note the trend of breaking over sex typing of occupations as found earlier by Tyer Edwins (1979). He had observed that business administration was a male-dominated profession. The trend found in this study could be explained by the findings of Kenneth (1983) who stated that there is increasing stress on achieving more equal proportions of females in traditionally male dominated occupations.

Outdoor occupations, involve agriculture, forestry and mining related activities and service professional and skilled occupations involve catering in a direct manner to the needs, desires and welfare of people. These are preferred more by girls. This confirms an earlier finding by Kamalanabhan, Vijaya, Sunder (1996). This study also confirms some of Bloch's (1980) findings that shows that girls showed more interest in aesthetic professions and contradicts the greater interest of boys in business activities.

The occupations for which no sex differences were significant were the science professional, technical professional and skilled, clerical, linguistic skilled and aesthetic professional occupations. It can be observed that this study confirms as well as contradicts many earlier studies with regard to sex differences in occupational preferences. Certain occupational preferences show no sex differences. Various research findings do not confirm to the traditional sex typing assumption explaining occupational preferences. These observations helps us infer the fact that sex as a variable as well as other synonymous variables like sex-typing, sex-role, orientation are not the only important variables that explain differences in occupational preferences. For both sexes,. specially the girls self-efficacy perceptions (Betz and Hackett 1981) with regard to occupations seems to be in a process of transition and change with the experience of changing cultural influences in society. It is possible that with the changing trend, the expectancy model (Brief et al 1979) that stresses on individual differences in terms of the importance given to obtaining different possible outcomes found in occupations, such as achievement opportunities, chance to benefit others, social relations, pay, benefits, security and supervisory relations, might be able to explain occupational preferences together with the self-efficacy perception model (Wheeler 1983).

## CONCLUSION

There are sex differences in preference for the science skilled, outdoor, business professional and skilled, linguistic professional, aesthetic skilled, service professional and skilled occupations. Preferences or science professional, technical professional and skilled, clerical, linguistic skilled and aesthic professional occupations show no sex differences. From the many research findings that confirm and contradict each other, it can be inferred that sex as a variable may not be the most important factor explaining differences in occupational preferences.

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# Indian Work Participation Rate and Curricular Requirements of Technical and Vocational Courses

R. SRINIVASAN

The role of Human Resource Development in economic growth was realised more than a decade ago which brought into existence the renamed Ministry of Human Resource Development at the national level in Sep. 1985. In our economy the paucity of resources should not be felt much as we can develop alternatively our population (Human Resource) with education and training to make them actively contribute for national prosperity. So it is the active population especially those in the 15-59 age group who have to shoulder the burden of carrying the economy forward.

In economics we speak of four factors of production – land, labour, capital and organization. Labour as an agent should be qualified and skilled so that their productive efficiency will be more than less qualified personnel. In this paper the composition of Work Participation Rate (WPR) has been analysed.

Asha Bhende and Tara Kanitkar (1987) say the term "labour force is equivalent to economically active population". Quoting multilingual demographic dictionary they state that "generally speaking the working population consists of those individuals who take part in the production of economic goods and services including unpaid family workers in an economic enterprise as well as persons who work for pay or profit".

## 1.1 WORKING AND NON WORKING POPULATION

The absolute number of working and non working population ie., productive and non productive consumers over the years 1961-91 is shown in Table 1.

First analysing the Indian population growth it is found that so far in free India the decade 1961-71 accounted for the maximum increase of 24.8%. The first decade of 1951-61 following independence recorded the lowest population growth of 21.5% (Indian Population in 1951 was 361 million).

The non working population has also been growing all these years. While between 1961 and 1991 non working population more than doubled it is not so with regard to working population, i.e., during 1961-91 working population went up by 72.13% where as non working population rose by 106.64%

On the other hand looking at the working-non working population ratio again the year 1961 recorded the lowest ratio of 1:1.39. The highest population growth of 1961-71 pushed up this ratio to 1:2.12 in 1971 implying a larger dependency ratio.

**Table 1**
**India's Working and Non Working Population 1961-91**

| Year | Working Population | Non Working Population | Working-Non Working Population Ratio |
|---|---|---|---|
| 1961 | 183 | 256 | 1:1.39 |
| 1971 | 175 | 372 | 1:2.12 |
| 1981 | 220 | 464 | 1:2.109 |
| 1991 | 315 | 529 | 1:1.67 |

Subsequently we see a decline in this ratio in 1981 and 1991.

### 1.2 Work Participation Rate (WPR)

The Indian WPR during 1971-91 is shown in Table 2.

The total WPR has gone up. But the WPR of men declined marginally while that of women produced maximum improvement. This has enabaled the men women WPR to come down heavily.

### 1.3 Rural-Urban WPR

When analysed location wise the rural, urban population and their WPR show the following trend.

The urban WPR accounted for only. 4% increase per decade between 1971 and 1991. Compared to this the rural WPR increased at a faster rate. Even here the decade 1971-81 showed a higher increase than 1981-91. The rural WPR for men remained same for two decades upto 1991 when it showed a slight fall. As for rural women's WPR it went up by 7.2% in 1970s and by 4.1% in 1980s. Anyhow one encouraging trend reported by Maithreyi Krishnaraj (1998) is that the "public sector has been a major employer of women and has been less discriminatory than the private sector. The expansion of public services led to a large increase in the employment of women functionaries in rural areas-nurses, ANMs, gram sevikas,

**Table 2**
**India's Work Participation Rate 1971-91**

| Year | Persons | Men | Women | Men women WPR |
|---|---|---|---|---|
| 1971 | 34.2 | 52.7 | 14.2 | 1:3.71 |
| 1981 | 36.7 | 52.6 | 19.7 | 1:2.67 |
| 1991 | 37.7 | 51.6 | 22.7 | 1:2.27 |

**Table 3**
**Rural, Urban Population and Work Participation Rate**

| Year | Population | | Work Participation Rate | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Rural | Urban | Rural | | | Urban | | |
| | (millions) | | Total | Men | Women | Total | Men | Women |
| 1971 | 439.1 | 109.1 | 35.3 | 53.8 | 15.9 | 29.6 | 48.9 | 7.2 |
| 1981 | 525.7 | 159.5 | 38.8 | 53.8 | 23.1 | 30.0 | 49.1 | 8.3 |
| 1991 | 627.1 | 217.2 | 40.2 | 52.5 | 27.2 | 30.4 | 49.0 | 9.7 |

anganwadi teachers and primary school teachers that did much to increase the participation of women in the public domain". The WPR for urban men is around 49% throughout the period 1971-91. The same for women is increasing steadily.

### 1.4 Projections for 2001 AD

The structure of our population for the broad age groups 0-14, 15-59 and 60+ yield the following percentages as shown in Table 4

The reducation in the percentage of children is due to declining birth rate. The increasing longevity will be reflected in the higher percentage of population in the age group 60+ expected to be about 8% in 2001. Anyhow the Government has to create more employment opportunities to absorb people in the age group 15-59 which is likely to be about 61% by 2001. The cheerful news for us is that by the turn of the century there will be a lesser percentage of dependent population (less than 40%) the lowest expected since independence.

Saraswati Haider (1998) reported that "of the total employment of women, women comprise only 4% of the organized workforce, some 96% of women are employed in the socalled unorganized or informal sector which is unregulated, non unionised, low waged and with unhealthy almost inhuman working conditions".

**Table 4**
**Indian Population in Broad Age Groups**

| Year | 0-14 | 15-59 | 60+ |
|---|---|---|---|
| 1951 | 37.4 | 57.1 | 5.5 |
| 1961 | 41.0 | 53.3 | 5.7 |
| 1971 | 41.4 | 53.4 | 5.2 |
| 1981 | 39.5 | 54.1 | 6.4 |
| 2001 (projection) | 31.0 | 61.0 | 8.0 |

The unorganized sector is the affected lot and now it is time to bring agriculture and allied activities as an organized activity. It is time to go in for a large scale emphasis on agro based and agro chemical industries in rural areas so that our agricultural workers can involve in related industrial activities during lean season to brighten their income levels. This is one probabale method by which agriculture could be turned as an organized activitiy. Even for industries agriculture is the feeder. Human Resource Development and Human Resource Management are complementary. Skill development courses are to be organized to equip our labour force to increase their productivity. The community polytechnic scheme and the manpower training development activity undertaken by polytechnics has enabled substantial wage employment and self employment among rural youth over the last two decades. With the launching of vocational degree courses also in 1990s now it is time to incorporate theory, practice and internship in all higher technical and vocational courses. Even entrepreneurship development is to be a component in curricula of all technical and vocational courses when self employment schemes are floated. Empowerment is possible only through a strong human resource development policy. Once people are equipped and confident of themselves human resource management will follow when all available resources are utilised optimally in productive activities. As apprenticeship training is not available for all who hold a degree or diploma in technical and vocational disciplines entrepreneurship development and practical training in industrial and commercial establishments during the course of study is to be a part of curricular requirement of all such courses. Such a curricular transaction will pay them and the nation much in the years ahead.

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