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Innovative Methods of Technical and Vocational Education

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Report of the UNESCO International Symposium
Hamburg, June 5-9, 1989

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Report of the UNESCO International Symposium
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Foreword

From June 5-9, 1989, the Federal Ministry of Education and Science jointly with Unesco held an International Symposium on "Innovative Methods of Technical and Vocational Education" at the Unesco Institute for Education in Hamburg, Federal Republic of Germany.

It was preceded by the first Unesco International Congress on "Development and Improvement of Technical and Vocational Education" held in Berlin/German Democratic Republic, in 1987. At the occasion of that event, a follow-up meeting was suggested to exchange experiences concerning innovative methods of technical and vocational education, with special regard to concepts of out-of-school vocational learning.

One of the major objectives of the Symposium was to define elements of close cooperation between schools and enterprises both at the level of the education system and of the process of vocational learning. Furthermore, the Symposium was intended to foster international exchange of experience in technical and vocational education.

I am particularly glad to present this publication immediately prior to the 25th General Conference of Unesco which will be opened in Paris in October 1989. This General Conference will have to take important decisions on the future role of technical and vocational education within Unesco's programme. Hopefully, the results of the Hamburg expert meeting will facilitate the decisions to be taken by member states.

The Federal Republic of Germany, as many other member states, has been striving for a more prominent place of technical and vocational education within Unesco's programme. I therefore welcome the opportunity arising only a few months after the Hamburg Symposium to decide on future actions Unesco might undertake in this field. The Federal Republic of Germany is willing to contribute actively to this decision-making process.

Jürgen W. Möllemann
Federal Minister of Education and Science

United Nations Educational, Scientific and Cultural Organization

The Federal Ministry of Education and Science, Federal Republic of Germany

Unesco International Symposium

Innovative Methods of Technical and Vocational Education

Hamburg, Unesco Institute for Education, Federal Republic of Germany, June 5-9, 1989

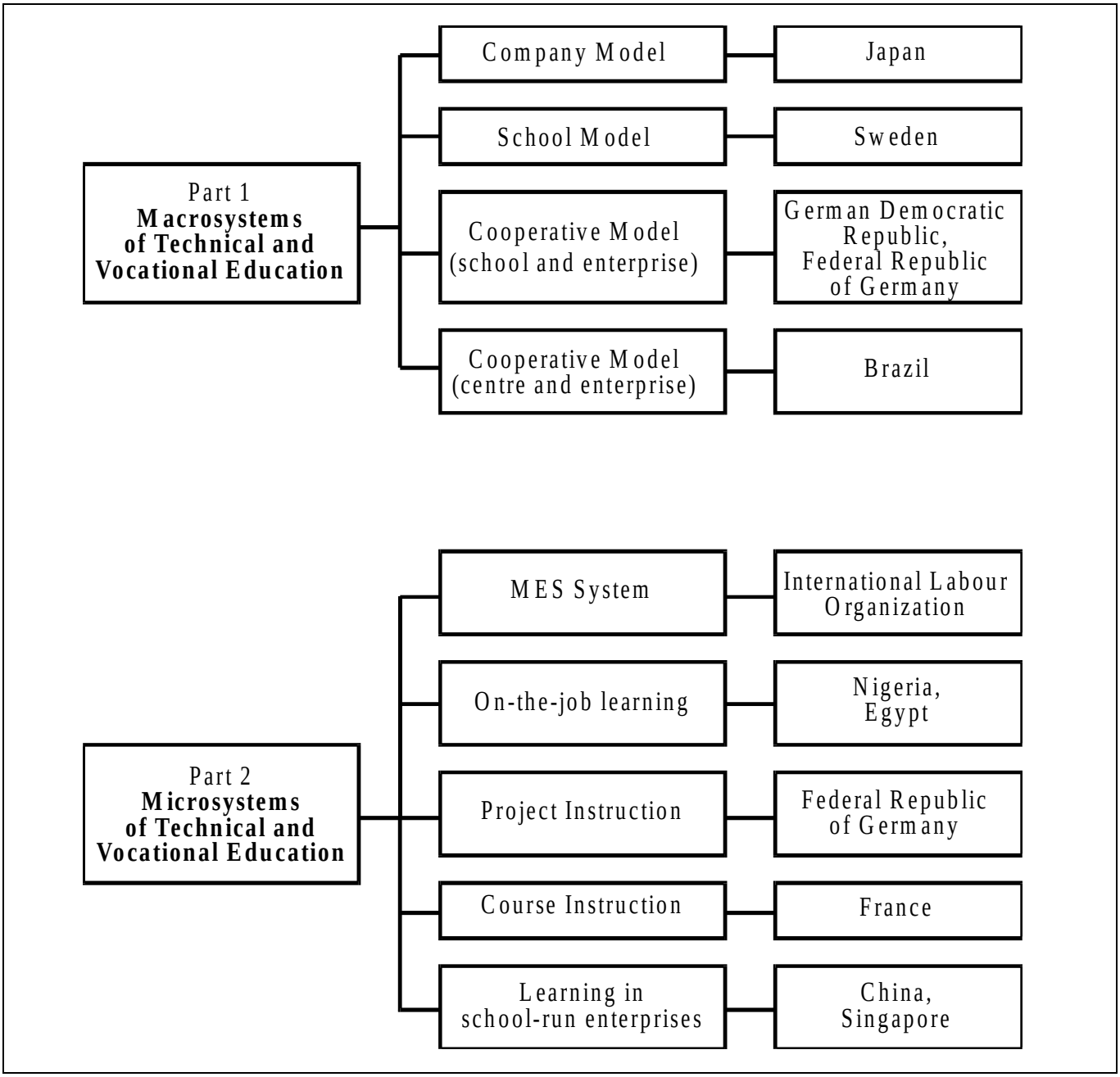

Illustration 1
Structure of the Symposium

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Introduction

Background and purpose of the Symposium

For some years now, a number of Member States of the United Nations Educational, Scientific and Cultural Organization (Unesco) have been making increasing efforts to give higher priority to Unesco's programme in the field of technical and vocational education.

This has certainly been a major reason for Unesco to convene its first International Congress on the Development and Improvement of Technical and Vocational Education which took place in Berlin/German Democratic Republic, in 1987. One of the items dealt with was the cooperation between institutions and administration of technical and vocational education on the one hand, and agriculture, industry, trades and services on the other.

Many participants of the 1987 Congress felt that fostering such cooperation might be instrumental in view of the increasing pace of technological development at the workplace that technical and vocational education is having to face. There was, however, an obvious need to intensify an exchange of experience in this field, particularly since Unesco's programmes and terminology in technical and vocational education have often been dominated by *school-based* concepts.

Systematic vocational learning in *enterprises* has a long tradition in Germany. Hence, the Federal Republic of Germany offered to organize a Symposium to deal with such concepts and experiences. Basically, the purpose of the Symposium was to acquaint participants with different frameworks of and didactic approaches to intentional vocational learning in school as well as out of school:

- On the macro level, different basic models of technical and vocational education systems were developed by *Wolf-Dietrich Greinert*, followed by case studies from Japan (presented by *Walter Georg* in the absence of a Japanese participant), Sweden (*Lennert Nilsson*), the German Democratic Republic (*Michael Guder*), and Brazil (*Guimarâes R. Boclin*). There was an additional case study on the Federal Republic of Germany, but since it was presented in the form of two films, including it in this publication was not possible.
- On the micro level, different didactic approaches to technical and vocational education systems were introduced by *Günter Wiemann*, followed by case studies from the International Labour Organization (*Eckhart Chrosciel*), the Federal Republic of Germany (*Harald W. Bongard*), France (*André Bruyère*), China (*Meng Guang-ping*), and Singapore (*Klaus Krüger*). Two additional case studies were presented at the Symposium about on-the-job training (Nigeria, by *Olu Aina*; and Egypt, by *Abdel Razek Abdel Fattah*); since they are not available in writing, they are not included in this publication either.

Organization of the Symposium

The Symposium was then organized by the Federal Ministry of Education and Science in co-operation with Unesco and held at the Unesco Institute for Education in Hamburg, Federal Republic of Germany, from 5-9 June 1989. Twelve participants from Algeria, Brazil, China, Egypt, Federal Republic of Germany, France, German Democratic Republic, Hungary, India, Mexico, Nigeria and Sweden attended, as well as eleven observers, six additional experts, and a representative of the International Labour Organization.

For a complete list of participants, please refer to page 53 of this publication.

The meeting elected the following officers:

Chairman	*Prof. Dr. Günter Wiemann* Institute for Vocational Education, University of Hanover, Federal Republic of Germany
Vice-Chairmen	*Prof. Guimarâes R. Boclin* National Service for Industrial Training (SENAI), Brazil
	Dr. *Michael Guder* Central Institute for Vocational Education, German Democratic Republic
	Mr. *Yashwant Singh* Director of Apprenticeship Training, Directorate General of Employment and Training, Ministry of Labour, India
Rapporteur	Dr. *Olu Aina* Associate Professor, Department of Vocational and Technical Education, Ahmadu Bello University, Nigeria

About this publication

Detailed information on the proceedings of the Symposium is given in Horst Biermann's Report on page 11. Both the basic lectures and the case studies are to be found in the section entitled "Contributions". For reasons of space, it was necessary to condense some of the manuscripts and to limit the number of illustrations. Also, an attempt was made to adapt the educational terminology found in the contributions to Unesco's usage.

Acknowledgements

This publication could not have been prepared without the help of the participants and experts who willingly submitted their manuscripts. The editor therefore extends his sincere thanks to all of them, especially to Mr. Olu Aina who, as the Rapporteur of the Symposium, has undertaken tremendous efforts to record the discussions, thus making it possible to compile the proceedings of this Symposium.

Opening addresses

Alfred Hardenacke
Federal Ministry of Education and Science, Bonn

Ladies and Gentlemen,

I welcome you cordially to this Symposium which has been organized jointly by the Federal Ministry of Education and Science and Unesco within the framework of a host country agreement. I should like to thank the Hamburg Ministry for School, Youth and Vocational Education, who made the local arrangements. Thanks also to the Unesco Institute for Education for letting us use its premises.

Invitations have been extended to all of the five Unesco regions: Africa, the Arab States, Asia/ the Pacific region, Europe and Latin America. We may thus expect interesting contributions on the subject of this Symposium.

Two years ago, Unesco's First International Congress on the Development and Improvement of Technical and Vocational Education was held in Berlin/German Democratic Republic. During that congress, it was suggested that, in a follow-up meeting, experience be exchanged concerning concepts of technical and vocational education which involve a sizeable degree of systematic learning at enterprise level.

The Federal Republic of Germany presented this idea to the 24th General Conference of Unesco, where the proposal met with general approval. The programme for this Symposium was then drawn up.

Investment in vocational qualification is as important as capital investment. Our enterprises share this view and are therefore prepared to provide considerable funds for in-house vocational education.

In fact, without a considerable contribution by the enterprises, it would not be possible to provide adequate vocational education, because

- the public education system would probably be unable to provide a majority of young people with practice-related specialized knowledge for a broad range of occupations, and
- it would not be possible for the government to always provide the funds required.

But it is also in industry's own interest to provide technical and vocational education itself in accordance with general government regulations: In this way, the enterprises train the number of young workers they need and thus remain competitive in the market.

This Symposium has two parts:

Part 1 deals with four macromodels of technical and vocational education, which differ with regard to the main training providers. Vocational education provided exclusively in the enterprise is compared and contrasted with technical and vocational education at school. Between these two extremes, there are two other variants which, although in a different way, combine enterprise training with additional external technical and vocational education. A case in point is the dual system of the Federal Republic of Germany with its part-time vocational schools.

Part 2 deals with certain didactic micromodels, which differ with regard to the methods applied; whether technical and vocational education is provided in the enterprise or in school can be ignored in this context.

The growing interest in systems and methods of technical and vocational education worldwide is underlined by Unesco's increasing concern with issues of technical and vocational education, in particular with enterprise and out-of-school training, a development which is highly appreciated and strongly supported by the Federal Republic of Germany.

In this connection, I should like to mention a problem which we have encountered when cooperating with Unesco in the field of technical and vocational education and which has not yet been solved to our satisfaction: At the 24th General Conference of Unesco, the Federal Republic of Germany pointed out that Unesco's terminology in technical and vocational education was misleading. For example, it is not clear why the terms *out-of-school education* and n*on-formal education* are largely synonymous in Unesco usage. Like numerous other countries, the Federal Republic of Germany has a system of formal technical and vocational education which, nevertheless, includes major out-of-school elements. Fortunately, Unesco's statistics were corrected in this respect a few months ago. I hope that this Symposium will help us arrive at further conclusions in this respect.

We are meeting here at the Unesco Institute for Education, which has given major impulses to literacy campaigns in recent years. This month, the Institute houses not only our present Symposium, but also a Unesco consultation on the interaction of education and productive work. The Federal Republic of Germany has, in recent years, considered literacy and technical and vocational education to be priority issues in the Unesco programme.

Coming to the end of my address, I wish you an interesting discussion and hope that this Symposium will be a success. Thank you.

S. R. Samady
United Nations Educational, Scientific and Cultural Organization, Paris

Dr. Hardenacke, the representative of the Federal Ministry of Education and Science; Ladies and Gentlemen,

It is a great pleasure for me to welcome the participants from Member States, the representative of the ILO and observers from non-governmental organizations to this Symposium on Innovative Methods in Technical and Vocational Education, which has been organized, in cooperation with Unesco, by the Federal Ministry of Education and Science and the German Commission for Unesco. I would like to express Unesco's gratitude to the authorities concerned in the Federal Republic of Germany for hosting this international meeting and for contributing significantly to its preparation and organization. I am delighted that this Symposium is held here in the city of Hamburg, an important cultural and economic centre, and at the Unesco Institute for Education, which is an expanding international cooperative project in the field of educational research and quality of education.

The importance of technical and vocational education for social and economic development has been widely recog-

nized. The demands of the economy affect both industrialized and developing countries. In particular the need for technical personnel in developing countries is crucial and places great pressure on systems for technical and vocational education and the limited national resources. In many industrialized countries, the training and retraining of large numbers of skilled workers and technicians to meet requirements of new technologies and changes in the employment structure have become an urgent task.

Worldwide trends in the development of education show that considerable efforts have been made by many countries to expand and modernize technical and vocational education. A statistical report on technical and vocational education in the world published by Unesco in 1983 indicates that student enrollment in full-time secondary institutions of technical and vocational education had risen from 15.7 million in 1970 to 24.3 million in 1980, which represents a growth of rate of 54 %, while the rate of increase in general secondary education during the same period was 45 %. More recent figures confirm this rapid growth in enrollment of young men and women in various branches of technical and vocational education. The development of part-time technical and vocational education and training has also been very significant, especially in the industrialized countries.

In Unesco's programme, technical and vocational education has been an important area of the Organization's action. Unesco's policy in technical and vocational education has been guided by the Recommendation concerning Technical and Vocational Education which was adopted by the Unesco General Conference in 1962 and revised in 1974. Under objectives, the Revised Recommendation refers to the contribution of technical and vocational education to society's goals of greater democratization and social, cultural and economic development; at the same time, it refers to developing the potential of individuals for active participation in the life of the community. It has been suggested that technical and vocational education should exist as part of a system of lifelong education and that it should begin with a good foundation in general education and a broad basic technical and vocational education, in order to facilitate horizontal and vertical articulation within the education system and between school and employment as well as adaptation to scientific and technological progress.

During the last three decades, Unesco has cooperated with its Member States in improving and developing technical and vocational education. In collaboration with other United Nations agencies and funding sources, Unesco has participated since the early 1960s in setting up a large number of national institutions for the training of engineers, technicians and technical teachers. Unesco has also carried out studies on curricula and teaching methods and promoted innovations and exchange of information and experience around the world. In 1987 Unesco organized an International Congress in the German Democratic Republic on the Development and Improvement of Technical and Vocational Education which reviewed major trends and suggested strategies for the development of technical and vocational education including the promotion of international cooperation in this field. Unesco is currently in the process of preparing its Medium-Term Plan for 1990-1995 and the programme and Budget for 1990-1991. Technical and vocational education will continue to have an important place in Unesco's future programme.

Despite the efforts made by most countries to develop their systems of technical and vocational education, a number of problems remain, among them the cost and efficiency of technical and vocational education, adaptation of training to technological developments and to structural changes in the economy as I mentioned earlier, and provision of qualified teachers and adequate facilities and materials to ensure the quality of technical and vocational education.

An important question related to the efficiency of technical and vocational education is the methodology and relevance of training which is the subject of this Symposium. As you know, different models of training and modalities of cooperation involving educational institutions and enterprises have evolved in accordance with social and economic conditions and the systems technical and vocational education of the countries concerned.

A study carried out by Unesco in 1986/87 on the application of the Revised Recommendation concerning Technical and Vocational Education revealed that measures for coordination between technical and vocational education institutions, industries and employment are taken by most of the countries. In this connection, a variety of mechanisms and modalities have been developed. These include joint advisory boards and school/ industry committees, cooperative education and training programmes, return to industry and summer practice, modular systems, etc. The need for reinforcing such cooperation depends on national legislative measures and regulations as well as the potential and willingness of the enterprises to ensure appropriate training consistent with the broad educational and training objectives.

I believe this Symposium will provide a good opportunity for an exchange of information and experiences concerning the different approaches and training models for technical and vocational education. The annotated agenda of your meeting has outlined a few models. This will be supplemented by country reports during the meeting this week. It is important that the different training modalities be examined carefully in relation to the conditions required for their effective application. The purpose of this Symposium is to learn about innovative methods of training and to benefit from available experiences in the participating countries, particularly from our host country, the Federal Republic of Germany, which has undoubtedly one of the most developed systems of technical and vocational education in the world.

In conclusion, ladies and gentlemen, I would like to thank you for having accepted to participate in this Symposium and for your contribution to it. I am confident that you will have an interesting and useful week of special presentations and discussions, as well as visits to industrial and training institutions which will contribute to better understanding of the different ways of organizing technical and vocational education and the philosophy and tradition behind them. Finally, I would like to assure you that any suggestions you may wish to make to Unesco, as a follow-up to this Symposium, for the improvement of technical and vocational education and promotion of international cooperation in this field, will be carefully considered in the light of our future programmes.

I wish you a very successful meeting.

Ravindra Davé
Unesco Institute for Education, Hamburg

Dr. Hardenacke; Ms. Ehmke and other representatives of the Federal Ministry of Education and Science; Dr. Samady; Professor Wiemann; Mr. Blom; Mr. Krönner; fellow participants and friends,

I have great pleasure in associating myself in extending a very warm and hearty welcome to all of you to this Institute, and especially to this programme. I am happy that Dr. Hardenacke and other representatives of the Federal Ministry of Education and Science are here, and I have great pleasure in extending a cordial welcome to them. Moreover, this Symposium has created an important opportunity for my colleague Dr. Samady to visit the Unesco Institute for Education, and I am extremely happy to welcome him to the Institute.

My colleagues and I are glad that the Federal Ministry of Education and Science and Unesco decided to associate the Unesco Institute for Education with this important international Symposium and to hold it at our Institute. This has helped us in strengthening our cooperation with the Federal Ministry of Education and Science and other agencies and individuals connected with this programme. The theme of the Symposium is not only significant and timely for Unesco Headquarters in Paris, especially in the context of the Third Medium-Term Plan, but also for the programmes and activities of the Unesco Institute for Education, and we are looking forward to profiting from your valuable deliberations.

The Unesco Institute for Education, as you may know, is an international research centre functioning under the large umbrella of Unesco. Its activities include research, research-based training and orientation programmes, publications, documentation and dissemination. Its programmes are for both industrialized and developing countries, and are closely aligned to the overall goals and objectives of Unesco. But all its activities are developed with a conceptual framework of lifelong education, and focused mainly on the content, methods and other qualitative aspects of education. It is the concept of lifelong education, on which the Unesco Institute for Education has brought out a large number of publications, and the specific focus of activities in the framework of this concept that brings this Institute closer to the theme of this Symposium.

According to the comprehensive concept of lifelong education, learning is not confined to the school alone, but it also occurs in the home, in the community, and especially at the workplace, which is significant in the context of this Symposium. Furthermore, lifelong education is not confined to general and liberal education only, but includes technical and vocational education as well in order to achieve occupational development hand in hand with the personal and social development of individuals and their communities for the purpose of ensuring a higher and better quality of life. The concept of lifelong education also encompasses both initial and continuing education through formal, non-formal and informal learning arrangements especially in the contemporary context of the explosion of knowledge in science and technology on the one hand and rapid obsolescence of existing knowledge, skills and related occupations on the other.

It is for these reasons that the Unesco Institute for Education is interested in the "Innovative Methods of Technical and Vocational Education" that will be discussed in the Symposium in an international and comparative perspective. The Institute has done some selective work in this direction which is of relevance to this theme, and as you are here at our Institute, I may share some information very briefly with you. For example, last year with the active cooperation of Dr. Psacharopoulos of the World Bank and a number of other specialists from different parts of the world, we brought out a special number of our quarterly journal, the International Review of Education, on the organizational, structure, sociological and economic issues of technical and vocational education. It also contains concise case studies of China, India and Nigeria, besides incidental examples of Costa Rica, Colombia and some other countries. This year we have completed an international investigation on curricula for lifelong vocational education based on specific experiences in technical and vocational education selected from seven countries, namely, the Federal Republic of Germany, the Netherlands, Poland, Sri Lanka, Tanzania, USA and Venezuela. The final report came out just a few days ago, and we shall be happy to share it with those who are interested in this publication. In fact, we are just in the process of distributing it to various agencies and institutions for dissemination purposes.

Furthermore, we have developed a fairly large-scale project on post-literacy and continuing education in the framework of lifelong education, for developing countries, and under this project also, we have specifically emphasized the acquisition of technical and vocational skills for income generation in order to fight the problems of poverty, besides ignorance and related issues. As part of this project, we have brought out between 1984 and 1988 some 20 case studies carried out in different regions of the world. They are published in English, French, Spanish and Arabic, and if any of you are interested, we shall be happy to share them with you. There are several other programmes and activities that the Unesco Institute for Education has undertaken in this important field of education for vocational development.

Thus, from the Institute's point of view, we are interested in learning from your valuable experience, sharing our humble work done so far in this field, connecting and interlinking the ideas to be generated by this Symposium with other activities and meetings of Unesco and the Institute, such as the one to be held here in the last week of this month, where the interaction between education and work will be one of the issues to be discussed in the context of secondary education curriculum. We shall continue to work in this field through research, follow-up action and other activities towards the promotion of harmonious progress of both general and technical and vocational education for better development and a better quality of life for individuals and their societies in all Member States of Unesco.

It is in this spirit that I wish this Symposium a great success. Thank you.

Report

by Horst BIERMANN

This report is based on the country reports submitted, the papers given, oral contributions made at the Symposium, and the Draft Summarizing Report prepared during the meeting.

Whereas the international Unesco Congress 1987 in Berlin/German Democratic Republic was held on *Development and Improvement of Technical and Vocational Education*, the 1989 Symposium was primarily concerned with the associated innovations and methods.

It was held with a relatively small attendance of experts concerned with the theory, planning or practice of vocational education, coming from universities, institutes for technical and vocational education, ministries, and educational institutions. The discussions, including those on the fringe of the Symposium, were heavily influenced by the possible consequences of new technologies on the content and structure of vocational education.

The programme was divided into two parts:

- Part 1 (macro level), and
- Part 2 (micro level) of technical and vocational education.

At the *macro* level, criteria for the classification of systems of technical and vocational education were to be developed; the *micro* level aimed at a classification of teaching and learning methods in vocational education. The Symposium was supplemented by country reports and case studies.

Part 1: Macrosystems of Technical and Vocational Education

Discussions at the macro level were inaugurated by a keynote paper of Professor *Wolf-Dietrich Greinert* from the Technical University of Berlin (cf. page 15 of this publication). The purport of these remarks was to classify systems of technical and vocational education and to define basic forms. Beyond this analytic function, the types identified and the associated criteria should facilitate communication. Specifically with regard to technical and vocational education the problem had already arisen at the 1987 Berlin Congress of conceptualization and this of comparability.

In the development of criteria for the basic types, the speaker dissociated himself from pragmatic and static approaches. Particularly the mere description of places of learning in technical and vocational education proves inadequate. Rather it is necessary for example also to include the institutions, so that social structures and interests are taken account of. As a principle of classification Greinert took the *role of government* in technical and vocational education as a starting-point, and arrived at three basic types: *market model*, *school* or *bureaucratic model* and *cooperative model*.

Model 1: The Market Model The government plays a minor role in vocational qualification processes

These models are based essentially on liberalist philosophy. As a consequence of market mechanisms there is frequently a decoupling from the general education system, and the students are to a large extent university-oriented. Technical and vocational education is left largely to the individual and the recruitment needs of enterprises. Since as a rule the state does not lay down any framework provisions, control and financing of training also remain a matter for the enterprises. The position of major enterprises is dominant in this system.

As a case study, *Professor Walter Georg* from the University of Hagen, Federal Republic of Germany, presented the Japanese system of technical and vocational education (cf. page 19 of this publication) in which in particular the minor role taken by the state is clear. The other features, such as recruitment of training personnel and staff, are evidence of this allocation, too.

Large enterprises offer in-house qualification, thus binding employees to the enterprise and making them relatively immobile in the external labour market. The general education system is not put in question by the enterprises, although it is not oriented towards technical and vocational education.

Model 2: The Bureaucratic Model The government is responsible for technical and vocational education

This type of system of technical and vocational education is based on the responsibility of the government for the detailed planning, organization and control of technical and vocational education and often also for its operation. School-type models are characteristic of this. *Greinert* also assigned to this classification - not without disagreement in discussion - the approach to in-company technical and vocational education in socialist countries.

Characteristics of state-organized technical and vocational education are, among others, the high degree of bureaucratization, the close connection between general and technical and vocational education (school careers), and the comparability of educational standards and qualifications. The role of enterprises in such systems can become marginal and be restricted for example, to making places available for practical experience.

Sweden is today regarded as the archetypal example of school-type technical and vocational education, *as Dr. Lennart Nilsson*, Docent at the University of Göteborg, Sweden, made clear in his presentation (cf. page 22 of this publication). Up to 90 % of under-nineteens go to secondary comprehensive schools. These form an integrated school system with a general and a vocational emphasis.

Both general and technical and vocational education are publicly financed. About one-half of the students complete a vocational line, which comprises various vocational groupings, and are thus qualified for employment in more than just one specific enterprise. The school-type technical and vocational education was introduced with the aim of overcoming traditional training forms.

Model 3: The Government-controlled Market Model The government provides a framework for technical and vocational education in private enterprises or institutions

The state merely sets framework conditions for the providers of training, as a rule in the form of vocational education acts. This type can be classified as a state-controlled market model. Characteristically, forms of cooperation emerge between public vocational schools and private training enterprises or inter-company training centres. Small and medium-sized enterprises participate in this form of training predominantly.

Typical features are the market-controlled recruitment of students, the orientation of training objectives and content to practical applicability, and the influence of social groups on training (e.g. vocational structure, financing, control, examinations). It can be seen that a cooperation of individual places of learning or of training providers does not by any means result in a dual system or a basic model in *Greinert's* definition.

The dual system in the Federal Republic of Germany as an example of a cooperative model was presented by the Federal Ministry of Education and Science with the aid of films. Whereas the first film showed the institutional guidelines and sharing of responsibilities at the two places of learning in the dual system, the second explained the work and role of the in-company instructors.

On the question of cooperation between schools and enterprises, *Dr. Michael Guder*, Deputy Director of the Central Institute for Vocational Education outlined the system of technical and vocational education in the German Democratic Republic (cf. page 25 of this publication). Clearly the state was responsible for all forms of education. From an institutional point of view, technical and vocational education of young people is only a part of the overall education system.

There are also state-run municipal vocational schools which provide theoretical training in the case of certain vocations and certain sizes of enterprise. In both cases theory and practical training in workshops, laboratories and shop-floor are closely coordinated. The lifelong stages of learning, training, work and continuing education are harmonized similarly. The traditional dual systems has thus been determinedly overcome. What has arisen is an organized training system providing systematic qualification with equal training standards for basically all young people.

By way of a further move for cooperation the *Brazilian Servicio National de Aprendizagem Industrial* (SENAI) was introduced by *Prof. Guimarâes R. Boclin* (cf. page 28 of this publication). SENAI is an institution for which there is only a skeleton agreement on the part of the government. Cooperation in training is restricted to the industrial sector. This institution is governed by a National Department and regional subdivisions who have the task of running the training units and cooperating with the local firms involved.

The financing of SENAI is by means of a contribution based on the enterprise's payroll, scaled according to enterprise size, of all industrial, transport, communications and fish processing enterprises. Various levels of training are offered depending on prior education of the young people in question. The training takes place in factories, mobile units, or in training centres, according to circumstances. The SENAI institution has been able to maintain autonomy both from the government and the various factories. Stress must be laid upon the social function of this institution in preventing drop-outs.

Concerning the macrosystems with their examples, discussion confirmed *Greinert's* position that all three basic models have been made possible by the industrialization of the countries involved. The reports from these countries showed, however, that none of the theoretical models can be found in reality. Normally mixed typed predominate, with various schemes alongside restricted by sector, region or training area.

It does not seem to be sufficient to compare countries with certain models, in particular in view of the structures which have grown up historically and socio-economically for education, training and further education. And so *Greinert* argued that the dual system in the Federal Republic of Germany did in fact predominate in initial technical-industrial training but not, however, in the caring or laboratory professions and not either in the field of continuing technical and vocational education.

The contributions from *Mr. André Bruyère* showed similarly that in the last decade a system of courses on the basis of business cooperation had grown up alongside typical school education. Although general interest had been expressed in the dual system of technical and vocational education, the discussion made clear that an isolated transfer of one of the three models from industrialized nations to those in the process of industrialization did not seem feasible in view of the complex mixture of systems.

The classification according to function rather than the customary descriptive differentiation of learning institution met with good response as the division of responsibility practised hitherto in institutions was becoming increasingly difficult as a result of new technologies and transformations in labour organization. The formulation of basic models of technical and vocational education can only be accepted as a first step to highlight the trend of the analysis. Further work should aid the development of comparative criteria based on this.

The attempt to classify the case studies of the three theoretical models and the additional country reports brought the discussion to the general conclusion that many countries have not developed professional statistics. Thus organized systems of technical and vocational education oriented empirically to the labour market often lack the necessary basic information. Likewise, despite all the statistical basis, educational and training forecast had proved to be a problem in the traditional industrial nations.

The transition of graduates from technical and vocational education at school to the labour market also frequently presented problems, both quantitatively and qualitatively. Graduates worldwide from schools with general education seem to have difficulties when faced with the choice of different educational careers, to orientate themselves towards technical and vocational education. The bestowing of certificates can result in students being overqualified in academic fields - as was shown in the Mexican example - in relation to the real requirements of the labour market, however, they turn out to be misqualified.

The request was made, therefore, in the discussion that further analyses of the three basic models presented should be designed with the principal object of contributing to the respective country's structures.

Part 2:
Microsystems of
Technical and Vocational Education

Professor Günter Wiemann from Hanover University, Federal Republic of Germany, introduced the second part of the conference with an international comparison of didactic models in vocational education (cf. page 33 of this publication). As in Part 1 of the Symposium, the various methodical approcaches in technical and vocational education were classified according to a specific criterion: their relation to real work situations. Four basic forms of didactic models of vocational learning were classified into two main groups:

- training in situations of natural life and work and

- training under artificial conditions.

One of the oldest and most natural forms of beginning work is on-the-job training. *Wiemann* explained the criteria of learning organization with the aid of examples taken from history and from other cultures. The aim is to produce for an actual situation, for a market. There is a high degree of job responsibility. The trainer knows his subject and his job. As a rule he is not a teacher. Through the work process the apprentice grows into his professional reference group too. The form of training is found in particular in what is called the informal sector; in the formal sector it is bound by the technical standards and work organization of the job.

Learning in course instruction, project instruction, and in school-run enterprises are quoted as examples of artificial systems of learning. The course instruction method has become important worldwide for the training of industrial workers. This was particularly clear in the examples from the metalworking field. Courses, in this context, are here considered to be methods in vocational teaching rather than institutions. This is a sequential attempt as complex requirements from actual work situations are isolated and separated into small elements and steps built up from one another. Today objective learning goals as a rule assist in the structuring of courses and in evaluating the standard of the qualification acquired at the end of the learning unit. The advantage of course instruction lies in the apparent similarity of the pedagogic method to industrial production methods hitherto. The advantages and disadvantages of course instruction do not differ greatly. It is largely a closed system, and hence problems arise in practice faced with demands of real-life work situations and also problems of acceptance of necessary innovation.

Project instruction is based in principle on the attempts of reform pedagogy at the turn of the century. It was rediscovered for technical and vocational education as a result of the anticipated requirements for skilled workers as a result of the new technologies. According to this principle it is important to simulate the actual complex work situation in factories as closely as possible. The aim is a polyvalent skilled worker who can autonomously detect, analyze and solve problems in groups or alone. This changes the role of the teacher for theory and practice also. As resulted from the discussion, a shift from course instruction to project instruction can lead to problems for the teaching staff with regard to their technical qualification as well as to their identity and acceptance.

One peculiar feature in the typology of the didactic models is the school-run enterprise, as in this organization all other forms of learning can be carried out. In principle it is a matter of combining the advantages of systematic learning in schools and productive work in factories. The sponsor may be a school, could also, however, be a factory or an independent institution. It is hoped that this Symposium will contribute to the development of a theory of school-run enterprises.

Examples of the different didactic models could be found in all countries, as was shown by the country reports and discussion, although with differing degrees of importance and incidence. In the opinion of Mr. *Eckhard Chrosciel* stress should be laid on the concept of the International Labour Organization (ILO) due to its worldwide significance.

After extensive research, the ILO has developed a concept for technical and vocational education replacing the traditional learning form with a modular system (cf. page 41 of this publication). This module system is flexible, is adapted to the regional and socio-cultural conditions, and is oriented to the employment situation. The *Module of Employable Skills* (MES) system is available for all core occupational areas. MES consists essentially of three areas:

- the concept itself, e.g. documents for developing curricula, job analysis etc.,
- instruction material in the form of learning elements, and a
- staff development programme.

More detailed information on the actual state of the MES system which was begun 15 years ago are given in the ILO handbook to be published at the end of 1989. This concept proved particularly productive in countries and sectors with no sufficient infrastructure in terms of enterprises, schools and qualified manpower. It is relatively quick and inexpensive to start up. The limits are currently seen where semi-skilled workers become superfluous and the demand is for technicians.

Mr. *Harald W. Bongard* introduced the new concept of project instruction of Volkswagen AG, Federal Republic of Germany, for the training of skilled workers (cf. page 43 of this publication). He pointed out that the social background for the new training programme went beyond technical and organizational change and included changes in values and the democratization of society. Volkswagen's aim is the prevention of breakdowns in production, this being possible by employing qualified personnel. Work quality control should be a part of all employees' work processes. Creativity and a responsible attitude are demanded as learning objectives in training, to meet the new demands. It is necessary to reorganize learning, content, targets and methods in training. Here projects in conjunction with other more open methods, such as instruction texts, have replaced the traditional basic courses. Young people learn largely through their own study, in groups or with tutors. Whereas the new role of the student demands an active learning and working style, the instructor's activity is based more on moderation, consultation and preparation of the learning situation. In the discussion it was stressed that the apprentices should learn under actual work conditions and not artificially, falling behind in matters of technology, work organization, and the use of material, machines and tools of the trade. A note of criticism made to the effect that the previous certification and examination system cannot do justice to the new training form and is also questionable as a prognosis for job preservation. It was also clear that in view of the high costs involved in this training it was applicable only to the elite in major industries. It was questioned as to whether the concept could not be suitably adapted and converted under simpler basic conditions.

If, on the other hand, one considers the portrayal of the school-run enterprises in China as presented by Mr. *Meng Guang-ping* from the State Education Commission in Beijing (cf. page 46 of this publication), one is struck by the variety of approaches in various sectors, enterprise sizes and sponsors. It is necessary to make use of all resources due to the need for qualifications. In this way it is possible to train at various levels by one's own efforts, i.e. without international support. Essentially only the financing of the training is state-controlled. Enterprises receive appropriate tax concessions and schools can make profits with their production. The Chinese examples of school-run enterprises highlight the flexibility and adaptability of these projects.

The question of cost and application was raised in the example of the school-run enterprise of the *German Singapore Institute* (GSI) which was presented by GSI Director Klaus Krüger (cf. page 49 of this publication). The *work of the* GSI concerns not only the training of skilled workers but also, for example, consultation by enterprises and further education. The centre of activities is in the field of industrial metal-working. There was a deliberate emphasis on new technologies as far as curriculum and equipment were concerned. The middle technical level in particular was not in evidence, in keeping with the qualifications and infrastructure of the city state. It follows, therefore, that the Institute sees itself as a training institution of key personnel who in turn develop a considerable multiplier effect.

In contrast to traditional school projects, projects in the GSI are developed as production tasks and are harmonized closely with the economy through institutionalized cooperation. New technologies, automation and industrial design are considered important subjects from the outset and are included in the project tasks.

Prospects

This first Symposium with participants from Unesco member countries on the didactics and methodology of technical and vocational education can be considered a success. Observations and discussions both at the macro and the micro level produced classifications of systems of technical and vocational education and of forms of vocational learning.

The concept of the school-run enterprise in particular found a strong following as it does not represent a rigid model, either institutionally or as regards the learning method, but rather represents an open system and so can be adapted regionally and sectorally to the technical standard, qualification and economic requirements of the respective countries.

Didactically both the MES system of the ILO and traditional course instruction or project instruction can be incorporated into the school-run enterprise concept. Thus this concept seems appropriate not only for elitist technical and vocational education, but also for the development of a professional infrastructure. Only as a consequence does the question of complex full-time schools or dual systems of technical and vocational education arise.

Contributions

Part 1: Macrosystems of Technical and Vocational Education

An International Comparison of Systems of Technical and Vocational Education - An Attempt at Classification

by Wolf-Dietrich GREINERT

This Symposium deals with the question of how systems of technical and vocational education may or should respond to new developments in the field of production, distribution and information technologies as well as to changes in work organization by adopting new qualification methods.

When considering this question on a national level, it suffices to look at the training methods as such, i.e. the microsystem of technical and vocational education. If we wish to consider the question in a wider framework (as this Symposium intends to do), we must also include the systemic and organizational level, i.e. the macrosystem, as there are relations between the micro- and macrolevels of systems of technical and vocational education which cannot be ignored.

In the following, I shall propose a classification for systems of technical and vocational education, because it is hardly possible to compare the large number of complex national systems of technical and vocational education, for example from the aspect of training method reform. My paper consists of three parts:

- The prerequisite:
  A reliable criterion for classification.
- The intermediate result:
  Basic types of formal technical and vocational education.
- The final result:
  National systems of technical and vocational education as variants and/or combinations of the basic types.

1 The prerequisite: A reliable criterion for classification

If we wish to assign the numerous national systems of technical and vocational education to a few basic types, we have to establish a criterion for such classification. The selection of a suitable criterion presents difficulties. This is obvious from the attempts made by four German authors in recent years to identify basic types of technical and vocational education:

- Lauterbach compares twelve countries and distinguishes between technical and vocational education by enterprises, at school, and the dual system, and mixed systems.
- Maslankowski distinguishes between the dual system, technical and vocational education at school, MES training, national services, and on-the-job training.
- Hegelheimer compares seven European countries and distinguishes between three types: dual systems, full-time school, and mixed systems.
- Zedler, following Hegelheimer's classification, distinguishes between four basic types: the dual system, full-time vocational school, mixed systems, and on-the-job training.

Despite their pragmatic orientation, these four classifications must be viewed with a critical eye. Even a first glance reveals that there are contradictions. For example, Maslankowski's MES training is a training *method*, which is used where a training *system* does not exist.

Lauterbach's, Hegelheimer's, and Zedler's basic type of "mixed systems" is a lapse in logic, as a mixed type cannot be a basic type.

The pragmatic character of the four classification systems is above all borne out by the absence of an explicit classification criterion. It becomes clear from Lauterbach's explanations that the crucial question is: In what place(s) of learning (school, enterprise, training workshop, etc.) does the greater part of technical and vocational education take place? All four authors identify a school-based system and a dual system, with three of them naming also the purely enterprise-based type of on-the-job training. Maslankowski's basic type of national services for technical and vocational education does not, however, fit into this concept. We may note: The main place of learning has become a generally accepted criterion for classifying systems of technical and vocational education. At any rate I could not find any other approach in the relevant literature.

The place of learning may be a plausible criterion for classification, but its value for analysis is limited. On the one hand, the term is not sufficiently precise and, on the other hand, it is used to denote a (new) pedagogical category. Places of learning are traditionally defined by the German Education Council *(Deutscher Bildungsrat)* as places which can be distinguished by their pedagogical function. Each place of learning is characterized by its functions in the learning process.

An aspect which is apparently excluded here quite deliberately is the question of responsibility, i.e. the question what social or political agents determine the structure and functions of the individual places of learning. This implies that systems of technical and vocational education are above all the result of considerations on what is expedient from the pedagogical standpoint. A brief look at the historical development of such systems, however, shows that they are first and foremost the result of a conflict between economic and political interests; they reflect the distribution of power in society. What should be learned at what place of learning seems to be a rather hypothetical question in that respect.

For this reason alone, the place of learning is not a suitable criterion for classifying systems of technical and vocational education. Furthermore, the notion of the place of learning has a static dimension, which means that, while it may serve to describe and analyze structures, it does not indicate how the system functions. Modern systems theory must, however, be a means for relating structure to function.

My approach to classifying systems of technical and vocational education is therefore based on a criterion which is both political and dynamic: The *role of the government*. How does the government define its own role in the process of vocational qualification of the majority of its citizens?

2 The intermediate result: Basic types of formal technical and vocational education

When analyzing the numerous national systems of technical and vocational education while applying the above criterion, we obtain the following three basic models:

Market Model
The government plays a minor role or no role at all in vocational qualification processes.

Bureaucratic Model
The government is the sole authority responsible for the planning, organization and control of technical and vocational education.

Government-Controlled Market Model
The government provides a more or less tight framework for technical and vocational education in private enterprises or other private training institutions.

Illustration 2
Classification of systems of technical and vocational education according to the role of government

Model 1: The government plays a minor role or no role at all in vocational qualification processes

This model could be called liberal. It is, however, better to term it a market economy system or *market model*. Such systems can be found in the United Kingdom, in the USA and in Japan.

Although the systems of technical and vocational education in these countries differ considerably, above all their socio-economic origin has been entirely different, they have one thing in common: Vocational education is not related to general education, for example in the form of vocational schools, nor is there a separate system which would guarantee minimum vocational qualifications for the majority of young people.

The above-mentioned countries have well-developed general education systems which, as a rule, involve 11 or 12 years of compulsory schooling and are rather strongly influenced by the government. All young people in these countries attend what is called a high school. The number of high school graduates going on to college and university is very high in these countries as compared with the situation in the Federal Republic of Germany.

Technical and vocational education for its greater part is not, however, under government influence. It is directly related to the productive factor of work and to the labour market. Its development and organization is left to the citizen's own initiative and to the commitment of enterprises, local authorities, and other training providers who offer and organize, practically without having to comply with government regulations, vocational education and training geared to practical work situations.

There are usually also school and government programmes (for marginal and problem groups) providing vocational qualification; however, the historically evolved traditional structures still dominate. Enterprises are major training providers. Above all, big enterprises usually achieve an outstanding position in the market owing to their economic superiority, as is the case for example in Japan.

What are the mechanisms responsible for the functioning of these market-oriented systems of technical and vocational education? The following is a list of mechanisms, which does not, however, claim to be complete:

- The market model determines the quantitative relations between qualification requirements and vocational education. Vocational qualifications are provided according to demand. Demand is determined by the customers, i.e. the enterprises.
- The type of qualification (qualitative aspect) is determined exclusively by the presumed applications in the enterprises. Inter-company qualification transfer depends on the market, but it is usually not very strong.
- The market mechanism of vocational qualification functions best when the potential customers provide training themselves and control the results.
- In this case, training is financed by the customers, i.e. it is governed by the principle of cost minimization. It will usually be related more to productive than to pedagogical principles (on-the-job training).
- Providers of vocational training select the trainees irrespective of superior social values (e.g. equal opportunities); trainees, in principle, have the same legal status as regular workers.

Model 2: The government is the sole authority responsible for the planning, organization and control of technical and vocational education

For logical reasons, this model should be termed *bureaucratic*; in view of its predominantly institutional form it may, however, be called the *school model*. It can be found in France, Italy and Sweden and also in various countries of the Third World. Bureaucratic systems of technical and vocational education can, however, also be found in socialist countries, where enterprise training plays an important or even central role (e.g. in the German Democratic Republic, in Poland and in Hungary).

School-based systems of technical and vocational education are similar to a great extent in structure and origin. Their special feature is a graded vocational school system closely linked with general education, in developed countries always at the upper secondary level.

Access to the different training courses which provide qualification at clearly defined levels is determined by the applicant's completion of lower secondary level education. This link between school education and technical and vocational education is also demonstrated by another feature of the system, namely the direct connection of school leaving qualifications with vocational qualifications (often included in wage agreements), which may even result in a real double qualification (e.g. university entrance and skilled worker qualification).

School-based systems of technical and vocational education are in principle hierarchical elite systems and are to be found mostly in countries with a centralized administration. Owing to their elitist character, they usually involve an education monopoly in the field of technical and vocational education which virtually precludes the development of competing forms of training, e.g. "dual" systems.

Private enterprise does not play a role in such systems of technical and vocational education, except perhaps as provider of places for students who are required to spend practical work periods in industry. The stronger the gov-

ernment's claim to the sole responsibility for technical and vocational education, the more the bureaucratic system of planning, organization and control is closed. Nevertheless there are cases in which enterprises cooperate indirectly in these systems: In France, for instance, the major chambers operate vocational schools which are subsidized by the government and therefore required to observe the training rules and regulations issued by the government.

What are the mechanisms underlying such school systems? In the following, some important mechanisms are listed:

- The quantitative relations between qualification requirements and technical and vocational education are determined by public planning authorities. Demand-oriented planning is most efficient when it refers to a limited number of established basic occupations.
- The type of vocational qualification (qualitative aspect) is not primarily determined by practical work situations, but usually also takes account of individual and social requirements. The more the vocational schools are related to general education including its performance and selection criteria, the more their technical qualification function is influenced by the system-related problems encountered by general schools.
- Planning, organization and control of the process of technical and vocational education are determined to a great extent by bureaucracy; the implementation of the related universal principles tends to guarantee the provision of systematic training strongly influenced by teaching theory.
- School-based technical and vocational education is financed from public funds. Since such funds are, by definition, limited, there are usually no national training models aiming to provide vocational qualification for an entire age group.
- School models function best for occupations and occupational fields which do not involve much training of psychomotor skills, e.g. commercial occupations.

Model 3:
The government provides a more or less tight framework for technical and vocational education in private enterprises or other private training institutions

This system could be called a *government-controlled market model*; however, it is precisely what we call a *dual system*. It can be found in the Federal Republic of Germany, in Switzerland and in Austria.

Such systems are commonly called *dual* because two places of learning, enterprise and (government-supported) vocational school, cooperate with the common aim of providing the trainees with vocational qualifications. The dual structure may, however, vary. South American dual systems of technical and vocational education, for instance, mainly involve inter-company training centres as the second place of learning; these centres are financed by the enterprises as a whole. The system of technical and vocational education which German industry intended to establish in the 1920s and 1930s, apprenticeship in industry involving instruction at a (private) industrial vocational school, can also be considered a "dual" system.

Government-controlled market models are characterized by the strong dividing line drawn between the system of technical and vocational education and the public general school system. This is demonstrated above all by the existence of a more or less detailed specific technical and vocational education law, which cannot be categorized as school law. The legal responsibility for technical and vocational education under such systems therefore lies, as a rule, with the department of economics or labour.

Government-controlled market models of technical and vocational education can be found above all in places which have traditionally had an advanced trade culture. Small businesses and the tradition of training provision by the crafts are not, however, indispensable prerequisites for dual technical and vocational education. As is demonstrated by the German example, the system can also be adapted by industry. What is essential for the model's functioning is neither the place of learning nor a specific enterprise structure, but rather the existence of a training sector which is designed according to private enterprise (i.e. free-market) rules and which can be modified by rules issued by the government.

The dual system can be defined as a system involving two places of learning only with regard to its institutional form. With regard to function, the dual character depends on the integration of two different sets of regulations governing technical and vocational education. This integration is reflected most clearly by the law on technical and vocational education, e.g. by the 1969 Vocational Training Act of the Federal Republic of Germany *(Berufsbildungsgesetz, BBiG)*, which, in a target-oriented approach, combines the private law sphere of the market with the public law sphere of the government.

What functional criteria can be derived from this basic pattern? The following are important:

- The quantitative relations between qualification requirements and technical and vocational education depend on the market (which provides the training opportunities); however, enterprises which offer training accept government-issued rules.
- The type of vocational qualification (qualitative aspect) is determined primarily by practical work situations in the enterprise. The definition of qualification goals involves not only the enterprises but also the government and other interest groups (e.g. trade unions, professional associations).
- The enterprises are the training providers. However, vocational training processes have to be organized according to government rules and are subject to direct or indirect government control.
- The costs of training are, in principle, borne by the enterprises. Dual training models are, however, characterized by the application of regularized financing models (e.g. fund financing) and/or co-financing of technical and vocational education by the government to a greater or lesser extent, as is the case, for instance, in the Federal Republic of Germany for the financing of part-time vocational schools.
- In dual systems of technical and vocational education, the extent to which vocational training is designed systematically and governed by pedagogical principles can be modified according to demand. The most important instrument in that respect is the modification of financial incentives.

The above analysis could create the wrong impression that the dual training model is an *optimized* system, particularly designed to avoid the disadvantages and one-

sidedness of the other two models. It is obvious that this is not the case. Variants of all three systems originated at about the same time as a result of long historical growth processes, and all models proved their efficiency in the industrialization of certain countries.

3 The final result: National systems of technical and vocational education as variants and/or combinations of the basic types

We must not be misled to consider the above basic types of formal technical and vocational education to be true copies of reality; all existing systems of technical and vocational education are variants and/or combinations of the three basic types, which are to be understood as models. There is hardly any country with a system of technical and vocational education which is precisely one of the basic types.

The model character of the basic types of formal technical and vocational education is now demonstrated by an attempt to briefly analyze the system of the Federal Republic of Germany while applying the above classification pattern. I have chosen the system in the Federal Republic of Germany not out of national pride, but for the following two objective reasons:

- The proposed classification system is much more difficult to handle than classification according to place of learning. Applying the suggested criteria requires a thorough knowledge of the system of technical and vocational education to be analyzed; I have such knowledge of this particular system only.
- Like many other organizations, Unesco has so far had great difficulties in describing and classifying the system of technical and vocational education of the Federal Republic of Germany by using its own terminology. Is our dual system to be classified as *formal* education or as *non-formal* education? Is it *full-time* or *part-time* technical and vocational education? An explanation is urgently needed.

When applying the above classification pattern to the system of technical and vocational education in the Federal Republic of Germany, the following results may be obtained:

- Like all advanced systems of technical and vocational education, the Federal Republic of Germany's system is a complex combination of all three basic types. The dual form, however, dominates. About two thirds of all 16- to 19-year-olds obtain their vocational qualification in the dual system (enterprise and part-time vocational school). Entirely school-based technical and vocational education is found in a few occupations of the health and social sectors.

  Since the beginning of the 1970s, however, full-time vocational schools have increasingly been assigned the task of providing basic technical and vocational education, so that the dual system focuses increasingly on the provision of specialized knowledge and skills. The market model is characteristic of the sector of continuing technical and vocational education in the Federal Republic of Germany: Freedom from government regulations, greatly varying application-oriented courses, voluntary participation, and varied forms of mixed financing are the most important features of the system.
- The system of the Federal Republic of Germany is not singular. It is only a special variant of dual technical and vocational education. It has the following features:
  - In addition to (private) enterprise, a second place of learning, namely part-time (vocational) school with the government being responsible for curriculum, finance and control;
  - only indirect control of technical and vocational education by industry's self-governing bodies (chambers);
  - in principle, individual financing of technical and vocational education by the enterprises;
  - design and recognition of vocational qualifications (recognized occupations) largely regulated by the government;
  - prevalence of the social partners in technical and vocational education policy.

All in all, the dual system in the Federal Republic of Germany is a very advanced form of dual technical and vocational education: One should be very careful when considering it as a model.

- The market for training places and the legislation in technical and vocational education as the central functional elements of dual systems are of a very special nature in the Federal Republic of Germany.
- Vocational education opportunities are voluntarily provided on the market for training places by industry, commerce, the crafts, agriculture, the civil service, the professions and the home economics branch. Most of the training provided is closely related to production and does not involve major costs; there is a tendency to use the students as (cheap) labour. However, some of the enterprises involved are able to offer interesting employment prospects. A small number of training providers, above all industry, offer high-cost, regular and future-oriented technical and vocational education separate from production (e.g. in training workshops). Employment prospects in these enterprises are usually very good.
- Of course, demand of individuals for training places concentrates on enterprises which offer attractive training and/or work places. Consequently, these enterprises dominate the market for training places, where they are able to exploit the customer potential to the extent they require. The large majority of less attractive enterprises are no more than a training reserve: As they provide training places above all to save labour cost, they absorb the remaining customers irrespective of the enterprise's current economic prospects.
- The modest training efforts of these enterprises nevertheless lead to recognized skilled worker qualifications which facilitate a change of employer or occupation for those who, upon completion of their training, are not subsequently offered employment by their training enterprises.
- Technical and vocational education in the different economic sectors is governed by the uniform national provisions of the Vocational Training Act *(Berufsbildungsgesetz, BBiG)*. The BBiG covers the following areas of enterprise training:
  - Establishment, contents and termination of the training contract including the rights and obligations of the students, the employer and the training staff as well as the payment of allowances;
  - the organization of technical and vocational education including provisions governing the personal, technical and teaching qualifications of the instruc-

tors, the type and establishment of training institutions, the organization of training for the recognized occupations including determination of the contents and the periods of training;

- examinations and supervision of technical and vocational education as well as provisions governing further training, retraining and technical and vocational education for handicapped persons.

Furthermore, the BBiG stipulates that committees be established at the federal, regional *(Länder)* and chamber levels; these committees take decisions and provide advice on issues in technical and vocational education. In 1981, the BBiG was supplemented by the Vocational Training Promotion Act *(Berufsbildungsförderungsgesetz, BerBiFG)*, which deals with statistics, planning and research in technical and vocational education.

- The institutional structure of the dual system of technical and vocational education in the Federal Republic of Germany is in general characterized by the existence of two places of learning: enterprise and part-time vocational school. Traditionally, the enterprise is to provide practical skills, while the school provides the relevant theoretical knowledge.

  This is a rather simplistic characterization which does not take account of the special institutional structure of the system of technical and vocational education in the Federal Republic of Germany, i.e. the broad range of training opportunities. For example, the enterprise offers numerous learning environments, ranging from the regular workplace to the workplace which is specially designed for learning purposes, to the learning corner, the training workshop, the research laboratory and the classroom. In addition, there are a growing number of inter-company training workshops, in a way a third place of learning because of the special institutional structure, which are to relieve the training burden above all for small and medium-sized enterprises.

  The traditional distribution of tasks among the places of learning is also becoming more and more indistinct: The school-based variant of the basic vocational education year includes the provision of practical skills; the traditional distribution of tasks between enterprise and school is no longer practicable with regard to new technological qualifications in the field of the recently revised recognized occupations in metalworking and electrical engineering.

  Despite these thorough institutional changes, the system of technical and vocational education in the Federal Republic in Germany still remains a dual system, as this dual character does not explicitly depend on the duality of learning places.

I hope that I have been successful in my attempt to help you to better understand the system of technical and vocational education in the Federal Republic of Germany. I would be happy if my classification system could also increase your understanding of your own national systems of technical and vocational education.

The Japanese Market Model - A Comparison of Japanese Qualification Strategies with those of Other Countries

by Walter GEORG

Before dealing with the structure of technical and vocational education and employment in Japan, I should like to make the following remarks concerning my paper:

- In a brief statement like this, the different strategies of technical and vocational education can only be explained by overemphasizing ideal types which are rarely found in real life. Reality is reduced to a certain number of models, which do not reflect the existing variety.
- Such variety is to be found particularly in Japan, where the mechanisms of technical and vocational education and employment are not determined by systematic institutional structures which could be described in organizational charts and diagrams. These mechanisms are part of informal policies and management strategies which have for years been a major topic of discussion in the western hemisphere. Evidence of this interest are such concepts and catchwords as quality circle, company clan or corporate/ organizational culture.
- Therefore, when comparing the macrostructures of technical and vocational education, we must not only look at the different institutions but also attempt to discover the underlying principles and mechanisms. What economic and social opportunities and risks accompany the respective organizational structure of training and employment?

In the following, I am attempting to make such an analysis for Japan. I am referring to the framework established by Professor Greinert, who distinguishes between market model, school model and dual model, and tries to assign the numerous systems of technical and vocational education to one of the three. Japan is an excellent example of the market model, because the contents and organizational structure of technical and vocational education seem to be largely free from government intervention and regulation. However, anyone who knows Japan would protest if I presented Japan as a model of a free-market economy. It is characteristic of Japan's economy that the state determines numerous limits to the free market mechanisms. Export enterprises which try to gain a footing on the Japanese market constantly complain about this.

The industrialization of Japan in the last quarter of the 19th century was a top-down process, i.e. it was triggered and controlled more by government investments in the economic infrastructure than by private initiatives. The traditional function of public administration is that of a driving force of industrial modernization, a function which still characterizes today's intensive communicative and cooperative relations between governmental and industrial management. However, these relations are based not so much on a legal framework of government intervention opportunities as on a soft, informal influence and the creation of a climate which is conducive to innovation. This, from the Japanese standpoint, means as little bureaucracy as possible.

This background information is, I think, very important for an understanding of the "Japanese market model".

In the following, I am focussing on the characteristic traits of the Japanese system of technical and vocational education when describing the background, functioning

and consequences of the market model, a model in which the government plays only a minor role or no role at all.

Hypothesis 1:
Under the market model of technical and vocational education the government has merely the function of preventive crisis management and repair.

Technical and vocational education in Japan has always been the task of the individual industrial enterprises. In the face of the postwar shortage of qualified workers the government first became aware of its responsibility. In 1958 the first vocational training act was passed. The most recent version (1985) provides for the establishment and maintenance of government-run training centres and for public funding for company and inter-company training centres. With respect to quantity and quality, this sector is, however, of marginal importance. Less than 1 % of the annual number of school leavers go to such training centres.

Most of these centres are designed for school leavers who were not successful in their first attempt to enter employment, or they provide retraining for the unemployed or the potentially unemployed. On the whole, the government-maintained training centres are above all supposed to reduce imbalances on the labour market by offering adequate qualification, and to close the gaps which technological change has left above all in small enterprises without training capacities of their own.

The large majority of Japanese enterprises provide training according to their own company concepts without any government intervention. Therefore, technical and vocational education is not a controversial issue between government and industry, nor is it an issue of trade union policy. Technical and vocational education is an integral part of enterprise activities and thus of industrial work organization and employment policy, and as such is not questioned by third parties. Neither the government nor the public expect the enterprise to achieve certain training standards beyond in-house needs. Vice versa, Japanese enterprises do not claim government funding for their training efforts. The government intervenes only in the case of labour market imbalances, and when the entrepreneurs are not interested because investments do not promise any profit.

This reduction of governmental functions is most clearly reflected by the fact that on the Japanese labour market vocational qualifications play only a minor or no role at all.

Hypothesis 2:
The market model of technical and vocational education limits the exchange processes on the labour market considerably.

Since there are no government-recognized occupations nor any generally valid certificates of vocational qualification, the labour market lacks an important control instrument. According to our western understanding, the instrument of recognized occupations guarantees standard vocational qualifications which are marketable. Everyone who has obtained such vocational qualifications is independent of the individual enterprise.

That is not the case with Japan. Neither the system of programmes for technical and vocational education nor the organization of work and training at enterprise level is geared to occupational profiles or the awarding of vocational certificates. Qualifications have a practical value for the enterprises concerned but no exchange value on the labour market. This means a considerable reduction in inter-company mobility. Since a change of enterprise would mean that the staff concerned lose the privileges they have acquired during permanent employment, and the enterprise loses its investments in technical and vocational education, both sides have little interest in such mobility.

Hypothesis 3:
The market model of technical and vocational education contributes to a clear-cut segmentation of the labour markets within and outside the enterprises.

The top segment of the Japanese labour market is the "regular" staff, with permanent employment and promotion as well as pension rights being guaranteed by the enterprise. Regular staff is recruited each year directly from among the school leavers and university graduates. This segment is estimated at about 30 % to 35 % of the entire Japanese work force.

This regular staff is granted a status similar to civil service at the expense of the larger, secondary labour market segments in which employment is mostly unprotected. In contrast to regular staff, "marginal" staff includes part-time and temporary workers, loan workers, (female) home workers, and the majority of the labour force of small and very small enterprises. The groups concerned are above all women, persons of advanced age (beyond retirement age), "unsuccessful" young people, and foreigners (particularly Koreans). There are hardly any exchange processes between the top segment and the secondary labour market groups (and if so, only in one direction). There is segmentation both within the enterprises and between them. The much-quoted "pillars" of the Japanese employment system, namely lifelong employment, the principle of seniority (with regard to payment and promotion), and company unions, can be understood only when bearing in mind this segmentation. They provide protection only for regular staff.

With regard to technical and vocational education in enterprises, this segmentation means that only regular staff enjoy long-term enterprise investments in education. The marginal staff (i.e. above all women and the staff of small enterprises) are given no opportunity to acquire any qualification of permanent value; they have usually acquired only a very narrow range of vocational skills and have only limited access to working aids involving modern technologies. All in all, segmentation leads to extremely unequal qualification prospects for the different groups of staff.

Hypothesis 4:
The market model of technical and vocational education requires other criteria for enterprise staff recruitment and other organizational models.

As there are no special vocational qualifications on the Japanese labour market, so-called work attitudes such as the ability and willingness to learn, to achieve, to adapt and to fit in are of central importance in the recruiting process of an enterprise. In the case of regular staff, decisions on recruitment are almost irreversible both for the enterprise and for the applicant. Therefore, there is careful consideration on both sides. The enterprise's most important criteria concerning the biography of the applicant are his/her family background and his/her learning ability, which is derived from school leaving certificates. For applicants the major criterion is enterprise size: the bigger the enterprise, the better the prospects for lifelong employment and a civil servant-like career with a salary increasing with seniority.

All Japanese enterprises recruit new regular staff once every year when students leave school or university. This rhythm increases segmentation: Small enterprises must content themselves with those school leavers who remain after the best have been creamed off by large enterprises. As small enterprises have only limited training capacities, they are most likely to attach importance to relevant technical qualifications when recruiting staff. Thus, this segment includes a kind of labour market for part-time employment of specifically qualified workers. However, as the employment conditions in small enterprises are neither very secure nor very attractive, these different recruiting patterns intensify discrimination against any institutionalized technical and vocational education outside the enterprise (government-supported training centres, vocational schools).

On the whole, the prospects of permanent employment and a guaranteed career depend on success in the enterprise's staff recruitment procedure. Whether the applicant is successful or not is essentially determined by the type of formal school qualification (secondary school, university), and still more by the rank of the institutions in the informal hierarchy of education institutions. The key to first-class employment is evidence of a first-class school education.

Hypothesis 5:
The market model of technical and vocational education increases the expansion of education and intensifies the hierarchical character of the general education system.

The Japanese recruiting and employment system rewards the individual's success in education. Japan is an educational meritocracy. Since during the nine-year compulsory education no distinction is made between different institutions and curricula, and since access to the three-year secondary school is not restricted, educational opportunities are largely independent of the pupil's social origin. A successful school career seems possible for everyone. The secondary school/ university entrance examination also aims to test the applicant's knowledge rather than his/her problem-solving ability. As a result there is excessive competition in education which starts at the preschool age; schooling aims to prepare the pupils for the university entrance examination, with special private schools providing complementary education.

This is accompanied by an extraordinary expansion of education: About 95 % of compulsory school leavers pass on to the three-year secondary school, and about 45 % of secondary school leavers enter one of Japan's approximately one thousand universities. This increasing enrollment in post-compulsory education adds to the marginal character of technical and vocational education at school. The share of secondary school students attending vocationally oriented courses has fallen from just under 50 % to under 30 %, and the downward trend continues. Vocational secondary schools have become a refuge for compulsory school leavers who have not been successful in the educational competition.

There is an informal hierarchy in the Japanese education system. School leavers compete for admission to the next stage of education. Admission to one of the reputed universities (and thus to top management jobs) is usually impossible if the applicant did not attend one of the best secondary schools. Failure in the admission test can hardly be made up later on in working life. Thus, examinations passed at a certain point in one's life decide on the distribution of vocational and social career opportunities.

Hypothesis 6:
The market model of technical and vocational education relieves the public education system of the need to meet vocational requirements.

The Japanese education system does not determine the pupils' vocational careers either by differentiating school curricula or by awarding school leaving certificates. Schooling has a determining function only with regard to the prospects for climbing up the career ladder, but not with regard to the fields of activity which the school leavers will enter.

Since enterprises seem to consider a good general school education the ideal basis for the acquisition of company-specific skills, the expansion of education has not triggered a qualification and absorption crisis. Despite the officially announced sceptical attitude of entrepreneurs vis-à-vis the all-too-high expectations of school leavers, the recruitment and selection mechanisms of Japanese staff policy have in fact encouraged the expansion of education. In contrast to the political response in other countries, which quickly attempted to stop the expansion, in Japan there seems to be less fear of overqualification or misqualification and also less belief in a social need for underqualified workers.

Although learning at schools and universities is not related to working life, the results of such education seem to meet the requirements of the employment system. Despite the virtual insignificance of technical and vocational education, the "secret curriculum" of the Japanese school system aims to prepare the pupils for a smooth transition to the world of work. It is not so much the acquisition of knowledge as the training of behaviour and orientation patterns which make the school such an important agent of socialization.

The school system makes great demands on the pupil's discipline and punctuality as well as his willingness to fit in and subordinate himself. Preparation for secondary school/ university entrance examinations starts early on and leads to permanent competition. Pupils become used to hard work in their early school days: An average of 240 school days per year means only short holidays as compared with western countries. A considerable part of classroom work is collective learning: Group work, pupil meetings, club activities, sports events, excursions, joint meals at school and cleaning of the school building are of great importance in everyday school life. After a long school day from 8.30 in the morning or earlier to the afternoon, many pupils attend additional private classes in order to improve their prospects of passing the entrance examination for the desired secondary school or university later on. By teaching its students to sacrifice leisure time, to practise personal commitment, to tolerate stress, and to be willing to tackle problems, the school indirectly contributes considerably to prevocational education.

This priority of the socialization and integration functions over the qualification function can also be found in enterprise training and work patterns.

Hypothesis 7:
The market model of technical and vocational education guarantees the workers' commitment and willingness to perform not via their identification with a certain occupation (or qualification) but via their identification with a certain enterprise.

This process of integration starts with the initiation ceremony and initial practical work experience. The aim is not to provide vocational qualification, but to admit the newly recruited staff to the family-like enterprise community. In Japanese enterprises, there are no clearly defined job profiles; the different teams have to deal with a broad range of tasks. As work organization is based on team structure, it is not necessary to define individual tasks and competences. Vocational qualification is a by-product of in-house work organization; it is the result above all of the mutual assistance within teams and of worker rotation involving numerous different jobs.

Vocational training aims to provide general company-related knowledge rather than specialized job-related skills. Every staff member is expected to accept any workplace. By rotation, the worker is to gather a wealth of work experience so that he/she can do different jobs in the enterprise. On the other hand, rotation increases the individual's adaptation to team standards, thus encouraging integration into a network of mutual commitments and intensifying in-house communication. Formal in-company training is only of minor importance; the staff policy of Japanese enterprises is aimed at producing "allround" workers, integrating them into the company community and including them in a network of moral values and numerous personal relations. Thus it is the "secret curriculum" of Japanese corporate culture and work organization which ensures the individual's motivation and emotional integration, guarantees informal qualification on a mutual basis and activates the worker's knowledge gained from experience.

Hypothesis 8:
The market model of technical and vocational education does not have the protective functions of organized vocational training and work.

Protective functions are the development of collective standards for work, such as the occupation-related claims with regard to the contents and form of working conditions, the definition of the reasonableness of individual tasks, and the setting of limits to the degree of enterprise integration. The Japanese worker's feeling of his/her own value depends on the degree of his/her integration into the enterprise and the team. This means that workers in Japan are less able to evade extra working hours and jobs than their counterparts in western industrialized countries. The absence of vocational standards means that the workers do not have much opportunity to oppose an unreasonable workload, and that they are interchangeable, and this all the more so as Japanese company unions do not provide an organized counterforce against the employers.

On the other hand, guaranteed employment and the principle of seniority are protective mechanisms which ensure the worker's loyalty, conformity and flexibility. By dispensing with a formal, bureaucratic or occupation-oriented organization of work and technical and vocational education, the Japanese model seems to be superior to the western bureaucratic model with regard to its self-control, flexibility and innovative capacity. At least from our western point of view, these advantages are achieved largely at the expense of the worker's social status. We must bear in mind, however, that the different types of training and work organization are part of different cultures, each with its special historical background and its own network of individual and social values. It would therefore not be appropriate to try and compare the systems by analyzing the advantages and disadvantages and establishing the superiority or inferiority of one system vis-à-vis the other. We shall hardly find suitable solutions for improving our own national systems by looking at other systems.

Now a final question: Do the ongoing and predictable changes in systems of technical and vocational education indicate that the systems are approaching the same kind of ideal model of training organization which would meet the requirements of modern industry to a particular extent?

In all industrialized countries, the increasing application of new technologies has caused a change in the traditional organizational structures. In the Federal Republic of Germany, doubts are increasingly being voiced about the traditional sequence of technical and vocational education preceding qualified employment, reference being made to the necessity of deregulation and more flexibility. In Japan, on the other hand, technical innovation is increasing the need for specially qualified workers who can hardly be recruited on the labour market, nor can they be trained by the enterprises themselves because they lack adequate training capacities. Practical work experience or out-of-company vocational qualification are gaining increasing importance on the labour market: They enable the workers to enter the regular staff irrespective of their general school qualification.

However, it cannot be concluded from such differentiation of the Japanese labour market that new types of vocational qualifications have been established. We should also be careful to interpret the attempts of western countries to achieve greater flexibility as a "Japanization" of the principles of work and training organization. The dissolution and constitution processes which can be observed in both systems are obviously taking place within the traditional institutions and strategies whose stability remains unaffected. Despite the large-scale technical, organizational and socio-economic restructuring, the specific principles of organization of work and training in different industrialized countries have remained largely unchanged. This points to a functional equivalence of the different organization of technical and vocational education and work rather than to a convergence as a result of the application of new technologies.

The Swedish System of Technical and Vocational Education

by Lennert NILSSON

Every system must be looked upon in its historical, socio-economic and political context. From that point I want to present you a historical view of the motives behind the main features of the vocational school system in Sweden.

Sweden has a population of about 8.5 million people. In Sweden, technical and vocational education is a part of the integrated secondary school. About 80 % to 90 % of all youngsters in Sweden in the 16- to 19-year age group are students in this school system. About 50 % belong to the vocational line. Each age group in Sweden consists of approximately 100,000 people. This means that about

100,000 are undergoing a two-year technical and vocational education.

Several hundred integrated schools exist, and there are five different places for teacher training for technical and vocational education. The responsibilities, from a political point of view, are bound to the Ministry of Education. The National Board of Education has the administrative responsibility. The organizations on the labour market are members of the different boards (rad) which have responsibility for changes in curricula and the extent of educational possibilities. Financial support from the state has increased to 90 %. The remaining 10 % is covered by local authorities.

Why do we have technical and vocational education in school form?

To get the answer, we have to be conscious of the two main traditions in Western Europe: On the one hand the theoretical school, mainly bound to the church and the state; and on the other hand the concrete education bound to the guild system for craft-oriented production.

The end of the guild system in Sweden in 1846 created demands on the local authorities to organize a kind of school in order to educate young workers in vocational theory and general knowledge. The practical skills were to be acquired through work with a craftsman or in industry.

The system first followed the German model: evening and Sunday schools, technical elementary schools, and technical institutes.

The industrialization begun in the 1870s led technical and vocational education to be viewed by the state as a tool to increase the rate of industrialization.

Criticisms of technical and vocational education were mainly confined to the lack of specialized training available for jobs on different levels in the factories during the new industrialized epoch. No legal framework existed which might have imposed obligations upon employees and employers through apprenticeship laws of the kind which existed in other Western European countries.

Demands of the crafts and industries during the first decade of this century were one reason behind the structural reform of 1918. The other was the demands from the liberals and social democratic party. These two political groups formed the new government in 1918.

The structural reform of 1918 was a response to the demands of industrialization, but these motives were combined with a belief in the social reform of work and society as a result of the universal right to vote. Young people from the working class were to be educated both as skilled workers and as politically responsible men and women who, by exercising their right to vote, would help to create a more humane society in which social and democratic justice would be prized.

The main points in the structural reform of 1918 were:

- The system of technical and vocational education would consist of three branches: education for crafts and industry, commercial education, and domestic education.
- Education for crafts and industry was to be organized on three different levels:
  - the first level: apprenticeship schools,
  - the second level: vocational schools and
  - the third level: technical schools.
- The apprenticeship schools were looked upon as a compulsory school occupying eight to twelve hours a week over two to three years, as a complement to the practical component of the technical and vocational education which had to be organized in workplaces. Local authorities were to decide whether this school should be compulsory or not.
- The vocational schools were organized as voluntary schools for those who wanted a further education in vocational theory related to their own jobs. There was a strong link between apprenticeship schools and vocational schools.
- The technical schools were organized without reference to the first and second levels in the vocational school system. In their funding and their curriculum, these schools were structurally very similar to secondary grammar schools. These schools were wholly financed by the state. The schools on the first and second level received equal financial support from the state and from the local authority.
- The curriculum in the local community vocational schools comprised vocational theory and general knowledge. At that time it was felt that it would be too expensive to integrate practical skills into technical and vocational education in local community schools. In the light of government motion No. 96/1918, it is clear that a very optimistic view was held of the possibility of developing the country during this increasingly industrialized epoch. At that time the country was governed by a coalition of liberals and social democrats.

The parliamentary speeches of the first social democratic minister of education and ecclesiastic affairs, Värner Rydén, show a very strong belief in the democratic evolution of work and social life as a result of the introduction of universal suffrage (i.e. the right of all men and women to vote).

An assumption underlying the structural reform of 1918 was that there would be increasing job opportunities for young people in the so-called "productive sector" of society.

From our vantage point approximately 70 years later it is easy to conclude that the reform ought to have been introduced at least ten years earlier, given job demands at various levels in the factories at the beginning of the industrialized epoch.

Economic depression and a high level of unemployment among young people in the early 1920s were strong factors behind supplementary reform. The 1918 reform was built upon the assumption that the practical component should be acquired in the workplace. In 1921, local community schools received state financial support towards teachers' salaries to provide the practical component of technical and vocational education. However, a system cannot be developed solely through state support of the teachers' salaries. After the economic crisis of 1933, the social democrats and the farmers had the political power in Sweden. They formed the government and had the political majority in parliament during the decade.

These two parties took an active part in decreasing youth unemployment. The main strategy was for the state to give financial support to increase the education of craft and industrial apprentices. Neither the employees nor the employers accepted, although for different reasons, this

kind of state intervention in the private sector of the economy.

The government's next step was to establish a new type of vocational school for unemployed young people. This type of vocational school began in 1935. The purpose was to give young people a comprehensive technical and vocational education. This type of school was totally financed by the state. The schools were organized in those parts of the country where unemployment was higher than average. In 1937, there were 11 schools in seven different counties with a total of 1,200 students. The total number of students in this type of school was approximately equivalent to that of the local community vocational schools in toto. This situation showed that there was a great demand for a reorganization of the vocational school system or at least a great demand for a new complementary reform.

In 1937, a parliamentary commission was appointed with the task of formulating proposals for a new type of vocational school as a complement to the local community vocational schools. The committee *(verkstadsskoleutredningen)* presented its report in 1938. The main suggestions were:

- A new system of regional workshop schools should be organized, based on the county councils. These schools were to recruit regionally and offer a comprehensive technical and vocational education; at least 24 workshop schools were to be created, one in every county. This new form of vocational school would also be a means of helping the development of rural areas.
- Every school should include about 150-200 students divided into 10-15 different departments. The education should be mainly of two years' duration for industry-oriented education and two to four years for craft-oriented education, and result in a complete education for skilled workers.
- Training in practical skills was to be organized in correspondence with the main feature of a workshop. The training provided was to focus on productive work in order to maintain the features of productive life and create craftsmanship in the different fields of work. Productive work was also looked upon as a means of maintaining qualifications in relation to the demands of the labour market.

  In order to create practical skills closely related to the demands of industrialized working life, the practical skills were to focus to a greater extent on mechanical skills. Previously manual skills had been predominant.
- The state was to provide financial support to cover the full costs of teachers' and headmasters' salaries and 90 % of the costs for equipment and other facilities. Besides, the state was to provide students with a maintenance grant during the period of their education.

In the late 1930s, it was obvious from the state that the vocational school system should be developed in line with structural changes in work and not according to cycles of prosperity and depression. The main assumption was that if systems of technical and vocational education were not organized in this way, there would be a lack of skilled workers in times of prosperity. The state had to intervene in order to create, through technical and vocational education, the asset which skilled workers represented. This was looked upon as a national question and not just as a matter of social equity. One of the duties of the state, especially as far as the social democratic party was concerned, was to reduce unemployment and work towards full employment. This political stance took root during the 1930s and had a very deep impact on the development of the vocational school system after the Second World War.

The workshop schools were the backbone of the vocational school system for 30 years, especially during the 1950s. The development of the practical component of technical and vocational education in local community vocational schools was modelled on the regional workshop schools. Thirty years after the 1941 supplementary reform, this branch of the vocational school system was replaced by the upper secondary comprehensive school (1971).

As a result of the agreement drawn up in 1938 *(Saltsjöbadsavtalen)* between the Swedish Employers' Confederation *(Svenska Arbetsgivarföreningen)* and the Swedish Confederation of Trade Unions *(Landsorganisationen i Sverige)*, the two main organizations in the labour market also prepared a joint official report on mutual cooperation aimed at increasing the education of apprentices over and above their existing collective agreements in the labour market in 1944.

In the early 1930s, employers and employees had not played an active part in increasing the provision of technical and vocational education. Now they found that it was in both their interests to work together to create and to assume responsibility for the direction of the system for technical and vocational education. In 1942 they had together been active in lobbying the government to put to parliament the question of setting up a National Board for the vocational school system. The coalition government agreed and parliament voted to create this type of authority for the vocational school system. In this authority, representatives of the employers and the employees were in a majority. The National Board for the vocational school system existed for 20 years, from 1944 to 1964.

Social motives are very evident in the complementary reforms of 1921 and of 1941. During the 1930s the Ministry for Social Affairs took the initiative in creating new forms of technical and vocational education for unemployed young people.

The supplementary reform of 1941 can be looked upon as a result of a new combination of social politics and labour market politics.

Underlying the supplementary reform of 1941 was a combination of social motives and efforts by the state and the organizations in the labour market to create technical and vocational education tailored to the industrialized labour market.

The increasing rate of industrialization and economic growth especially during the 1960s created new manpower demands, but also possibilities for a redefinition of the vocational school system in a way which responded to demands of greater equality.

In 1968, 50 years after the first structural reform, a new reform was decided upon by the government:

- The external structure of secondary schools was to be reorganized. The gymnasium, the continuation school and the vocational school were to be brought together in a new comprehensive school. The education formerly provided by the vocational school system was to be organized into 16 different subject areas.

- Technical and vocational education was to be organized in broad initial blocks, in which students would receive an allround education in specific groups of subjects during their first year. These "branches", or groupings of subjects, were linked to clusters of specific vocations, one of which students chose as the focus of their second-year studies. All the various forms of education organized in this way should have a duration of two years.
- During the first year, practical skills and vocational theory should occupy approximately two-thirds of the total time. About ten hours should be devoted as follows: To the Swedish language (four hours per week), athletics (two hours per week) and the structure of the labour market (one hour per week); besides these compulsory subjects, students were to choose at least three hours per week in one general subject such as mathematics, English or drawing. In addition, students could choose optional subjects, mainly during the second school year.
- Technical and vocational education should expand. In 1970, 35 % of 16-year-olds should have the opportunity of following a vocational orientation, 30 % the gymnasium orientation and 20 % a continuation school orientation.
- State financial support should be independent of the different orientations in the new comprehensive school. The full costs of teachers' and headmasters' salaries should be paid by the state. In fact, the state took responsibility for about 95 % of the total costs of the school system at the secondary level.

The idea of a structure of technical and vocational education which offered an initial subject area orientation, followed by successive specialization towards a more specific occupation, was not an idea of the 1960s. This framework for the development of the vocational school system in Sweden was first discussed in 1939 by a committee set up in 1936 to propose measures to avoid harmful social consequences of industrial rationalization.

It was another 25 years before "a new competence for skilled workers in industrialized society" resulted in the structural reform of technical and vocational education. The main theses were that training in manual skills should decrease while skills relevant to the mechanization of production should increase. There should also be an attempt to meet new demands arising from an industrialized mode of work organization. The mode of work and the tasks should be redefined as a result of new techniques and new forms of work organization. All these things indicated very great quantitative and qualitative changes in manpower demands.

The industrialized form of work also made it possible to reduce the working hours and the duration of technical and vocational education. This situation enabled reforms to be made in the pursuit of equality between students who had earlier had a theoretically oriented education, and those who had had a practically oriented one.

During the 1960s, the opportunity of introducing reforms which would achieve greater quality was grasped. In 1968, the government and the parliament gave their consent to the reforms proposed by the Vocational School Committee. In 1971, the new comprehensive school began, and within it a redefined technical and vocational education.

The 1968 structural reform of technical and vocational education can be seen as a combination of adjustment to the second epoch of industrialization, and of response to a social demand to create equality between different types of technical and vocational education as well as between the vocational school system and the school system for academic education.

The Cooperative Model of Technical and Vocational Education in the German Democratic Republic

by Michael GUDER

In connection with scientific and technical as well as the economic and social developments, the education and qualification of skilled workers is gaining significance. Above all, the impact of the so-called key technologies has extremely enhanced the scientific and practical work done to design skilled worker qualifications. International comparisons have shown that the education systems of different countries respond to comparable structural developments in technology and industry with quite different educational concepts, both on the whole and in detail. This has something to do with educational tradition, but also with the specific social and economic situation. It has been confirmed again and again that the educational concepts of one country cannot be transferred to another country unchanged. This is why an exchange of experience and a comparison of solutions are so very important, a task which Unesco has specifically undertaken to perform. The following paper describes the German Democratic Republic's approach to technical and vocational education.

1 General survey

The German Democratic Republic has a total population of 16.7 million. 8.6 million persons are gainfully employed, that is to say more than 97 % of all employable men and women. In 1988 the qualification structure was as follows:

- 21.6 % cadres from higher education institutions and technical colleges;
- 4.0 % master craftsmen;
- 60.7 % skilled workers;
- 13.7 % semiskilled workers.

The various routes of technical and vocational education build on the 10-year general polytechnical school, which provides both general and polytechnical education and is not yet differentiated by future occupations. After completion of this school, skilled worker education is possible in

- 238 occupations after grade 10; these occupations include 98 basic occupations (broad-profile occupations) with several specializations (a total of 392);
- 47 rare crafts;
- 62 occupations for 8th-grade leavers of the general polytechnical school.

Lower-achieving adolescents leaving general polytechnical school before grade 8, in addition, have an opportunity to undergo education in sections of skilled occupations.

Higher education entrance qualifications can also be obtained by several routes including the extended secondary school, where classes provide vocational education combined with higher education entrance qualifications in 82 skilled occupations, as well as a preliminary course at a higher education institution following the completion of

skilled worker education and a period of gainful employment.

In general, the education system is designed according to the principle of horizontal articulation; there are no dead alleys. Every adolescent at any level of education may obtain an entrance qualification for an institution of higher education. A prerequisite is that he or she possesses the required physical and psychological qualities and has performed well at the preceding educational level. However, the number of persons trained in the various occupations and occupational groups is proportional to the actual needs of the economy.

2 Vocational education closely linked with the country's economy

Technical and vocational education in the German Democratic Republic comprises vocational education of apprentices and vocational and continuing education of skilled workers and master craftsmen. From the very start, it has been an integral part of the integrated socialist education system and has, at the same time, been closely connected with the reproduction process in enterprises, industrial combines (associations uniting several nationally owned enterprises in a particular industry), industrial sectors and the overall economy. Its structure and system acknowledges that technical and vocational education greatly contributes to the reproduction of the capacity for work of society and enterprises; this contribution can most effectively be made in close connection with industry. What now characterizes this connection?

- The most important type of vocational education institution is the so-called enterprise vocational school *(Betriebsberufsschule).* Enterprise vocational schools were gradually established from 1948 onwards, as nationally owned enterprises developed on the territory of the later German Democratic Republic. They are government education institutions which are, at the same time, part of a enterprise. They combine theoretical instruction and practical training in training workshops, laboratories, specialized training workshops or directly in the enterprise's production section. There are 330 enterprise vocational schools.

  Since the late 1960s, enterprise schools *(Betriebsschulen)* have been developing on the basis of the enterprise vocational schools in major enterprises (a total of 380). These schools, as a rule, provide apprentice training, skilled worker and master craftsman vocational and continuing education, polytechnical education for general and polytechnical school students and, in many cases, they also have a hostel for apprentices. Two thirds of all apprentices are trained in enterprise vocational schools and enterprise schools.

  A second type of institution in technical and vocational education is the municipal vocational school (*Kommunale Berufsschule,* 245). Municipal vocational schools are government institutions of education which are subject to the local authorities (county councils). They provide the apprentices of enterprises that have no vocational school of their own with a theoretical education. Most apprentices come from small industrial enterprises, from the commercial and service sectors of the economy, and from the private and cooperative crafts.
- Vocational education of apprentices is, in principle, based on a training contract concluded between the adolescent and a enterprise. Thus, the apprentice is a member of the enterprise with all rights and obligations. The training contract guarantees the apprentice a job in the enterprise on completion of training.
- The enterprises are responsible for training adult workers to become skilled workers and master craftsmen as well as for their continuing technical and vocational education. For this purpose there are not only the enterprise schools but, in many enterprises, also academies of further technical and vocational education (*Betriebsakademien,* 715).
- The teachers and heads of vocational education and adult vocational education are members of the enterprise. They are thus closely connected with the production process, they are acquainted with the occupational requirements to be met by skilled workers, and they enjoy extensive opportunities for continuing education in the enterprise themselves. The heads of the education institutions report directly to the director of the enterprise as regards their education and training work.
- Industrial combines and enterprises plan the required occupational and qualification structure and derive from it the requirements to be met by technical and vocational education. Programmes of technical and vocational education including continuing education are thus oriented to the specific needs resulting from scientific and technical as well as economic and structural developments.
- Industrial combines and enterprises are essentially responsible for developing the skilled worker occupations and determining curricula for vocational education. With regard to the majority of skilled occupations (170), the combines are fully responsible for the establishment and activities of special vocational commissions.
- Industrial combines and enterprises are responsible for the material and technical equipment of enterprise vocational schools and enterprise schools as well as of academies of further technical and vocational education. This provision ensures that the devices, machines and facilities required for specific occupations are available for vocational and continuing education, for example in informatics.
- As a rule, the enterprises bear the costs of practical vocational training as well as of investments in vocational education and adult education institutions. This is about 70 % of the total expenditure on technical and vocational education. The cost of providing teachers for theory instruction and tutors in hostels for apprentices, including also the cost of municipal vocational schools, are borne by the government.

3 Management of technical and vocational education

Managing technical and vocational education is designed as a process of cooperating and sharing responsibility. In accordance with the constitutional foundations of the German Democratic Republic, it is supervised based on economic branches as well as on geographical areas. The coordinating organ is the State Secretariat for Vocational Education. The State Secretariat is responsible, on behalf of the Council of Ministers of the German Democratic Republic, for implementing the government's education policy and for coordinating and supervising all necessary measures. This is done in close cooperation with the

ministers, the heads of other central government organs and the chairmen of the district councils. Tasks in technical and vocational education performed under governmental, branch and geographical supervision are thus implemented in coordination. The State Secretariat is responsible, among others, for

- _setting up the basic requirements for the development of skilled occupations, for drawing up governmental curricula and for designing educational programmes;
- developing the classification of skilled occupations and of the various specializations for master craftsman education;
- supervising the drawing up and issuing of governmental curricula;
- drawing up, enforcing and supervising the provisions governing skilled worker examinations;
- drawing up and issuing the programmes for the basic education of master craftsmen;
- participation in the planning of the integration of school-leavers into technical and vocational education;
- supervising and controlling, on behalf of the government, the results of technical and vocational education, and not least,
- guaranteeing the scientific lead for the further development of vocational education.

It is the task of the various ministries to implement, in their sphere of responsibility, the government's educational policy. They ensure the planning of technical and vocational education in the corresponding branch of industry and the planning for the next generation of skilled workers. They are responsible for creating all necessary education capacities in the industrial combines and enterprises within their sphere of responsibility, and for guiding and supervising industrial combines as well as the competent organs of the district councils in the implementation of governmental curricula. For the purposes of performing their technical and vocational education tasks, the ministries have central units for technical and vocational education.

The industrial combines and enterprises are in charge of the planning and implementation of all personnel, material and financial prerequisites for vocational and continuing education. They manage and plan this process in agreement with the needs of the territory, thus creating all the prerequisites for the superior quality of the education and training work on the basis of legal provisions, governmental curricula and continuing education programmes. For managing these processes, industrial combines and enterprises have departments for education and manpower development. They have close working relations with the directors of institutions of technical and vocational education.

The local people's representations (county and district councils) are responsible for the implementation of the government's policy in technical and vocational education in their territory. They have to provide guidance, ensure coordination and exercise control over all enterprises and institutions of technical and vocational education within their territory. For this purpose, the local councils have divisions for technical and vocational education and vocational guidance. In addition, the local councils are responsible for guiding and controlling local institutions and vocational guidance centres.

4 Curriculum development and skilled worker education under the influence of modern technologies

Technical and vocational education of apprentices at enterprise vocational schools, enterprise schools and municipal vocational schools is, in principle, based on governmental curricula, which have been confirmed by the ministers in charge and declared binding by the State Secretary for Vocational Education. Before such a curriculum is drawn up, an occupation and qualification profile has to be prepared. This profile is the result of a thorough analysis of the development of the skilled occupations, and in particular of an analysis of changed working media, working objects, technologies, division of labour in the enterprises, etc.

Responsibility for preparing the occupation and qualification profiles and the curricula lies with the special vocational commissions. These commissions, which report to the industrial combines and other institutions, are honorary bodies composed of experts in technical and vocational education, engineers, occupational scientists, industrial medicine specialists, and other experts. They are supported by the scientific institutions of technical and vocational education. In addition, representatives of the trade unions contribute substantially to the preparation of these documents. The adoption of each individual curriculum requires their approval. All general questions of curriculum development, including the profiles of the various skilled occupations, are coordinated by the State Secretariat for Vocational Education in close cooperation with the central units for technical and vocational education at the competent ministries. This coordination process prevents the development of occupations which would be of interest only for one combine.

Since 1986 all vocational education curricula are being revised. The process will be completed by 1990. Since September 1988, vocational education for more than 90 % of apprentices follows the new documents, on the basis of the following scientific results and experience:

- The whole range of skilled worker occupations existing in the German Democratic Republic, which include both broad-profile occupations and highly specialized occupations, has proved very stable. Above all the model of basic occupations has turned out to be flexible enough to include new occupational requirements resulting from the modern technologies. As a rule, requirements resulting from new technologies can be integrated into existing occupational profiles with relative ease. The result is usually a close combination of traditional and modern occupational contents. This applies in particular to the requirements of modern information technologies. The integration of new contents into existing occupations prevails over the establishment of entirely new occupations.
- In principle, it must be assumed that conventional and modern technologies will coexist for a long time to come. Thus, it is understood that, up to the year 2000, the majority of skilled workers in the metalworking industry will work at traditional machine tools. At present, the share of skilled workers operating computer-controlled equipment is between 7 % and 10 % of the occupations concerned.
- Sound occupational knowledge and skills are equally important for work involving modern technologies. Yet, basic occupational skills as well as the mastery of working media and working objects remain a decisive

prerequisite for handling the new technologies. This has been proved by the experience gained by skilled workers handling personal computers, CNC technology, or computer-controlled chemical systems. Therefore, technical and vocational education will have to combine a sound basic education with special training for the future job. Both components together ensure occupational flexibility. Flexibility, however, will increasingly require the inclusion of so-called key qualifications, such as the ability to cooperate, sensitivity to technological development, or reliability. These characteristics can be developed only in close combination with occupational skills.

- Of increasing significance for mastering one's occupation is continuing education, not only in one's own occupation, but to some extent also in unrelated fields. An example illustrating this is the combination of mechanics and electronics in a large number of metal-working occupations and also the advance of information science. We are therefore of the opinion that the skilled occupation and thus also the relevant curriculum must be planned as a unit of initial and continuing technical and vocational education. This is in keeping with the differentiated educational requirements of industry and provides an opportunity for achieving flexibility in technical and vocational education.

The strategy for technical and vocational education outlined above is put into practice via a corresponding didactic and methodical concept. The basic idea is to have effective processes of education and practice, based on learning tasks and jobs. The purpose is to arrive at a variable combination of different training methods in theoretical and practical education, with the aim of enabling the apprentice to carry out his or her occupational work independently and creatively. The organizational forms of practical training include training workshops, the training unit, the apprentice unit, and also training in working teams.

5 Teacher education

Theory teachers are educated at universities in eleven disciplines. Admission to studies requires university entrance qualifications plus the completion of skilled worker vocational education in the corresponding study discipline. Preference is given to candidates who have attended classes providing vocational education combined with higher education entrance qualifications. Direct studies extend over four and a half years. The qualification can, however, also be acquired via distance studies. In addition, there are postgraduate studies in theory of technical and vocational education for engineers and economists.

Teachers for practical instruction are educated at engineering and technical colleges, after completing skilled worker vocational education and practical work, in direct studies lasting three years or distance studies lasting five years. Education is provided in 22 disciplines. Practical training, however, is also provided by master craftsmen or engineers or by other experienced staff who may have acquired their teaching qualification via distance studies.

Continuing education of theory and practice teachers includes their day-to-day work, special training periods in the enterprises, various forms of the work of methodology commissions, and cyclical continuing education. The latter is compulsory and involves participation in several special courses within a period of five years.

6 Planning for the next generation of skilled workers and vocational counselling

The dynamic development of the economy leads to changes in the requirements to be met by occupational and qualification structures in the industrial combines and enterprises. Planning, based on legislation, is made for a five-year period; details are laid down annually. The planning process is carried out in close consultation between the central level and the industrial combines, enterprises and territories. Requirements made by the governmental planning commission regarding the distribution of school leavers among educational routes, occupations and industrial sectors are binding for the ministries and their respective industrial combines and enterprises. The latter, in turn, coordinate their demand with the territorial organs, the result being the basis for the planning of admissions to enterprises.

The need for the greatest possible precision in planning far into the 1990s is emphasized by demographic factors. Declining numbers of pupils during the 1980s, a higher proportion of working persons close to retirement age, but also social measures and other factors are bringing about an absolute limitation of the work potential which will continue until after the year 2000. In 1985, only three quarters of the number of school leavers of 1980 were available. In 1990, there will only be half the number of 1980. This circumstance compels us to make even greater efforts to ensure adequate numbers of young workers.

The German Democratic Republic has a network of 220 vocational counselling centres for recruiting skilled young workers. In addition, there are specialized training workshops in enterprises and information centres at higher education institutions and technical colleges. Cooperation among all participating institutions is based on a statutory ordinance. Major responsibility is also borne by the enterprises, which provide polytechnical education and supervise working groups, etc.

Development of a child's interest in occupational work begins early on; individual measures are available even at kindergarten age. Special events are organized in grade 6 of the general and polytechnical school for students and parents and continued up to the time when an occupational choice is made in grade 9. The large number of first-time applicants confirms the success of these measures. Of course, this does not mean that the German Democratic Republic has solved the well-known problems involved in traditional occupational selection behaviour; girls are still reluctant to choose technical education while other occupations are demanded in excess. Modifying occupational selection patterns cannot, however, be a task for vocational counselling alone, but requires an education effort on the part of society which begins in the family.

Brazil: The Entity Called SENAI
by Guimarâes Roberto BOCLIN

The National Industrial Apprenticeship Service, SENAI, was set up in 1942, by decree-law No. 4048/42, for the purpose of providing basic, advanced and skills training of the work force for the secondary economic sector. That work force, in full course of expansion, was not being adequately served, either quantitatively or qualitatively, by the official or private academies that were re-

sponsible in those days for what was then referred to as industrial teaching.

SENAI, organized, maintained and operated by the industrial sector, is an entity subject to private law, administered by normative and administrative bodies at national and regional levels.

SENAI's normative bodies are as follows:

- The National Council, with jurisdiction throughout the whole of Brazil, consisting of the President of the National Confederation of Industry, who is ex-officio head of the body, and of the Presidents of the Regional Councils, representing the economic categories of the industrial sectors, the Director-General of the National Department, representatives of the economic categories of transportation, communications and the fish processing industry, and the representatives of the Ministry of Education and the Ministry of Labour.
- The Regional Councils, with jurisdiction over the corresponding national entities, comprising the following members: the President of the respective Federation of Industries, who is ex-officio head of the body, the Director of the Regional Department, representatives of the economic categories of the industrial sector, representatives of the economic categories of transportation, communications and the fish processing industry, and representatives of the Ministry of Labour and the Ministry of Education.

The National Department and the Regional Departments are the respective administrative and the executive bodies.

The National Department is in charge of essentially normative, technical assistance and coordinating functions, whereas the Regional Departments look after the operation of the vocational training units and participation with the training services of the various enterprises.

The industrial, transportation, communications and fish processing industries make contributions for the upkeep of SENAI amounting to 1 % of their respective payrolls, with enterprises having over 500 workers required to pay an additional levy of 0.2 % of their payroll.

A further statutory responsibility of the enterprises is to employ and enroll in SENAI a number of 14- to 18-year old apprentices equivalent to at least 5 % and at most 15 % of the workers whose jobs call for skills training. Up to the completion of the first half of the maximum period stipulated for learning the respective trade, the apprentices earn half the national base wage. In the second half they receive two thirds of the aforesaid base wage.

In addition to paying the compulsory contributions set by law for the upkeep of SENAI, the entrepreneurial sector, looking on the institution as an agency for basic and advanced training of its labour, cooperates with SENAI by participating in the technical advisory boards of the various schools, appoints experts for developing the courses and programmes, facilitates job market surveys and studies, makes technicians available for giving courses, enrolls youth or adult apprentices in the various courses, donates sundry equipment and didactic materials, evaluates the efficiency of the courses, provides the schools with industrial assignments for execution by the student body, provides guest study facilities for students and for updating of faculty members' know-how, and cooperates through financial backing to the construction and establishment of schools and training centres. The aforesaid cooperation by the Brazilian entrepreneurial sector is undoubtedly a positive proof that SENAI is a sui generis entity, having the characteristics of a vocational training agency, but accepted and viewed by the enterprises as their all-encompassing, fully organized and outstanding cooperative skills training centre.

At the present time SENAI has 24 Regional Departments, embodying

- 178 vocational training centres (168 in SENAI itself and 10 operated in cooperation with enterprises),
- 17 technical academies,
- 4 technological centres,
- 266 mobile units (262 within SENAI itself and 4 run in cooperation with enterprises),
- 64 general training centres (54 within SENAI and 10 run in cooperation with enterprises),
- 8 training agencies,
- 17 operational training units (seven in SENAI and 10 in cooperation with enterprises), and
- 3 personnel development centres.

At every one of the entity's vocational training centres, as well as in the units set up within enterprises themselves, SENAI's activities have economic and social impact and scope, fostering increases in output, betterment of productivity and social upgrading through vocational promotion of its students.

1 SENAI's modalities of action

SENAI carries on programmes and activities covering all forms of training for jobs:

- Vocational apprenticeship.

  A process of systematic vocational training of skilled workers, by means of theoretical and practical programmes at a level of one or more of the last four series of primary schooling, and intended exclusively for the 14- to 18-year age group.

- Vocational qualification training.

  A process of systematic vocational training, which may or may not entail specific systems, being of variable duration dependent on the type of trade involved, and intended for preparing skilled or semiskilled workers.

- The degree of qualification depends directly on the immediate work force requirements.

  Qualification may be provided at first or second grade levels, in accordance with the level of schooling called for and the vocational profile aimed at. It is intended for students aged fourteen and over, and may or may not include a component of general education.

- Vocational qualification.

  A process of vocational training provided at the second grade level, whose programmes entail general education and special training components, for development of technicians (with full vocational qualifications), and assistant technicians (with partial vocational qualification).

- Full vocational qualifications activities.

  Intended for preparing second-level technicians.

- Partial qualification activities.

  For training auxiliary technicians.

- Training of technologists.
- A process of vocational training carried on at a third level, with programmes covering components of both general education and special training.
- Vocational training.

  A process aimed at coping with immediate problems of enterprises, connected with productivity. It is intended for workers of the various vocational categories, and for persons who do not as yet have the qualifications required to join the work force. Training involves a limited number of operations and takes a relatively short time.
- Vocational upgrading.

  A process aimed at expanding the knowledge and improving the skills of a worker in a trade, for the performance of his specific activities. It expands the abilities of the worker in the typical activities of his field of endeavour, not inducing a shift in the field of work, but making it possible to perform existing functions more effectively.
- Vocational specialization.

  This process enables a worker in a particular trade to acquire in-depth knowledge in a particular part of the range of activities involved in his occupation. It makes it possible for the worker to engage in other activities as well, since the development in depth generates new areas of activity leading to new occupations.
- Vocational refresher training.

A process largely resembling the upgrading activities. The methodology and techniques of operation are the same. But refresher training means acquiring new knowledge and skills relating to the same area of activity of a particular occupation, as a consequence of the progress in technology.

2 Unemployment, underemployment and the informal sector

It must be admitted that the informal sector, in terms of economic practices, provides a creative solution, but one of an emergency nature, to untrammelled demobilization of the work force in the absence of an official unemployment compensation programme.

It is, however, to be hoped that recuperation of economic activity will bring a shift in the volume of these practices, which are far from meeting the needs of the client sectors involved. The informal sector ought, indeed, to be confined to serving as a source of supplementary income for the more needy families.

Such a programme, however, as must be clearly understood, calls for a specialized agency to give continuity to its action even within the limitations we have sketched out. Though necessary, it involves dealing with techniques that have to do with autonomous work and the mastery of how to market such services, plus the marketing and technology of handicrafts level production, which are fields outside the purview of SENAI.

Our entity, though dealing with the lower income bracket, provides training oriented in terms of the requirements of the formal sector, enhancing in its graduates the concepts of punctuality, disciplined teamwork, saving out of wages, deployment of techniques and use of technology- and capital-intensive equipment.

3 SENAI's involvement with automation technologies

Selection of labour-saving automation technologies is a problematic process. On the one hand, there are those pointing out the destructive effects of modernization, and the bogies of unemployment and concentration of income. From a different angle, voices are heard warning of the possibility of obsolescence or loss of competitiveness where traditional processes are still being used.

Thus even in the "heartland" nations that generate the most advanced scientific knowledge, there has been some hesitation in applying labour-saving technologies, even though such methods admittedly herald social benefits in the long run. The dilemma involved is typified by examples of the failure of policies aimed at containment of technological modernization that ended up turning into the object of interminable pointless controversies of intellectuals and politicians.

This ambiguity has a direct impact on vocational training activities, since we cannot forswear our objectives by providing instruction based on prevalent realities of the field we seek to serve, and affording services to the social sectors linked with both options referred to, at one and the same time. The first of these two options is specifically the purview of the enterprises using such techniques. In the view of the latter, adoption of a particular process of production must necessarily be in accordance with the mechanisms and competitive demands of the market itself, leaving aside emotional and ideological attitudes. In this environment, vocational training plays the role of an instrument for the spread of the technologies selected, that of a bureau for the transfer of innovative know-how.

The latter stance does not, however, indicate that the institution is exempt from the effects of the current unemployment crisis, if for no other reason than because having our graduates find their niche in the job market means that the economic structure must produce parallel job opportunities. Vocational training involves initiation into a trade, occupational refresher training, upgrading and skills training, couched, in all cases, in terms of the demand-in-being. Any other approach would end up turning into mere flights of fancy, simulation or empty rhetoric.

SENAI does, indeed, feel the effects of absence of any more effective national employment policy capable of harmonizing the pressures of the impact from investments by the public sector in industrial modernization, on the one hand, and the supply of labour on the other.

A candid dialogue between the state and society at large, such as called for by the present situation in Brazil, would be required for querying projects and devising compensatory mechanisms so as to achieve compatibility between public and private investments and the need for providing jobs as a result of the demands stemming from population growth.

4 Supervisory and managerial staffs for industry

One of the more complex priorities facing SENAI is undoubtedly the training of supervisory and managerial personnel to serve the future requirements of industry.

Though there are many points at which these functions intersect one another, such as, for instance, in relation to the efficient use of time, human resources, technology and capital as factors of production, there is considerable diversity as regards the inherent nature of the way administrative facts are dealt with at the level of organizational

culture, and the other requirements involved in dealing with highly subjective matters.

In appearance there has been no change from what prevailed previously; yet the nature of the supervisory posts will have to be modified in terms of the expectations of mutual relationships within an equalitarian society, valorizing even more the privatization of the economy, democratization of decisions, collective bargaining and heightened competitiveness in the market. All these factors will doubtlessly call for adaptations in the pattern and dynamics of entrepreneurial management.

In the meantime, Brazilian society, paced by the enterprises and their executives, is moving more and more into the informatics age, in tune with the worldwide trend. Mainframes, medium-, mini- and micro-computers are spreading at a fast pace, opening new portals to achievement, side by side with increasing knowledge and training. The respective facilities are growing in number day by day: With thousands of computers in daily use; a tremendous variety of peripherals; a wide range of experience; curtailment of costs; more powerful magnetic and semiconductor memories; teleprocessing facilities; cheapening of data communication; in brief, a state of the art in processing at levels of hardware, applications, and software that is tantamount to a conspiracy against the traditional schemes of training, threatened as they are with anachronism in the light of the demands created by the dynamics, diversification and speed of the solutions demanded by management.

To cut a long story short, vocational training must match the requirements of a new day and age.

5 Lines of action of SENAI

The vocational training activities developed by SENAI are carried on at vocational training centres or in enterprises, in accordance with a cooperative model in all cases. In both situations the role of the enterprise is of the utmost importance, since SENAI is responsible, in line with its rules of action, for preparing the work force for the job market.

6 Training of workers at vocational instruction centres

After completion of studies on labour requirements for the various occupations comprising the job market, a decision is made regarding the occupations that are to be taught at the centres. The respective numbers involved are taken as a basis for sizing the physical capacity to be installed, with due regard at the same time for the resources that will be available, particularly financial ones.

Each trade to be taught is matched by a job analysis carried out in the enterprises involved, so as to determine the required profile of performance of students, covering mastery of the skills entailed in doing the basic tasks of the trade, and naturally including mastery of the machinery, tools, equipment, raw materials, technology and basic principles of industrial hygiene and safety.

Job analysis is conceived as a process whereby a particular occupation is broken down into the whole of the factors comprising it. The purpose is

- to highlight the tasks and operations pertaining to a particular job;
- to identify the occupation levels existing in the job market;
- to describe the content of each job;
- to identify the processes and technical standards of the trade, as well as pertinent vocational, social and legal characteristics involved therein;
- to identify the group of psycho-physical characteristics the occupation demands on the part of the individual for its performance;
- to indicate the technical and scientific subjects involved in learning about and mastering the job.

The method adopted in giving the courses is that of individual instruction that started to be tried out in 1966 in evening courses, facing the whole of the difficulties that arise in a situation of change when passing from a traditional method to an active one, involving student-centred approaches, entailing variable durations of courses, constant acquisition of knowledge, and with the instructors as facilitators of the learning process, the students in an active role and attendance being provided on an individual basis.

The evening courses, organized along the lines of those for teaching young apprentices, were aimed at adults and provided first of all, in alternate and simultaneous programming, the theoretical knowledge called for in doing the work in each skilled occupation, and then passing on to actual performance of the physical work involved.

The evening courses lasted three years, broken down into six periods of five months each, called "terms", in which theoretical instruction was alternated with shop practice.

Promotion from each "term" to the next occurred at five-monthly intervals, based on a demonstration of the proper absorption of theoretical and practical knowledge that was appraised on the basis of a minimum weighted rating. The students not getting a passing grade were required to repeat the term which thus extended the time needed for completing the course. For this and other reasons the rate of drop-outs from the evening courses was quite high, and it was observed that the training centres did not suitably meet the requirements of labour training called for by the enterprises.

The teaching method was the traditional one, involving the setting up of heterogeneous groups in terms of levels of competence on starting, and students could begin and complete the course at individual periods. Yet the following observations were recorded: The desired objectives were not always attained; there were many drop-outs caused by the flagging of interest on the part of those who already knew more than the others on the one hand, and those unable to keep up with the group on the other; the hard-and-fast duration of the courses made no allowance for individual differences; and the intended homogeneity of each group was not attained.

New approaches were tried and considered valid, and the individualized instruction methodology was adopted little by little in all courses given.

The individualized instruction methodology largely used in the entire SENAI system fosters more efficient and more all-encompassing learning, since it induces the student to play an active role in the educational process, turning him into the central factor of the activities, and paying due heed to his rate of learning and to individual differences. At the same time, it fosters the development of initiative, creativity, capacity of judgement, and other qualities essential to proper vocational training, in a definitive break with the passive components of the traditional methods.

The work is organized in four phases corresponding to the complete cycle of the learning processes: study of the subject, proof of knowledge acquired, application or transfer of that knowledge, and evaluation. At the outset the student studies, draws up routines, and acquires new concepts, based on reflective thought processes. Consolidation of that knowledge can then be achieved by experimentation, demonstration, or even the performance of exercises. In that third phase, a check is made to determine whether the student should be required to participate individually or in cooperation with the instructor, but it is up to the latter to make the final evaluation.

7 Training of labour within industry

With due regard for the diversity of the enterprises attended, plus the limitations of its physical facilities, SENAI also mounts programmes within the respective enterprises, which may go all the way from programmes of apprenticeship for youths, on-the-job training of workers for a particular job, and even programmes for providing the enterprise's entire work force, to the extent of broad-scale activities in cooperation with industries that have to face changes of structure, technology, production processes or alterations in quality.

Training of workers for a particular work post calls for a job analysis to be effected.

Work post analysis means a process whereby a particular activity is broken down into the elements comprising it, and the contents are described at a level of detailing suitable for the objectives and the target population. The purpose is:

- to indicate the tasks and operations pertaining to a given job;
- to describe the contents of the job;
- to identify the processes and technical standards of the work and the vocational, social, and statutory characteristics pertaining to it;
- to identify the group of psycho-physical characteristics the post requires on the part of the individual who is to perform it;
- to indicate what are the technological subjects that must be studied for knowledge and mastery of the post.

Work post analysis has a methodology of its own and can be applied by SENAI or enterprise technicians duly trained for the purpose.

Work post analysis and job analysis leads to a structured and coded record of all information involved, with a view to

- determining the goals of instruction;
- describing initial patterns of action by students;
- setting up criteria and desirable performance standards;
- developing tests for purposes of evaluation;
- preparing course curricula;
- developing programme contents;
- preparing instruction materials;
- selecting and producing auxiliary resources;
- preparing the plan of control and evaluation.

For both apprenticeship at job site and training in a work post assignment, SENAI works together with the enterprise to prepare plans and programmes, embodying the objectives of instruction, the contents, techniques of instruction, and instruction resources. The instructors, who may be on SENAI's staff or, preferably, on the staff of the enterprise involved, are selected and prepared for their tasks. Once training has started, SENAI and the enterprise follow up, supervise and evaluate activities and issue the respective certificates.

Programmes aimed at covering a enterprise's entire work force entail the need for making a survey of the training needs of the complete staff, and this is done with specific methodology deploying all levels of supervisors.

At the end of the activity programme, a clear idea will have been obtained as to who has to be trained, in what, and by when. From that point onwards, SENAI once again applies work post analysis in relation to each training requirement detected in the survey, after which the procedures already referred to are applied.

For enterprises having to cope with structural changes, or shifts in technology, production processes or quality, the work methodology entails the most varied of surveys, starting with a precise definition by the enterprise of those modifications that are going to occur and how soon they are going to take place. The enterprise will then be required to provide the patterns of performance aimed at and the survey of entire work force already on the job, spelling out the various areas of activity, the level of schooling, the time on the job and so on, to make it possible to determine at the outset the gap between current realities and future needs.

From that point on it is possible to visualize the activities that need to be engaged in so as, in case of need,

- to make vocational shifts of members of the organization; and
- to make up for shortcomings in general education and job capability.

Subsequent to the latter stage, the work amounts to planning and programming the activities to be carried on, to make up for the shortcomings in general education, or offset the weak points in vocational competence through one or another of the various modalities of preparation for work to be carried on at SENAI, at enterprises themselves, or in joint SENAI/ company programmes.

Part 2: Microsystems of Technical and Vocational Education

An International Comparison of Didactic Models in Technical and Vocational Education

by Günter WIEMANN

Although an international comparison of macromodels of technical and vocational education reveals major differences, the didactic micromodels chosen by different societies to impart those occupational skills that are considered necessary are very similar.

The differences between these models can best be evaluated when the models are examined in practice to see how they work and prove their worth in modern industrial production and services.

1 Learning goals in technical and vocational education (problem-solving approach)

Occupational competence is acquired by learning, in an occupational setting, to work in a manner integrating different problem solutions in a systematic way.

These learning processes include in particular:

- Process learning -
  the mastery of techniques and processes to acquire *technical competence*;
- Social learning -
  the mastery of social processes in the workplace and in the enterprise to acquire *social competence*;
- Learning to plan -
  the mastery of target-oriented integration of techniques and processes, social processes and skill utilization to acquire *planning competence*.

1.1 Process learning (technical competence)

Competence at work consists in mastering a few basic techniques which are integrated with the required tools, materials and substances so as to achieve, by way of a number of operations, the goals set.

Examples of basic techniques from the occupational field of metalworking to be mastered in theory and practice are:

- measuring, calibration, gauging and marking technology;
- cold-working and hot-working (e.g. bending);
- cutting (e.g. sawing, drilling, turning);
- joining techniques (e.g. friction-type locking and positive joining, such as threading, riveting, welding;
- controlling (e.g. feed motions at machine tools).

1.2 Social learning (social competence)

Systematic work cannot be effective unless it is integrated into the existing formal and informal social processes in a enterprise. This is why social learning must address above all the social processes in the environment of the workplace; it must include in particular

- the horizontal (colleagues) and vertical social processes (cooperation at work);
- the handling of structural and behavioural influences as well as conflict settlement and its techniques (conflict settlement);
- the management structure and flow organization of an enterprise (work organization).

1.3 Learning to plan (planning competence)

Desired occupational problem solutions (performance of jobs in the enterprise) are possible only by means of target-oriented, planned integration, in particular

- of the various techniques and processes;
- of the various social processes.

The ability to bring about such integration systematically is termed *planning competence*; this competence can help to integrate the following individual processes:

- the various techniques and processes (e.g. sawing, welding);
- the various workplaces (e.g. bench, machine, assembly line, individual and group workplaces, operational logistics);
- the various (horizontal and vertical) social relations;
- the various management and administrative functions within the enterprise (job scheduling, job evaluation, accounting, works council, insurance and health);
- the various communication systems (linguistic, mathematical, graphic as well as electronic communication);
- the various utilization systems (enterprise and market).

2 Didactic Models

The purpose of a didactic model is to assist in the organized acquisition of occupational skills required for the reproduction and development of society and economy (social and economic function) as well as in the creation of permanent employment opportunities for those who have completed initial technical and vocational education (individual and social function).

2.1 Criteria for the selection of learning goals

Didactic models are determined in the first place by their learning goals, which guide them and which describe their learning level and rank. The selection of learning goals can be based on the following criteria:

- reproduction, i.e. the mastery of perfect application of the techniques learned;
- polyvalence, i.e. the mastery of techniques as well as social and planning processes via theory-guided, integrated occupational activities in occupational fields;
- autonomy, i.e. the mastery of techniques as well as social, utilization and planning processes via theory-guided, integrated autonomous activities in occupational fields.

2.2 Economic selection criteria

The selection of learning goals always has an economic aspect, too, because the application of these goals has to take account also of the organizational and financial conditions prevailing in a country.

The selection of didactic models has to take account of the following economic criteria:

- time economy, i.e. the optimization of learning and examination periods;

- material economy, i.e. the optimization of material utilization, maintenance and repair, self-supply, economy, recycling;
- staff economy, i.e. the optimization of the use of teaching staff, counsellors, curriculum experts, members of examination boards;
- space and equipment economy, i.e. the optimization of the use of buildings, equipment, boarding schools, of traffic and maintenance costs pertaining to central institutions of technical and vocational education.

2.3 Selection of learning contents

The selection of learning contents to design and structure curricula, which must be based on learning goals, must ensure that the curricula become compulsory for a whole country, a region, a school type, an occupational field or a subject, if general goals of social policy in its widest sense are to be pursued.

The claim to a general validity of curricula is based on specific criteria:

- standardizability, i.e. learning goals, curricula, learning periods, examination level, the specific abilities of the teaching staff and material constraints (learning aids, school buildings) must be described in a standardized way;
- reproducibility, i.e. the standards described must be applicable to any given place of learning, by any teacher or instructor, at any locality, and at any given time;
- quantitative adjustability, i.e. the learning standards mentioned above must be adjustable according to quantity, depending on a desired enhancement or reduction of goals;
- transferability, i.e. the standards described above must be transferable according to specific socio-cultural conditions (e.g. in the Third World, in various regions of a country) without the need to abandon principles and criteria.

3 Selection of didactic models

The purpose of didactic models is to impart the qualifications considered necessary by society; the organization of the models answers the question where and how occupational competence is to be acquired according to well-defined learning goals.

A comparison of the different structures developed in industrial societies for imparting working skills shows that, basically, only four clearly distinguishable didactic models of the organization of vocational education exist:

• on-the-job training	**natural type of learning system:** technical and vocational education as part of the jobs to be done at the workplace
• course instruction • project instruction • learning in school-run enterprises	**artificial type of learning system:** technical and vocational education in non-workplace situations

Illustration 3
Basic didactic models
of technical and vocational education

3.1 On-the-job training

On-the-job training is the oldest and most frequent (natural) type of technical and vocational education in all societies and, in its pure form, has the following features:

- Organization of learning:

  The trainee acquires skills in the enterprise by observing, imitating, joining in, assisting and trying, by informal imitation of what he or she sees.

  Working on real jobs in the enterprise makes immediate economic sense: The products which the trainee has helped to produce reach the market, and their quality is controlled by feedback provided by the demand for such products within the enterprise and at the workplace. The trainee's work is always practical, at all times related to real demand, and it provides the prerequisite for the trainee's future ability to earn a living.The trainee shares the communicative, social and ritual relations within the community of staff members, which has its own spirit and will influence the trainee's way of speaking, behaving and thinking.

- Teaching staff:

  The professionally competent master craftsman, the journeyman, the experienced coworker take over work tasks required by the market, negotiates with clients, with the customers' department or the job scheduling department in the enterprise, he passes on appropriate tasks to the trainee, he plans the work and work processes, in many cases he joins in the work himself, he instructs the trainee, e.g. by way of the four-stage method (preparation, demonstration, imitation, practice), he controls work progress and evaluates work results; in short, it is the teaching staff's task to make decisions, to give or refuse permission, to instruct, to assure, to evaluate results, to settle conflicts, etc.

First Excursus
A critique of on-the-job training from the point of view of technical and vocational education theory

The description of ideal on-the-job training raises the question why this traditional form of vocational education is being replaced partly or wholly by artificial, school-based or quasi-school systems (e.g. a basic metalworking course in a training workshop or in part-time vocational school).

Criticism of on-the-job training from the point of view of technical and vocational education theory has a long tradition. The complete or partial shifting of vocational education to systems outside real work situations as a result of this criticism cannot be explained solely by the gradual social development of certain life styles, tasks and roles (e.g. the transition from sick-care at home to the modern hospital system); rather this shifting has been caused by the conflicting aims of company management and modern learning. The following factors are important in particular:

- *The company, with its management and technological structure, is designed to optimize goods production with the aim of complying with the competitive conditions presented by the market; the company's structure has not been developed to meet the requirements of vocational education.*
- *The company depends for orders on the market situation and thus on an accidental segment of goods production (specialization), the possible result being*

merely segmental opportunities for learning against the demand for a complete set of learning goals.

- *The company employs its staff as goods producers, for whom the teaching of young workers can be no more than a side occupation.*
- *The company is exposed to the market's continuous pressures for modernization and develops new and ever more complex structures with the result that vocational education becomes more and more marginal.*

In response to the criticism voiced by vocational educationists, which I have just briefly outlined, attempts were made to overcome the structural weaknesses of on-the-job training by introducing didactic systems that either supplement on-the-job training (part-time vocational school, introduction of systematic models like MES, courses in the framework of inter-company training) or replace it. These systems must be described explicitly as non-direct forms of learning. All known didactic structures are, however, characterized by the claim that they undertake to imitate and approximate real work situations in the company.

Artificial didactic systems which expressly strive to supplement or replace on-the-job training are based on the following considerations:

- *Place of learning:*

  Vocational education in this framework must take place in a separate place of learning explicitly reserved for vocational education, for example in training workshops, training laboratories, vocational schools, inter-company training facilities, etc.).

- *Organization of learning:*

  The corporate structures which by definition aim at production and prevalence on the market do not allow systematic learning which is in keeping with the approach recommended by technical and vocational education theory. Specifically designed didactic systems, on the other hand, are based on systematic learning processes adhering to the laws governing learning. In order to support learning, systematic teaching aids are used (textbooks and tables, laboratory devices, audiovisual aids, etc.), the express purpose being that learning goals (such as learning targets, curricula) are achieved, learning times are optimized and, in particular, trainees are made to understand technological, scientific and mathematical laws involved in the jobs they perform.

- *Teaching staff:*

  Didactic planning, instruction and the control of learning progress in technical and vocational education are the responsibility of full-time teaching staff, who have been specifically prepared for this task through their own work experience and through familiarization with technical and vocational education theory; their work is based on the results of systematic research in technical and vocational education.

Second Excursus
Learning in artificial systems of learning

Whenever societies decide to supplement or replace traditional on-the-job learning with alternative types of training, artificial systems emerge which have been designed explicitly for the purpose of technical and vocational education at a specific place of learning. This decision is roughly subject to the following criteria:

Functions	*Preparation for an occupation as skilled worker in the core area of industrialization - manufacturing, maintenance, repair - by means of industrial vocational training; on this basis ...*
Recruitment	• *a fair-sized group of selected adolescents (selection via final school examinations and tests)* • *for key positions in lower management (machine operator, foreman, master)* • *in combination with advancement and career prospects (second chance education)*
Optimization	• *with a selection of vocational learning contents (applicability, completeness, controllability)* • *in a carefully planned learning framework (systematic approach and regularity)* • *under the supervision of selected experienced instructors with experience in technical and vocational education* • *including also results in research in technical and vocational education* • *at a considerable expense (staff, space, technical infrastructure* • *at a place of training specially reserved for vocational learning and separate from production*
Qualification	• *to become competent skilled industrial workers* • *who have polyvalent skills and can therefore be employed at any time, at any place and in many occupational task to elaborate extensive and flexible problem solutions*
Socialization	• *with calculable social dependability* • *and an occupational performance available at any time and* • *who accept corporate standards and hierarchical interests;*
Training goal	*the goal being that they make a major contribution* • *to the efficient manufacturing of sophisticated goods while continuously striving* • *to bring down labour costs.*

Illustration 4
Learning in artificial systems of learning

3.2 Course instruction

Industrialized societies have developed a methodological approach which is the opposite to on-the-job training: course instruction. This method is based on a so-called basic metalworking course developed during the late nineteenth century, and since then has been introduced in company-based training centres, vocational schools and

inter-company or other off-plant training centres, with its basic methodological structure unchanged.

Course instruction has the following characteristics:

- Place of learning:
  Course instruction requires for its implementation a specific place, separate from real work situations in the enterprise, with specific jobs to be learned, e.g. of basic technical and vocational education; of an introduction to welding, hydraulics and pneumatics as well as for CNC technology.
- Organization of learning:
  The complex and usually integrated work skills to be learned in the enterprise and later to be applied in real work situations are broken down into a series of individual learning units and practice periods, organized by degrees of difficulty (progressing from easy to difficult jobs and from simple to complex tasks); they have to be mastered by the student in a linear and additive manner, progressing from one training phase to the next.

  A great variety of highly developed learning aids are used to ensure didactic planning, imparting of knowledge, and control of learning progress.

  Experience gained in course instruction has shown that breaking down complex jobs into sequences is likely to lead to a high level of performance of students within relatively short training periods. As a result of this favourable experience, this approach was adopted also for other occupational fields (e.g. electrical engineering, building and wood engineering, plastics technology, printing technology, textile technology), including also theoretical instruction (subjects, courses).

  The great advantages of course instruction, i.e. breakdown into sequences, polyvalence, transparence and its regular nature, have contributed to the extraordinary spread of this teaching method initially in Europe and later in the United States, and also in technical and vocational education in the developing countries, for it has been found that course instruction can be adapted with relative ease to all societies, cultures and languages.

  Another achievement in technical and vocational education theory is the polyvalent learning structure; course instruction helps at the same time to overcome the traditional principle of training in a single occupation by preparing students instead for a variety of related occupations and activities, so that they are flexible enough to handle unfamiliar, unforeseeable tasks as they arise.

  The introduction of simultaneous, supplementary instruction in theoretical subjects at in-company schools or public vocational schools has turned out to be yet another consequence of course instruction with its strong emphasis on process learning (acquisition of work practice).
- Teaching staff:
  The temporary or permanent separation of vocational training from the enterprise, combined with the construction of specific artificial systems of learning (as in course instruction), calls for teaching staff who are acquainted with the teaching methods required for this task; the result is that there is a need for special training facilities for instructors and teachers at vocational schools, combined with research in technical and vocational education theory on the part of trade associations, at institutes and at universities.

  In course instruction, teaching staff can rely on well-proven learning aids in order to prepare and support instruction and to evaluate learning results. The whole learning structure is highly independent of the individual teacher and ensures fair evaluation; this is why long and costly training of the teaching staff is unnecessary. In this case it is sufficient to familiarize the staff with relevant teaching methods, provided that they have successfully carried out their occupation for some time.

Third Excursus
A critique of course instruction from the point of view of technical and vocational education theory

- *Place of learning:*

  The above-mentioned advantages of course instruction are obvious; they can, however, become counterproductive if learning at a separate place of learning (which is necessarily simulative) loses contact with the real work situations in the company because it takes place outside the company for too long. How long it is advisable to have training outside the company at a separate place of learning depends on
  - *the structure of big enterprises with a high degree of rationalization and a specific company size (e.g. in motor vehicle construction, in the steel and chemical industries), which demands that vocational education be separated wholly or partly from real work;*
  - *the structure of small and medium-sized enterprises under increasing pressure for specialization, which forces these enterprises to provide vocational education, at least partly, outside the company (e.g. in part-time vocational schools and in inter-company vocational education facilities) if the said learning goals are to be achieved;*
  - *the structure of the trainees, which means that high-achieving, confident and creative trainees learn more easily in real work situations than lower-achieving individuals who need more attention and sustained support;*
  - *the structure of the learning contents, which means that learning contents with a major theory component (i.e. in electronic engineering, in natural science occupations) are with advantage taught in special places of learning, while others with a major experience and practice component (e.g. in mechanical engineering) are preferably conveyed in real work situations.*
- *Organization of learning*

  Didactic systems with a linear structure can become counterproductive whenever the entire didactic system of a place of learning is dominated by rigidly fixed learning sequences, by an isolated learning situation, and above all by the expected results of learning; in this way both the complexity of real work situations and the complexity of occupational problem solving processes are sacrificed while, really, this is what vocational education should, deliberately and systematically, convey.

  Learning goals which go beyond the mastery of normal work processes - for example theory-guided and autonomous action - cannot be realized in closed didactic systems with a high degree of outside determination by teaching staff.
- *Teaching staff:*

It is a law inherent in social groups - in this case instructors and teachers of vocational schools - that these groups develop for themselves collective interests (and bodies representing these interests), which can also become counterproductive by undermining the mandate of vocational education; this is true whenever status and income considerations are given preference over the vocational mandate and the pertinent continuing education.

3.3 Project instruction

An alternative method which is clearly different from course instruction, i.e. project instruction, has been successfully developed with the explicit aim of overcoming the latter's weaknesses.

- Place of learning:

  For this teaching method, too, it is necessary to have a location for training which is separate from the real work situation, because otherwise the extensive planning effort required for project instruction is impossible to make. On the other hand, however, the selection of project tasks taken from the manufacturing process, and reintegrated into this process on completion of the project, provides interesting possibilities for teaching.

  At the time of shifting from course instruction to project instruction or of an enhancement of course instruction by project instruction, new requirements emerge for the relevant training institution. This is true in particular for the equipment and the organization of workshops and laboratories, which must make project solutions possible.

- Organization of learning:

  The purpose of project instruction is to imitate the complexity of real work in the enterprise by simulative learning which is close to reality, with the aim of avoiding the remoteness from reality which is characteristic of course instruction.

  The selection criteria for project instruction are expressly oriented to polyvalent and autonomous learning; this means that the organization of learning must be based on autonomous problem-solving on the part of the students. Instruction focuses on jobs which have been selected according to economic and didactic criteria and which must

  - allow the integration of techniques, social processes and planning processes;
  - in terms of the degree of difficulty, enable students to produce problem solutions on their own initiative;
  - by way of their function, possess a practical value (if possible with social relevance) in order to make sense for the student and
  - be likely to be completed within a foreseeable period of time and at reasonable costs.

  In contrast to the predetermined learning structure of course instruction, project instruction must proceed from an open learning structure, because learning processes and learning results cannot always be planned: The risk of failure must be explicitly accepted. The learning processes, which are not precisely calculable as a result of the largely autonomous learning on the part of the student, can be made visible by previous and subsequent courses, the aim being to ensure near-complete achievement of the said goals of learning.

- Teaching staff:

  In contrast to course instruction, which is based on precise rules and regulations, project instruction makes great demands on teaching staff in terms of planning, implementation and assurance of the results of training. Preparation of instruction requires a great deal of time, imagination as regards the anticipation of possible events, and great commitment including the readiness to deal with conflicts emerging with the students.

Fourth Excursus
A critique of course instruction from the point of view of technical and vocational education theory

The fact that project instruction in technical and vocational education (and also in general schools) has hitherto made only slow progress has important reasons:

- *Place of learning:*
  The redesign of the places of learning in order to make them suitable for project instruction is expensive; as a rule, more floor space is required to provide room for learning groups to move about, a new arrangement of work benches and machinery for group work must be introduced (e.g. pentangular benches, combination benches, mobile machinery) and traditional machine rooms must be variable. Places of learning for integrative learning of theory and practice and new learning aids must be created; on the whole, this means complicated and costly investment.
- *Organization of learning:*
  In particular, a desirable "open" learning structure which is not predetermined for every situation that may arise has traditionally not been regarded as guaranteeing the success of training. Since learning processes cannot be planned precisely, considerable structural conflicts and social disturbances are bound to occur and, above all, learning goals cannot be controlled and guaranteed as in course instruction and in subject-related vocational school instruction.

3.4 Learning in school-run enterprises

The expression school-run enterprise is liable to misunderstandings, because it is open to at least two different interpretations:

- First interpretation:
  School-run enterprises are explicitly organizational, economic and didactic models which link technical and vocational education to production for the market; the manufactured products and the production processes are used for vocational education and students are allowed to work for production as they acquire more skills.
- Second interpretation:
  Other didactic systems, too, including course and project instruction, allow students implicitly to fulfil production tasks for the market. The production tasks to be completed contribute to vocational education, and the students are allowed to work for production as they acquire more skills.

For clarity's sake, it is suggested that only the first interpretation of school-run enterprises should be accepted, and that the second interpretation should better be explained with the expression "learning by carrying out production tasks".

The following thoughts therefore relate to the first interpretation, i.e. an explicitly organized school-run enterprise.

- Place of learning:

School-run enterprises are separate training institutions, which, though similar in equipment to the manufacturing plant, are, in addition, supplied with all necessary equipment for teaching and learning (classrooms, laboratories, media rooms, etc.).

- Organization of learning:

  The organization of vocational education is structured in such a way that all previously discussed teaching systems can be linked consecutively with one another.

  Safeguarding this didactic model is possible by an external partnership cooperation with neighbouring enterprises, with local and regional markets, with schools in the general education system, and with the institutions of continuing technical and vocational education.

The definition of a school-run enterprise includes the following characteristics:

- Procurement:

  For manufacturing and vocational education it is necessary to make products which have sales chances on a local or regional market; cooperation with neighbouring enterprises is expedient; this is true in particular of the procurement of materials, of the modernization of technical equipment and of the recruitment of teaching staff.

- Manufacturing:

  The selection of work tasks also takes account of the occupational skills of the students. This is why, in order to optimize learning opportunities, preference is given to labour-intensive tasks (prototypes, devices, repair, maintenance, etc.). Mass production is justifiable in school-run enterprises only as a planning task.

- Selling:

  Goods produced are sold either by the school or by partner enterprises or by special selling agencies.

- Funding:

  The proceeds from the sale of products, from remunerated work in continuing education and from innovation counselling, provide some relief for the school with regard to investment and current cost.

- Assistance:
  School-run enterprises are a suitable place for providing vocational orientation on skilled occupations and on opportunities for continuing technical and vocational education for schools in the neighbourhood; in this connection, the school-run enterprise assists students in the introduction to the world of work.

- Campaigning:
  The above-mentioned tasks include the possibility of campaigning for skilled occupations in the region with the necessary information on training conditions (structure and duration of training, examinations, continuing education, boarding schools, costs, etc.)

- Counselling:
  The modern equipment of the school, the level of training of its teaching staff, the technical and information resources (technical library, collection of standards, learning media) allow the school to provide competent counselling to enterprises in terms of management (establishment of new enterprises, accounting, bookkeeping, etc.) and in technical terms (tool grinding, introduction to new technologies, etc.).

- Innovation:

  Since school-run enterprises are not immediately exposed to market pressures, they are suitable institutions for innovations of technical products and processes whose development can at the same time further vocational education of students, the continuing education of teaching staff and the cooperation with enterprises (technology transfer).

- Promotion:

  Students who are highly motivated and particularly efficient can be enabled by their school to acquire qualifications and take vocational and general examinations which allow them to go on to further education institutions; in this way, a special occupational elite is created in the medium term.

- Learning:

  Technical and vocational education, if organized appropriately, combines the technical and economic functions of the school-run enterprise, which offers students a unique opportunity during training to assimilate both thought and behaviour patterns of an enterprise.

- Teaching staff:

  In view of the teaching staff's dual function of having to produce for the market while at the same time making possible meaningful vocational education, the special requirements of this teaching model can be met only if there is teaching staff with different skills at a high technical, economic and didactic level as well as long practical experience and imagination in the way they teach (this is needed above all for the school head). As a rule, this ambitious model makes it necessary to recruit teaching staff with very different backgrounds, and special attention must in addition be given to the recruitment of staff for the acquisition of orders, for marketing and for sales.

Fifth Excursus
A critique of instruction in school-run enterprises from the point of view of technical and vocational education theory

- *Place of learning:*

School-run enterprises as a didactic system have so far been formed only in countries where enterprises do not take an active part in vocational education; where school-run enterprises have been formed, this has been done under the following conditions:

  - *Tradition: An indispensable prerequisite for enterprises to play a major role in vocational education is a tradition-based attitude on the part of entrepreneurs and trade unions, which implies that they wish this and support it actively (as is the case in the Federal Republic of Germany); if this prerequisite is not fulfilled, technical schools, training centres and school-run enterprises are established as institutional and didactic variants of in-company training.*

  - *Elites: Countries who intend to industrialize their economy establish training institutions with a high general and technical standard, while making recruitment of trainees conditional upon the fulfilment of stringent admission requirements; the purpose is to train a technical elite for management positions in enterprises with a view to advancing the technical and industrial development of their country; this happened, for example, in 19th-century Prussia when the "Königlich-Preußische Fachschulen" were estab-*

lished in Schmalkalden, Iserlohn, Remscheid and Siegen.

- *Cost reduction: on account of the considerable investment and running costs of school-run enterprises, an attempt is made to reduce operating costs and raise funds for further investments by means of production for the market.*
- *Competence: the close connection between production and vocational education holds a major chance of avoiding the weaknesses of simulative didactic systems, thus making possible reality-based learning.*

- *Organization of learning:*

  The establishment of school-run enterprises is usually the result of a prevailing deficit; this didactic system is intended to replace real-work learning in the company. In this connection, the following critical questions arise:

  - *The economic and financial situation of many schools requires that priority be given to production goals; but the recruitment of instructors from enterprises and the resulting socialization problems concerning patterns of thinking and behaviour can also bring about a situation in which such a school is dominated by economic considerations; another factor is the pressure exerted by the partner enterprises in order to achieve specific market goals with the help of the school.*
  - *The learning climate in a school, the prevalence of curricula and examinations, and the socialization of teaching staff (recruited from higher education institutions) can bring about a situation in which learning dominates while production is neglected.*

  These two contrary positions (and observable developments) of school-run enterprises when being faced with having to make a choice between "real" and "simulative" learning can be made congruent with the help of the following formula:

  - *A manufacturing company produces the quantity that can be sold on the market.*
  - *A school-run enterprise produces the quantity that is required for teaching and practising, in other words, production for the market is used as a "vehicle" to reach the complete set of learning goals.*

- *Teaching staff:*

  School-run enterprises depend for their functioning on teaching staff with high technical, economic, educational and innovatory competences plus an extraordinary commitment to the "pioneering phase" and stamina in the political and economic "tug-of-war" between the learning requirements made by the school and the enterprise's economic interest. This almost intractable problem has frequently led teaching staff to submit exclusively either to the interest of the company or to the requirements of learning.

  Yet, it is this ambiguous position of the school-run enterprise, namely that it is not quite a school and not quite a company, which provides this didactic system with an educational openness, liveliness and innovative tendency that cannot be achieved by any other model.

4 Conclusion

Vocational competence can be imparted by way of different teaching models; but the extent to which the technical and vocational qualifications imparted are appropriate, flexible and transferable in modern industrial production and services and, in particular, the degree of autonomy in the workplace resulting from the ability for independent occupational problem solving, are decided by the model or combination of models chosen.

Illustration 5 (below) points out the control of occupational problem-solving through the integration of occupational "knowledge" and occupational "doing". Illustration 6 (next page), in conclusion, compares and contrasts the potentials and capacities of the different concepts of technical and vocational education.

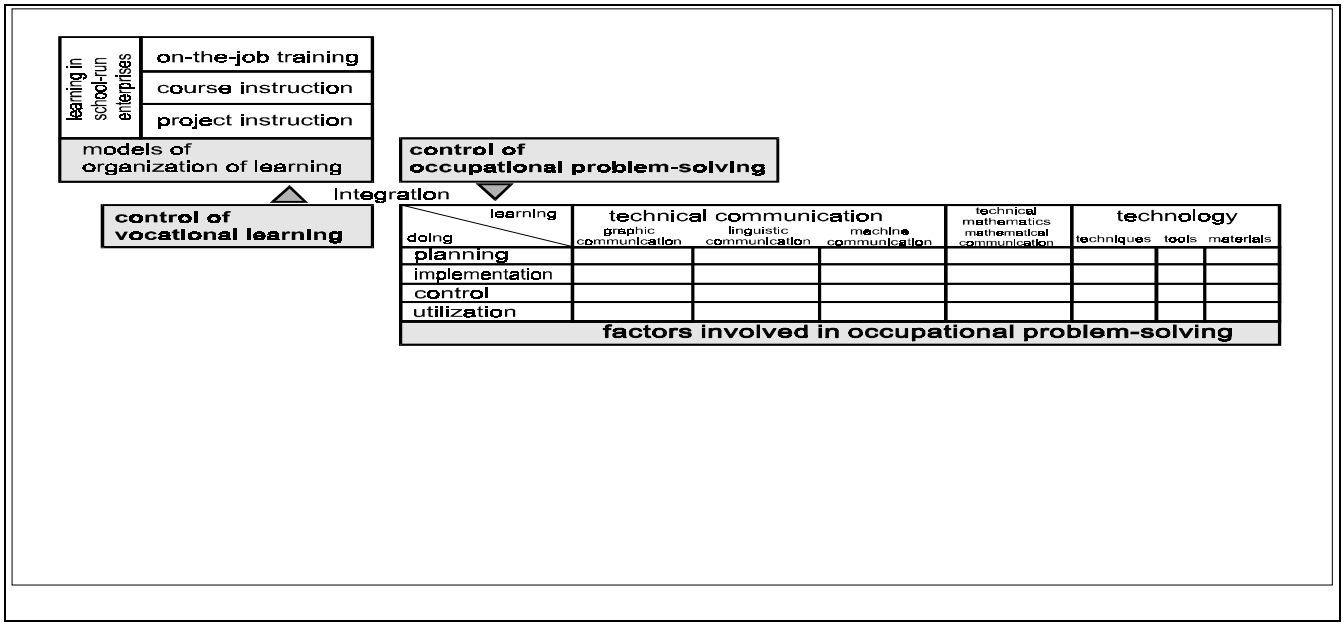

Illustration 5
Didactic relationship between occupational problem-solving and vocational education in technical occupations

On-the-job training:
Occupational problems are solved in real work contexts. Emphasis of learning is on carrying out work under the direction of experienced staff; occupational knowledge is acquired informally by learning rules gained from experience

learning / doing	technical communication	technical mathematics	technology
planning			
implementation	*learning by sharing in the company's work*		
control			
utilization	*working for the market*		

Course instruction (I):
Occupational problems are broken down into learning sequences and structured according to theoretical considerations in linear form. Learning takes place outside the real work context at a separate place of learning under the direction of full-time instructors

learning / doing	technical communication	technical mathematics	technology
planning			
implementation			
control			*course: turning*
utilization			*course: gauging, calipering*

Course instruction (II):
Occupational problems are broken down into learning sequences and structured - by subjects - according to logical considerations. Learning takes place outside the real work context at a separate place of learning under the direction of full-time instructors.

learning / doing	technical communication	technical mathematics	technology
planning	*technical drawing*		
implementation			*course: gearing*
control		*course: motion*	
utilization			

Project instruction:
The solution of occupational problems is simulated by the construction for training purposes of complex learning situations in which learning and doing are integrated. Learning takes place outside the real work context at a separate place of learning under the direction of full-time instructors

learning / doing	technical communication	technical mathematics	technology
planning	*integrational learning by making complex products*		
implementation			
control			
utilization			

School-run enterprises:
The solution of occupational problems takes place under quasi-real learning conditions in a school which is a firm. On-the-job training, course instruction and project instruction may be integrated. The school-run enterprise combines vocational learning with production for the market under the direction of full-time instructors

learning / doing	technical communication	technical mathematics	technology
planning	*integrational learning by making complex products for the market*		
implementation			
control			
utilization			

example

Illustration 6
Basic models of the organization of technical and vocational education

The Concept of Modules of Employable Skills (MES) Training *by Eckhart CHROSCIEL*

A continuous but regulated supply of different types and levels of well-trained and skilled human resources is one of the essential prerequisites to economic and industrial development. It has long been recognized by industry, crafts and commerce that vocational training is in itself an investment, as the quality and standard of goods produced and of services rendered depend to a large extent on the level and degree of skills that the staff involved possess.

Many of the vocational training programmes that have been and are being used by technical assistance projects in developing countries originated in the industrialized countries. They were often developed at times when changes in terms of new technologies, production processes, tools, equipment, materials, as well as in occupational profiles, occurred at far slower rates than in the period of rapid change which characterizes today's world. These training programmes were designed to meet the certification requirements of recognized national occupational profiles, as well as to suit the educational level of the locally available training population. The methodologies and instructional materials used for such programmes require technically and pedagogically well-trained and experienced staff. Because of the rigid, time-based structure of both the training programmes and the instructional materials, modifying them to changed or different training needs is in most cases difficult and time-consuming.

The recognition that a new generation of flexible training concepts and programmes, on a modular basis, would be required to enable training authorities and industries to cope effectively and efficiently with fast-changing training needs, in many countries led to research and development work in this area.

In the early 1970s, the International Labour Organization (ILO) started its own research to develop a flexible, employment-oriented vocational training concept, as well as new types of instructional material, suitable for learner-based and instructor-led application. Studying and taking into consideration, where applicable, the results of similar developments from other sources, the ILO has over the past five years developed a modular vocational training approach using *Modules of Employable Skills* (MES). This approach follows present trends whereby the structures and contents of vocational training programmes are based on the competencies required to perform the tasks contained in a given job and/or national training specifications. MES developments have so far concentrated on the following areas:

- the concept itself in terms of procedures, forms, charts and other documents to carry out job, task and skill analysis, to develop, implement, control, monitor and evaluate vocational training programmes and to develop instructional materials;
- a bank of instructional materials in the form of *learning elements*;
- a concept, programmes and instructional materials for vocational training staff development.

Logical and acceptable divisions of work, in the form of technical tasks, are the basis for the development of MES training programmes. Global occupational profiles or technical fields of work, which are broken down into such tasks, can be used as initial task lists to support local programmes in line with national or specific occupational profiles. Banks of *learning elements* or of other suitable instructional materials can support the development of training programmes for these national and specific occupational profiles.

Social and economic developments often lead to the creation of new jobs comprising tasks from different occupational areas for which new training programmes have to be developed. Banks of task analysis data and of *learning elements* could facilitate the development of training programmes for such new jobs.

As the definition of a task is often subject to varying interpretations which might range, for example, from marking out an installation layout to the complete installation of an electric system in a building, it was decided to introduce a new term called *the Modular Unit* (MU), with a precise and clear definition which says that "a modular unit is a logical and acceptable division of work within a particular job, occupation or field of work with a clear start and finish and which would not normally be further subdivided." Where technology is of a standardized nature, the substantive content of a modular unit can be used on a global basis taken from the initial task list.

The modular units performed within given jobs are grouped into modules of employable skills. An MES job specification consists of a job description and a list and precise descriptions of those modular units performed within a given job.

Examples of employable skills show that in situations where only one craftsman is working, he/she will have to perform all those modular units required to complete a given job, in order to be usefully employable or self-employable. In situations where there is enough work to justify the employment of two or three workers, the module of employable skills of each worker would consist of clusters of related and often interlinked modular units, reflecting the division of work among them. In some employment situations, this can lead to very narrow specializations whereby a module of employable skill might consist of only one modular unit.

Modules of employable skills can also consist of modular units from different occupational areas and different fields of work. Illustration 7 (next page) gives an example of the module of employable skills of a first-line maintenance mechanic working in a small hotel. It consists of twelve modular units from different occupational areas.

Masterlists of modular units from a given occupational area or field of work can be documented on Job-*Modular Reference Charts*. The main purpose of this type of chart is to facilitate the identification of modular units performed within groups or clusters of related jobs, for which training programmes have to be prepared. The content of these charts can easily be updated in the light of changing training needs.

MES training programmes can be updated or expanded to suit new requirements. This is of particular importance when workers have to be updated to enable them to apply new technologies or work processes in their jobs, or when redundant workers need to be retrained for new employment opportunities. For example, the training programme for a simple electrician, who initially

had to perform only ten modular units in his job, can be expanded to include training for nine more modular units required to carry out two newly introduced installation methods, and to connect three additional electric circuits.

	MU Title	Occupational Areas	Field of Work
01	Changing light bulbs	Electrical Engineering	Domestic electrical installations
02	Replacing single phase power plugs	Electrical Engineering	Domestic electrical installations
03	Replacing fuses	Electrical Engineering	Domestic electrical installations
04	Replacing washers on water tabs	Plumbing and Pipe Fitting	Installing and maintaining domestic water supply systems
05	Replacing water tabs and valves	Plumbing and Pipe Fitting	Installing and maintaining domestic water supply systems
06	Repairing clogged-up water drains	Plumbing and Pipe Fitting	Installing and maintaining drainage systems
07	Replacing locks on doors and windows	Woodworking	Installing and maintaining doors and windows
08	Replacing broken window glass	Woodworking	Installing and maintaining doors and windows
09	Patching up paintwork	Building Construction	Painting in buildings
10	Maintaining and repairing water tanks	Mechanical Engineering	Sheet metal work
11	Cleaning filters of air conditioners	Air Conditioning and Refrigeration	Installing and maintaining unit type air conditioners
12	Changing wheels of customers cars	Automotive Engineering	Car servicing

Illustration 7
Module of Employable Skills of a maintenance mechanic working in a small hotel

The instructional material for use with MES training programmes was initially designed in the form of *learning elements*. These are self-contained instructional booklets, each covering a specific item of skill or knowledge. Each *learning element* consists of

- precisely formulated learning objectives;
- a list of required equipment, materials and aids;
- a list of other, related *learning elements*;
- instructional pages which contain short, concise texts and which are profusely illustrated;
- a progress check which is matched to the learning objectives of the element.

Learning elements of this type are suitable for both learner-based and instructor-based application. They contain, in the form of texts and illustrations, what a good instructor would explain and demonstrate to his trainees. Because of the short, concise texts and the many simple line illustrations, *learning elements* are readily adaptable to computer-based training, interactive training, or various distance learning techniques.

The concept of *learning elements* has been designed not only for MES training but also for use with other vocational training approaches. On the other hand, *learning elements* are not the only form of instructional material used for MES training. Other suitable instructional material from all kinds of sources can, and should be used whenever *learning elements* are not available or not applicable. To facilitate the proper selection of such material and the planning of lessons or instructional units (the term used for a lesson plan in MES training), a simple form has been developed for use by instructors. Well-prepared instructional units can also form the basis for *learning elements* to be developed at later dates.

Learning elements are developed under the following six main categories:

- Work Safety (general and overriding while specific aspects of work safety are included in each element);
- Activities;
- Theory;
- Graphic Information/Circuitry;
- Technical Information, Materials/Components/ Methods;
- Technical Information, Tools/Equipment/Machines.

Learning elements from these categories can be compiled to form limited or comprehensive training programmes. Depending on the level of decision-making required for a worker to perform a given modular unit, activity *learning elements* can be supported by different types of information *learning elements*.

Learning elements which have initially been developed for training in a particular occupational area can, in many cases, also be used for training in other occupational areas.

In-depth skills analysis is used to identify the *learning elements* and/or instructional units required to train a person to perform the steps of work of a given modular unit. This information is documented on *Modular Unit/ Learning Element Reference Charts*. This chart is usually prepared in such a way that all the steps of work are listed, including those required for decision-making, and all the *learning elements* and/or instructional units required to impart the skills needed to perform the various steps of work. Once correctly prepared, this document can be used as reference to facilitate the development of MES training programmes in many other training situations. It is, however, essential that the content of such charts is verified on the spot and that they are subsequently modified to suit local conditions and standards.

Learning elements or instructional units of a common and basic nature apply to many different modular units. They are listed on the respective modular unit/ *learning element* reference charts. Repetitive statements of their titles may therefore occur if a training programme has to be prepared for more than one modular unit. Whole MES training programmes are therefore shown on MES *Selection Charts*. On these charts, all the modular units of a given training programme are listed in correlation to the titles of all the *learning elements* or instructional units required. This chart can also be used by instructors or by

the trainees as a control document, by colouring the arrows pointing to completed *learning elements* in relation to the modular units of the programme.

Guidance Material for the Instructor

Guidance Material for the Trainee

List of Equipment, Materials and Aids

Learning Elements

01 Applying First Aid
02 Observing and Using Safety Signs
03 Observing Safety Precautions in Working with Hand and Machine Tools
04 Observing Safety Precautions in Working with Ladders and Scaffolds
05 Selecting Protective Clothes
06 Reading Construction Plans
07 Reading Architectural Diagrams
08 Identifying Ladders and Their Uses
09 Measuring Using Rules and Tapes
10 Marking Out Using Rules, Tapes and Straight Edges
11 Marking Out Using Chalklines and Plumbbobs
12 Marking Out Using Spirit Levels and Water Levels
13 Marking Out Installation Layouts in an Installation Cabin

Performance test to match the skills, standards and conditions of this modular unit

Modular Unit 1
Marking Out Installation Layouts

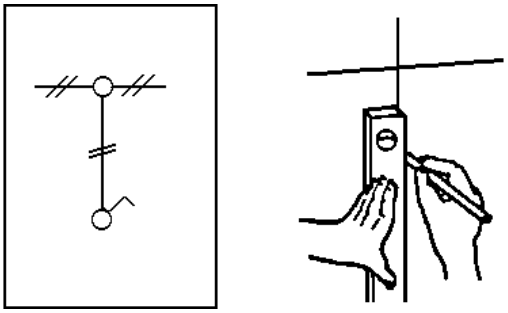

Illustration 8:
Learning Package

For each MES training programme, a *learning package* is prepared which consists of the following (cf. Illustration 8):

- guidance material for the instructor;
- guidance material for the trainee;
- a list of tools, equipment, materials and aids required;
- the titles of those *learning elements* and/or instructional units required to close the training gap;
- a performance test which matches the objectives of the total training programme and, as required, phase tests for each modular unit.

There are arrangements of phase tests and the final performance test for a training programme. Accreditation and certification can be documented by introducing a *skills passport* with national or even regional validity. The MES training cycle is applicable to initial training, upgrading, updating or retraining.

One of the most important aspects of MES training is the systematic training of vocational training staff, in line with their job requirements, to plan, develop, implement, monitor and evaluate training programmes, and to develop the instructional material required for such programmes. Up to now, 47 *learning elements* and related programme outlines have been developed to train staff in the above-mentioned aspects of MES training.

Recent Trends in Industrial Technical and Vocational Education in the Federal Republic of Germany

by Harald W. BONGARD

Although the structure of crafts and industry, the economic infrastructure and the economic systems of the countries represented at this Symposium are very different, and despite the fact that quite different educational systems operate in these countries, we all want to know what educational endeavours are required to use human resources to improve living conditions in general.

In studying this question, we shall confine ourselves to trends in initial technical and vocational education, and present an example from the industrial sphere in the Federal Republic of Germany, the basic elements of which can be transferred to many other qualification programmes: the qualification process at *Volkswagen* company.

In so doing, we shall focus on the training of those skills which, in the discussion, are referred to in quite different terms, as so-called *key qualifications*, as *transfer qualifications*, or as *interdisciplinary qualifications*, etc. Some of the skills involved are:

- The independent execution of skilled work;
- collaboration with others in a team;
- the procurement, utilization and passing on of information;
- methodological competence to solve different problems; and
- the ability to organize one's own learning processes and to complete them successfully.

The training programmes already developed or to be developed must also be assessed in the light of corresponding advances made with regard to

- changes in the social structure,
- technological changes, or
- changes in work organization.

To do so, it is necessary to give a brief description of these changes and to specify what requirements are being cancelled or needed less than in the past, and what other requirements are becoming more and more important.

For the sector of industrial production worldwide, the prevailing trend can be described as follows: Instead of

- exposure to physical strain and to
- harmful environmental influences, and
- the requirement of manual skills or dexterity,

demands on the quantity and structure of knowledge and skills are increasing.

The combination of knowledge and skills, of theory and practice, of technical and general learning contents, together with the necessary methods, is to ensure the competence of independent skilled workers. These comprehensive learning contents are required if trainees are to understand complex technical patterns, processes and control structures.

In our view, requirements also increase in terms of the ability to concentrate and to assume responsibility, and thus also in terms of the assurance of the quality of the goods produced. In this sphere, quality assurance concepts which have in the past all too often assured quality only by expensive refinishing have to be eliminated.

Equally, requirements in terms of the ability to cooperate with other staff are increasing, since assembly and/or repair work, the operation of complex work systems, the improvement of internal operations, and the design of workplaces can in future only be carried out by smoothly functioning groups of workers. We will conclude this outline of the scope for designing industrial vocational education by adding to this catalogue another requirement which tends to be taken for granted today, namely the ability for lifelong learning and for readily adjusting to changing requirements.

Changes in the technical sphere and the sphere of work organization call for motivated and independent teamworkers. These new demands are based on a changed conception of man in the working environment, and thus necessarily also of man in vocational education. Vocational education is increasingly becoming the first stage of a lifelong education process, which will always take place to a major extent in the enterprise.

Volkswagen has developed a new qualification concept. Its essential characteristics are described in the following, in order to answer, at least partly, the interesting question of how this concept can be realized in the enterprise. The pertinent guidelines will be specified.

The basic principle of technical and vocational education in the enterprise and in the production process is to give the student systematic training to prepare him/her for working life in in-company educational facilities, via training workshops, qualification centres, in-company training places, or learning laboratories. The qualification phases in real work situations in the enterprise should be prepared as well as followed up in in-company training facilities.

Alternatively or in addition, written concepts, e.g. guiding texts, can help staff to explain complex facilities, logistic systems, or organizational structures, so that trainees are enabled to understand and use them. In this way, in-company learning can become effective and meaningful.

Learning in the framework of technical and vocational education should alternate between group and individual learning processes; the group (at *Volkswagen* it consists of six trainees) should stay together over a period of one or two years, if possible.

Anyone wishing to influence and design social processes must allow these processes to happen and encourage them by means of organizational measures. However, an educational task cannot be solved by creating the organizational framework alone. In order for social processes to be encouraged, instructors must be qualified accordingly. But qualification by seminars alone is not sufficient in our view. In order for favourable social processes to be supported and negative ones to be changed, yet another requirement must be fulfilled: Instructors must be enabled to experience these group learning processes themselves. At *Volkswagen*, therefore, groups or teams of about seven instructors each have been formed. We have combined this with yet another modification. Our instructor teams are responsible for providing complete training for one or several occupational groups of approximately 120 trainees each. These instructors have acquired the qualifications needed to cater to all qualifications spheres involved in their training sector, which we call a learning field.

The instructor team is also responsible for qualification when the trainees are in the enterprise, which is about one-third of overall training time.

The instructors' work has also changed fundamentally. The principle of fixed learning sequences for all trainees, the complete determination in advance of all tools, drawings, operating and process materials, the establishment of training schedules which determine when which machine has to be operated by which trainee, all this has been given up at *Volkswagen* in favour of other organizational forms of learning which are to enable trainees to develop self-sufficiency, organizing ability, initiative, responsibility, and quality awareness.

We have therefore developed a learning project for the first training year in the sector of metalworking; this learning project confronts groups of trainees with complex tasks while providing them with methodical aids. After a planning phase, these groups then discuss the results with one of their instructors. The instructor acts as learning consultant, who is supportive of the learning processes taking place in the trainees. In this function he will refrain from providing answers to open questions and, instead, give hints for self-help.

In the first year of training, each trainee in the occupational field of metalworking builds what is called a *Multispan* (multicutter), or in electrical engineering, a *Lötstation* (soldering station).

The *Multispan* is a device driven by a drilling machine, which combines a mechanical saw, a tool grinding unit and a boring unit. This learning project, which covers a period of about ten months, contains all basic vocational qualifications. But not every trainee makes all parts himself. If, for example, a trainee has acquired the qualifications for milling, but has deficits in turning, he will carry out the lathe work for his group. In return, he is provided with parts which another group member makes in order to compensate for his own deficits. This approach to some extent increases awareness of quality during the educational process, because substandard parts will not be accepted. Also in the case of *Multispan*, not all drawings, measurements and aids are determined right from the start. Although everything has been designed, the given designs are not binding. There is scope for the trainee to act on his or her own initiative, an approach which increases creativity.

In order to encourage the trainee to become more independent, aids are systematically withdrawn during the learning process; in this way, trainees are enabled to ac-

quire increasing competence. Differences in the pace of learning and working are to some extent within the groups themselves, but also compensated for, via internal differentiation, by additional support and remedial measures. The trainees are not only allowed to support each other during the learning processes; they are, on the contrary, explicitly encouraged to do so.

Yet another feature of the new trend is the development of organizational skills and of the ability to work independently. A person who is constantly told precisely what to do and is not allowed to come to grips with problems, will never become self-sufficient. At *Volkswagen*, we have therefore abolished the traditional machine tool courses. In the trainees' very first week, our instructors tell the groups of trainees about machine tool safety. Afterwards, every trainee plans his own machine tool work for a total period of about eight weeks. To do so, he must make a time estimate, and enter his name in the relevant machine utilization plans. The utilization periods must then be considered by him in his daily or weekly schedules, and he is expected to make any necessary arrangements with his colleagues if plans are modified.

The above examples show just how important an integrated approach is in skilled worker/ employee training, which should not only provide but also enhance social and individual skills. We hope that this paper will help us discuss and encourage the changes required in technical and vocational education in our respective countries.

Course Instruction: The French Example *by André BRUYÈRE*

The different courses which exist in France may be assigned to four categories:

1 Courses for the integration and reintegration of young people into employment

These courses were designed in view of increasing youth unemployment. They are of a social as well as of an economic nature. These are offered for young people who have left school without a qualification. Two types should be mentioned in particular: courses providing an introduction to working life and courses preparing for employment. The young participants receive an allowance. Duration varies from two to six months. With regard to the second type of course, working time is divided between training (75 %) and the course in industry (25 %).

2 Courses for information and orientation

These courses primarily cater for those young people who attend the preparatory classes provided at the end of the second grade of lower secondary school (*collège*). It may be the aim of these courses either to familiarize young people with the industrial working environment or to give them an insight into the occupation or the group of occupations for which they intend to prepare themselves. In the latter case, the courses in industry are longer and last 15 to 18 hours per week according to a scheme of alternation of one and two weeks.

This preparation for working life is particularly interesting for those who do not wish to take part in one of the traditional forms of school-based training.

3 Compulsory courses forming part of training

These courses can take place at different stages of training: either during or at the end of a school year or at the end of the training period.

These courses must be aimed at fulfilling at least three tasks which are essential for the harmonious development of training:

- familiarize the student with the economic reality;
- explain to him/her the sense of his/her efforts, the purpose of his/her training;
- maintain zeal and motivation, fill the gap which the young person may feel between school and reality.

The question what place the course should take in training is rather important. It must be adapted to the nature of training, to the age of the student and to the training stage he/she has reached.

The learning objective must be clearly and jointly defined by the actors in the training institution and those responsible in the host enterprise. To express this necessity the terms *concerted education* and *period of in-company education* have been chosen.

The school/ enterprise relations must lead to a real partnership and a new pedagogical principle. In-company training is regulated; it appears in the regulations of a large number of technical qualifications.

There are three types of courses for participants in school-based training:

- Training sequences in industry for students attending the lycées professionnels of upper secondary education. They were introduced in 1979 following a major concerted effort by the teachers' unions and the employers' representatives. The aim is to initiate students into industrial life and activities and to enable them to apply, in work practice, the knowledge and skills they have acquired at school. At the same time, young people are to be confirmed in their training choice; they are to be given an opportunity to discover the enterprise, the equipment, the production, and the social and human relations within a production or service unit.

  The courses are of short duration: an average of 15 days, divided into two, three or four periods over a total of ten weeks. An agreement is concluded between the school and the enterprise, and "the pedagogical annex" establishing the contents, the objectives and the modalities of the course constitutes the masterpiece to which the teachers and the enterprise instructors must refer. A survey is conducted at the end of the year.

- Practice periods for students preparing for the secondary qualification *baccalauréat professionnel*.

  This practice period covers 14 to 16 weeks of the two-year schooling. It is to enable the pupil
  - to work with industrial-scale equipment or installations under conditions which cannot be created in school;
  - to adapt to the work organization;
  - to learn about industrial reality, to understand the importance of everyone's role and responsibility.

  These periods at school and in industry must ensure continued training. The skills to be imparted to the student are specified in relevant regulations, and the re-

quired papers and materials are jointly defined by school teachers and enterprise instructors.

There is an interdisciplinary evaluation of in-company training; a final statement is proposed to the jury.

- Courses in industry during the preparation of the secondary qualifications *baccalauréat technologique and brevet de technicien supérieur* (BTS).

  Although participation in a course in industry is not required to obtain the qualification of *baccalauréat technologique*, relevant regulations recommend such practice periods of four to six weeks' duration at the end of the first year.

  In contrast to this, the students preparing for a BTS must complete a full-time course at one or several public or private enterprises within the framework of a course agreement. The duration of the course is from four to eight weeks.

  After five years of vocational studies, the student can be better included in the production process. A certificate of completion of the course is required before the candidate enrolls for the oral vocational examination.

  It should be noted that, for the past two years, the French *Ministère de l'Education Nationale* has been awarding scholarships in order to enable students preparing for the BTS to participate in courses in European enterprises.

4 Voluntary courses

Various young people are involved in courses of this kind. Motivation, which is often more related to reality, varies greatly. Consequently, there is the complex issue of inadequate global treatment.

Conclusions

This development has produced a new idea about the design and organization of school instruction and about the respective roles of schools and enterprises, the latter being considered one way of providing training in another place of learning.

Both have realized what immense profit this new situation might yield, while cohesion among the educational staff has increased. The students are better motivated because they understand why and for what purpose they have to make such efforts. They have become aware of the roles they are expected to play as workers and citizens. During their training, they have an opportunity to compare theory and practice by using modern equipment.

Concerted education confirms the new principle of learning on the basis of projects. Therefore it should be given a distinct place in Professor Greinert's classification of macrosystems as a school-based system in order to include the modifications of the past ten years which have led to a profound change in technical and vocational education in France.

Learning in School-Run Enterprises
by MENG Guang-ping

1 Some background information and a look at the general situation

1.1 China's economy in transition

China is now undergoing a special stage in which the planned product economy is being transformed into a commodity economy. This is a transitional stage during which the old and new economic systems coexist. The rapid development of a commodity economy cries out for the improvement of the workers' capabilities, which has in turn increased the need to develop technical and vocational education. As a result, the technical and vocational education system faces many new challenges. For example, in the past, students from technical and vocational schools used to take their practice courses in a factory. All the expenditures and losses the factory incurred therefrom were covered by the state. Therefore, factories did not complain about students' on-the-job training. Now, however, since enterprises have begun to adopt the contract responsibility system, business accounting has been directly connected with the income of the workers. Thus, many enterprises refuse to let students practice in their factories. In fact there are at present no national laws requiring enterprises to take on such a responsibility.

1.2 Industrial enterprises

China is a vast country with a very unevenly balanced economy. From the viewpoint of regional development, every county along the eastern coast in the five provinces of *Shandong*, *Jiangsu*, *Zhejiang*, *Fujian*, *Anhui*, and the city of *Shanghai*, has an average of 200 enterprises with an output value of over 100 million yuan (3.75 yuan ~ 1 US $). But in the north-western provinces of *Xinjiang*, *Gansu*, *Shaanxi*, *Ningxia*, and *Qinghai*, a county averages only 80 enterprises with an output value of merely four million yuan.

Levels of technical equipment also vary greatly ranging from the very advanced to the rather backward. According to an investigation made on the equipment used for production in 8,285 enterprises of large or medium size, equipment produced in the 1980s accounts for 33 %, that produced in the 1970s makes up 44 %, that produced in the 1960s 13 %, that made in the 1950s 9 %, and that made before 1949, the year of the founding of the People's Republic of China, comprises 1 %. A 1986 survey of China's major industrial enterprises shows that equipment on par with international levels constitutes 13 %, that measuring up to advanced domestic levels makes for 22 %, that reaching average domestic levels accounts for 47 %, and that reaching only poor domestic levels makes up 18 %. It is thus evident that the extent of training needed to be attained by trainees and the amount of training they could possibly receive varies considerably in different circumstances in technical and vocational education.

1.3 The role of agriculture

Since the majority of Chinese people live in rural areas, technical and vocational education for the farmers is especially significant. At present, farmers constitute the majority, about 63 %, of the total number of people in employment, but the commodity rate of their crops and sideline products is only 58 %. The amount of grain that can be purchased by the state is only 34.4 % of the total

production. After deducting the grain that has be to sold back to rural areas, the commodity rate of grain is less than 25 %. It is true that China's grain production numbers first in the world, but the grain per capita is only 365 kilograms. The grain shortage problem is becoming more serious owing to the incessant growth in Population. Although There Has Been A Continuous Increase in farmers' income and a great improvement in their lives with the reform of the economic system in rural districts, there are still 70 million people living in poverty, i.e. they survive only at the lowest possible standard of living. In 1987, the average annual per capita income in China's rural areas was only 463 yuan.

With the rapid development of township enterprises, their output value in 1987 reached 50.8 % of the total value of output in rural areas. For the first time in history the output of enterprises surpassed that of agricultural products. Every year about seven million peasants join the work force of township enterprises. Yet there is a general shortage of technical personnel. Even in culturally and economically more developed coastal provinces, technicians and higher technical personnel make up no more than two out of thousand of all staff in enterprises. Technical and vocational education in the rural areas must help free peasants from poverty, because only by increasing their income will such an education be welcomed by the peasants.

1.4 Structure of the work force

There is a great potential demand for technical and vocational education from the whole of Chinese society. At the moment, there are about 19.3 million primary school graduates a year throughout the country, among whom 70 % can go on to junior middle school; there are about 11.5 million junior middle school graduates and 37 % of them can go on to senior middle school. Those who can go up from senior middle school to receive a higher education are less than 25 %. All these young people who are unable to go to an institute of higher education will enter the world of work and join those who need to receive technical and vocational education. This number is amazing.

Compounding the problem of students' lack of technical skills is the fact that the technical expertise of employees already working in the enterprises is far below standard. In terms of the current eight-grade system for workers, among the workers in state-owned enterprises, 71 % are on the elementary level (i.e. from the first to the third grade); 26 % are on the middle level (i.e. from the fourth to the sixth grade); and only 3 % are on the advanced level (from the seventh to the eighth grade). In order to improve professionally, a large number of elementary- and middle-level workers also need to receive technical and vocational education. But such an education, so far as its scope of development is concerned, is wholly inadequate to meet the tremendous demand. What should be considered is how to give the roles of the schools and enterprises full play in this aspect so as to narrow the gap as tightly as possible. It is important here to try to open more channels of funds for this education and to increase the economic benefits of training. Because the Chinese government will have a very tight budget for a fairly long period of time, it is impossible to largely increase its investment on technical and vocational education.

2 Some types of school-run enterprises

2.1 Factories attached to schools

The first type of school-run enterprise to be discussed is that of factories attached to schools which aim at training skilled workers and technicians. While providing a place for students to obtain practical training, such a factory has regular professional workers and fixed kinds of products. It is run by the school to ensure the production activities in the factory will match the curriculum activities of the school. The factory, just as other regular factories, can receive both investments and loans. In order to support such a school-run enterprise, the government has a special preferential tax policy for these factories, namely, a tax cut of 50 %, on the condition that the school must guarantee that no less than 60 % of the profit will be used to expand and improve its teaching facilities.

The *Xianyang Machine Tool Technical School* in the *Shaanxi* province is an example of such a factory. This is a secondary technical school aimed at training technicians. The students, numbering 1,500 in all, must be graduates from junior middle school and study at this technical school for four years. In addition to various kinds of laboratories necessary to facilitate theoretical teaching, the school has a factory that produces universal and tool grinding machines. With a regular staff of 574, the factory occupies an area of 18,800 square meters and possesses 500 major machines for production. Its annual output is 200 grinding machines, some of which are even exported abroad. In 1988, the factory made a profit of 464,000 yuan.

According to the curriculum of the school, every student must have 20 weeks of practice during four years. Some training in basic skills, such as that for a fitter, is conducted in special practice workshops. Most of the operation practice is taken by students during the production process under the guidance of experienced workers. In this way the training of students is not just a consumption. During the training, the students can also finish part of the production work. Of course the skills of the students cannot reach the requirements for an experienced worker, so they can only work on something the quality of which they guarantee. For instance, when a student learns to be a turner and works on a workpiece, he can only process the workpiece to a certain degree, and the final polishing work still has to be done by an experienced regular worker in order to reach the precision prescribed by the blueprint.

Another example is the *Yantai Skilled Workers Training School* in *Shandong* province. The school has a factory which produces transmission gear-boxes to be used for tractors. Since many of the mechanical cutting processes are consistent with the requirements for training students to be skilled workers in machine tools, students can be delegated to join some of the production work. Under the guidance of their teachers, the second-year students begin to spend half of their school time doing some elementary processing work, while reserving the other half of their time for classroom study. During the third year in school, students use one-third of their time for classroom study, one-third for technical training in the practice workshop, and another one-third for independent operation in the factory during which the teacher makes inspection tours and gives occasional guidance. The graduates must pass a qualifying technical examination. Results show that in this way about 84 % of the students can reach the fourth grade in the eight-grade system for workers. The profit of this Yantai school-run factory in 1988 was 3,530,000 yuan.

2.2 Farms run by schools

Another type of school-run enterprise is that of farms run by technical and vocational schools which cater to the needs of peasants. Such farms are used not only for students to gain practice, but also for peasants to learn and disseminate advanced farming techniques. Usually during the period of studying at school and practising on the farm, the students may also manage their own small farms at home. The beneficial results brought about by the techniques spreading from such schools are immeasurable and far exceed in value the actual goods produced by the school-run farm itself. This is an effective way to help peasants master practical techniques so as to improve production, and so it has been warmly welcomed by the peasants.

The *Baofengsi Secondary Forestry School* in the mountainous areas of *Zhuolu* county, *Hebei* province, is another typical example of a school-run enterprise. It has an orchard of mostly apricot trees because almonds are the special product of that area. Unfortunately, the annual yield of almonds in this region is very low, owing to a general lack of scientific management among the peasants. The school recruits local young people with a middle school education. While teaching the students certain scientific theories, the school has arranged for the students to practise in the school-run orchard, to learn some basic grafting and pruning skills, and to attain some biological and chemical knowledge in order to prevent and eradicate plant disease and insect pests. Since most of the students have some fruit trees around their homes, they can quickly apply the techniques learned from school to their small family orchards. Meanwhile, they can bring to school the problems they come across in family orchard management and consult with the teachers and experienced workers. The students are thus at the same time both students and managers. For those who do not have a small orchard at home, the school can also provide them with loans to help them set up an orchard. The combination of study and management brings quick economic benefits to most of the students during their three years of study. The amount of almonds produced by their orchards is generally one to three times higher than that produced by local farmers. As the school becomes more popular among the local farmers, students come not only from local areas but also from other mountainous regions as well. Since those whose homes are far away cannot travel home frequently to take care of their orchards, the school has adopted a principle of block release of study and work, i.e. allowing students to study at school for a period of time (usually over a month) and then allowing them to go back home for a period of time to manage their orchards, after which they then return to study again. This is a way of "sandwich learning", a wholly indigenous teaching method. Up until now the school has provided technical service to 17 villages in the neighbourhood.

Another example is the *Secondary Vocational School of Nangong County, Hebei* province, which was originally an ordinary middle school. In the beginning, the school set up a mushroom species breeding base and a mushroom cultivating base. These bases not only provide mushroom species to the local farmers but also teach them mushroom cultivating techniques in short-term courses. In addition, a school-run factory producing canned mushrooms was built up through loans. The raw mushrooms are purchased from local farmers and, after being processed in the factory, are sold in the market. Thus the training bases have been extended in a way from school to farmers' houses, forming a chain of production from school to farmers and from farmers to the market. Since the canned-mushroom factory was built in 1987, the school has paid back most of the loans. The profit the farmers have obtained even in the first year is much more than what is gained by those who have not joined this chain of production. The students are graduates from junior middle school. During their three-year study at the vocational school, half of the time is devoted to learning the courses required in an ordinary senior middle school.

The two examples given above are about proprietary school-run enterprises. The following two types of enterprises we are going to discuss are of a non-profit nature.

2.3 Nursery school branches in hospitals

China is in great need of nurses. At present, the proportion between doctors and nurses is upside down: For every four patients, there are 1.2 doctors, but only 0.5 nurses. Calculated according to the number of beds available in hospitals, there is a shortage of 200,000 nurses in China. Yet only 30,000 nurses can graduate a year from the present nursing schools throughout the country. Taking the natural depletion of nurses into consideration, the annual increase of nurses in fact is only 10,000. In order to solve this problem, measures toward cooperative management by the nursing schools and the hospitals have been taken in a number of cities. Usually a nursing school with fairly good facilities and teaching faculties is the central school which has several branch schools in a number of neighbouring hospitals. Part of the training, mostly normal middle school courses and basic professional courses, is conducted in the central school. Another part of the professional courses and practical training is taken in branch schools in various hospitals according to the overall plan and requirement of the central school. The teaching work there is mainly done by doctors and experienced nurses in hospital. The examinations, for the setting of whose standards the central school is responsible, are taken in branch schools in the hospitals. This type of school management has not only enlarged the number of students in the nursing schools, but, by way of practical training in hospitals, has also alleviated to a certain degree the problem of the shortage of nurses. The hospitals responsible for the school's training have first priority to employ their own nursing school graduates. The regular expenditures for running the branch schools in hospitals are covered by the government. As this type of school management has been proved feasible and effective, the Ministry of Public Health and the State Education Commission jointly issued a state regulation in 1987 to ensure the quality of such co-operatively run vocational schools.

2.4 A school-run restaurant

For some professions which require high skills of operation, the vocational schools generally adopt a method of training which may be regarded as an improved apprentice system. The students acquire the tricks of a profession through a technical training which is more scientifically organized than the old apprentice system. For instance, Chinese cooking makes great demands on the skills of the chefs. The students in the cooking class of *Jinsong Vocational Senior Middle School* in *Beijing* must be junior middle school graduates. During their three years in school, the students will learn Chinese cooking theories in addition to the general courses of senior middle school. Half of their school time is taken up by learning various

skills from cutting to cooking, and the longer they have practised, the higher their skill. There is a cooking laboratory in school for students to start in laboratory class under the guidance of the teachers. As might be expected, the dishes the students have made are usually not very satisfactory to the taste, so they are either eaten by students or sold to them and their teachers at a discount. The school runs a public restaurant for profit. After being trained in the school's cooking laboratory, the third-year students are expected to cook in the restaurant in turns. As the restaurant does not have any hired professional cooks, the cooking work is done entirely by students under the supervision of their teachers. This is a higher level of training for students which enables them to take up a job immediately upon graduation. Since there is a constant change of chefs in the restaurant and the quality of dishes is not always stable, the prices there are generally lower than those in other restaurants of similar levels. Generally speaking, however, the service in the restaurant is good, so it is still well patronized. This kind of school-run enterprise is half for profit because the profits it makes are mostly used to cover the expenses of the students' practice courses. Since the government grant for the school is very limited each year, the gap between budget and needs for professional training has to be filled in this way.

3 Conclusions

For as vast a developing country as China, it is a fairly practical way to develop technical and vocational education by means of cooperation between schools and enterprises. In China, there is neither a fully developed labour market nor abundant funds to provide all the training facilities for students in the vocational schools. The joint strength of school and enterprise, either in the form of a school-run enterprise or in the form of cooperative management between school and enterprise, enables the students to acquire both the necessary professional skills and a certain degree of theoretical knowledge. Before the reform of the economic system in 1978, most of the secondary technical schools, which relied wholly on state investment, emphasized learning at school. They provided very few programmes involving cooperation between schools and enterprises or any type of school-run enterprises. During the reform of the economic system, the schools were required to meet the demands of enterprises at large with newly designed skill training programmes. Therefore schools have turned to school-run enterprises or cooperative management with enterprises. In 1988, among the 2,957 secondary technical schools throughout the country, there were 479 schools who owned their own factory or farm for production. The most rapidly developed vocational schools, however, are those newly built or those transformed from ordinary middle schools. Most of them started by setting up school-run enterprises or establishing cooperative relations with enterprises. Of the 8,954 secondary vocational schools in 1988, there were 6,479 schools that had either a farm or a factory, for otherwise, if the schools had relied solely upon the state education investment, they could hardly have survived. This is also called the three-in-one school system of "teaching, technical service and production".

But in running this type of vocational school, there are some points that deserve special attention:

- The training of students must be given priority in the management of school-run enterprises. This is a principle that should be closely observed. In normal circumstances the school-run enterprises would gain some profit, which is good in itself. Yet if the pursuit of profit is taken as the major purpose of such enterprises, as is the case in other enterprises, it would interfere with the fundamental goal of training students.
- It is very important for industrial enterprises run by vocational schools to choose the right product. The whole production process should meet the requirements of the student-training programme, and at the same time, the operations should not be too hard for students to handle. Though not easy to choose, once the right decision is made, it would greatly facilitate both production and teaching, of course not without constant coordination in the course of production.
- In the current Chinese system of technical and vocational education, there is a general problem of overemphasizing theory, in the light of both quantity and depth, and of inadequate training of students' practical abilities. The practice courses in school-run enterprises should help to solve this problem. Yet it should also be noted that the practice students can possibly gain in school-run enterprises is usually limited in variety and scope. In the present age of rapidly developing technology and swiftly changing society, we cannot imagine it would be enough just to teach students certain skills for only one particular employment position. We have to take into consideration the need for the development of young people to face the challenges of the future.

The German-Singapore Institute - A Centre for Multifunctional Transfer of Training and Technology

by Klaus KRÜGER

1 Supporting Agency and Organizational Form

The *German-Singapore Institute* (GSI), a training institution of the *Singapore Economic Development Board* (EDB), offers technical and vocational education in the field of production engineering and modern technologies.

As EDB considers that industrial development in the long term requires a sufficient number of qualified workers, EDB's manpower division is also involved in technical and vocational education of qualified staff for industry.

The Institute was founded in 1981 as a joint venture between the Federal Republic of Germany and the Republic of Singapore. It is to provide technical and vocational education above all for the technical staff at middle management level (technicians) in the metal industry.

In addition, the Institute is to be a centre for modern technologies which supports the Singapore industry in the introduction of new technologies and systems. For that purpose it organizes information events, offers continuing education courses for participants from industry, and provides advice on new technologies, while at the same time supporting small and medium-sized enterprises by supplying them with technical solutions to hardware and software problems.

With regard to both its organizational structure and its supporting agency, the Institute is a technology transfer institution with training functions rather than a school in the usual sense of the word. The instructors working for the Institute are not qualified teachers but engineers, tech-

nicians and master craftsmen with additional teaching qualifications.

The Institute's organizational structure is geared to industry's needs. The teaching/ learning hours are the same as those in industry. Like workers in industry, teachers and students at the Institute are required to attend for 44 hours per week.

At the Institute there are no prolonged vacation periods like those at public schools and higher education institutions; instead there are industrial-type vacations. The teachers and instructors are not public servants; they are employees who have concluded a regular work contract with the supporting agency. The salaries are linked to performance.

2 Integration of the German-Singapore Institute into Singapore's existing system of technical and vocational education

In contrast to the Federal Republic of Germany, where there is a long tradition of technical and vocational education regulated by the government and organized jointly by industry and government (dual system), Singapore does not have universal, government-controlled vocational education. In Singapore, vocational qualifications are obtained either through on-the-job training or through attending public or private technical schools, polytechnics or universities.

Therefore, the number of workers in Singapore's industry with no or only limited qualifications was very high in the past (compared with the situation in the Federal Republic of Germany or other European industrialized countries).

3 The German-Singapore Institute

3.1 History of the Institute

The GSI was founded in 1981 and accepted its first students in 1982 after a construction phase of only one year.

Under the intergovernmental agreement, the Federal Republic of Germany was to establish a training institution in Singapore for production engineers at the middle management level. Furthermore the Institute was to provide training for technical instructors as well as continuing technical and vocational education for industrial staff.

I should like to emphasize that the supporting agency is the Economic Development Board and not the education ministry, as one would have expected.

The German funding share is contributed by the Federal Ministry for Economic Cooperation. Planning and implementation on the German side are the task of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

3.2 Initial situation and goal of the GSI project

As industrialization progressed in Singapore in the 1980s, it became obvious that the local metal industry suffered from a great shortage of experienced technical staff at middle management level. Even the large number of graduates from the two polytechnics could not remedy the situation, because polytechnics training was not sufficiently oriented to industrial practice. In contrast to technician training in the Federal Republic of Germany, which requires a skilled worker qualification followed by a period of work for admission, polytechnics training does not usually include laboratory training and practical work experience.

The newly founded German-Singapore Institute is to remedy this situation. Both qualified workers, some of them with several years of industrial experience, and high-school graduates without any vocational education as well as secondary school-leavers with O-level certificates are admitted to the GSI's two-year and three-year full-time courses. After completion of these courses, they are then to fill up the ranks of the technical middle management of the metal industry.

Today, the Institute provides training for about 250 students annually in the field of general production engineering including plastics technology with the following three priorities:

- cutting and CNC technology;
- tool, model and facility design as well as CAD/ CAM technology;
- industrial automation, assembly and robotics.

For the two-year course, about 100 applicants can enrol every January and July; for the three-year course, 100 students are admitted once every year.

Admission requires two A-levels at high school or, in the case of skilled workers, the O-levels together with the NTC-2 certificate of the EDB training centres. In addition, applicants are required to pass an entrance test of mathematics and science as well as of the English language.

Furthermore, the applicants have to prove above all their verbal skills and personal qualification in an interview.

4 Organization of training and curriculum structure

4.1 Organizational structure of the Institute

The Institute's organizational structure is geared to industrial requirements. For example, students and teachers are obliged to be present for 44 hours (five and a half days) per week. There are only two weeks' leave between semesters. Each time the student enters or leaves the Institute he must clock in or out. This is intended not so much as an attendance check than a means to familiarize students with typical features of the industrial working environment.

In the tight two-year course, more than 50 % of instruction takes place in workshops and in the numerous laboratories, which are usually equipped with machines and devices used in industrial production.

We do not consider it a sensible approach to train the students on special "training machines" or laboratory equipment which are not related to the real working situation and do not enable the student to learn everything he should. From our point of view, the best teaching aid is the machine which the student will have to handle later in his industrial working life.

This is particularly important in the developing countries for the following reasons: In recently industrialized countries, most of the rapidly developing industries (unlike industry in Europe) do not have a sufficient number of highly qualified and experienced technical staff members who could familiarize school-leavers with the existing industrial technology. Frequently it is exactly the other way round: The recruitment of highly trained and practice-oriented technicians is a prerequisite for introducing new technologies into the enterprise.

The entire equipment of the GSI is therefore more similar to that of a modern industrial enterprise than to school equipment. The Institute has the same departments as an industrial enterprise, for example

- cutting,
- tool manufacture,
- thermal treatment,
- plastics processing,
- design,
- quality and materials testing, etc.

Therefore we like to call our institute a teaching factory. This means that, during training, students are acquainted with an environment largely identical with the one they will be working in later on.

The major difference between the GSI and an industrial enterprise is, however, that we are doing production for learning, a company is doing production for earning.

4.2 Structure of the two-year diploma course

Training at the GSI includes four phases and lasts four semesters:

Phase 1: Basic training (*basic course*), six months, first semester;

Phase 2: Technical training (*common core*), six months, second semester;

Phase 3: Special training (*elective course*), nine months, third and fourth semester;

Phase 4: Project work (*project phase*), three months, fourth semester.

In addition to supervised work during the semester, there is an examination at the end of each semester, the result of which determines whether the student will pass on to the next semester. In the middle of the fourth semester, there is a final examination concluding formal training. During the following three-month project phase the students form teams, each team working on a complex technical project for industry or for the Institute. This project work which concludes the training is a particular feature of the GSI curriculum, which I shall describe more fully later on.

4.3 Curriculum structure

Basic Course (1st semester)

On account of the students' different educational background (A-level or NTC 2), basic training takes place in two separate groups with different learning contents.

The A-level holders' training includes three and a half days of practical training per week (i.e. two-thirds of the entire training time) in which they acquire basic metal-working skills, while theoretical instruction during the two remaining days deals with basic technical subjects.

NTC-2-holders are mainly taught basic science subjects such as mathematics, physics, chemistry and mechanics; they spend only a day and a half per week in the workshop, carrying out, for example, production tasks for the fourth semester project-phase students.

Common Core (2nd semester)

In the second semester, the students of the A-level group are mixed with NTC 2 and O-level students and are trained together. The students are provided with both broad and thorough theoretical and practical training which introduces them to the different areas of production engineering, quality control and design. I should like to point out that in this semester, about 80 % of design exercises take place at CAD workstations rather than at the usual drawing boards.

In addition to its two design rooms equipped with drawing boards, the Institute has three large CAD laboratories with more than 120 CAD workstations for two-dimensional and three-dimensional design.

The Common Core furthermore includes an introduction to control technology (pneumatics and hydraulics) as well as to the fundamentals of electronic data processing in order to improve the students' computer-handling and programming (Basic or Pascal) skills.

More than half of the entire phase 2 training takes place in the different workshops and laboratories, which are equipped with the latest technological devices. This laboratory and workshop training is aimed not only at providing the students with theoretical knowledge, but above all at enabling them to use in practice what they have learned.

Elective Course (3rd and 4th semester)

At the end of the second semester, the students must choose one of the following special subject areas:

- automation and robotics,
- cutting and CNC technology,
- design technology and CAD/ CAM.

Admission to the subject areas depends on the student's performance in the individual subjects during the first and second semesters. In the case of NTC 2 students, previous vocational education is also taken into account.

The elective course focuses on the handling and use of modern technologies such as numerically controlled machine tools and processing facilities, CAD/ CAM and robots, the application of modern control techniques, flexible handling and automation as well as computer-aided production planning and control.

In the middle of the fourth semester, there is a final theoretical examination which concludes formal training and is followed by the three-month or six-month project phase.

Project Phase

On the one hand, the project phase is to provide for a "smooth transition" of the students from training at the Institute to real working life in industry. On the other hand, the teamwork situation is to increase the students' ability to learn and cooperate in a group towards a common goal.

The project teams, usually consisting of four students assisted by two coordinators, work on projects such as the independent design, construction and manufacturing of a complex technical system from the field of applied automation (e.g. a unit for the automatic assembly of electrical components, a packaging machine etc.). Additional work to be performed by the teams includes scheduling and organization of production, purchasing of supplies as well as cost calculation.

The results of the project work are documented in a comprehensive project report and form part of the final examination. At the end of the semester, the project is then presented to an examination board which evaluates and marks the performance according to fixed criteria.

The students' performance, the results, and their work attitude and social behaviour in the team prove that this

project-oriented phase of learning is a suitable training method.

4.4 Compact course

All students take part not only in language education but also in a one-week compact course which introduces them to the fundamentals of labour education and communications technology so that, later on during their working life, they will be better able to process and pass on information.

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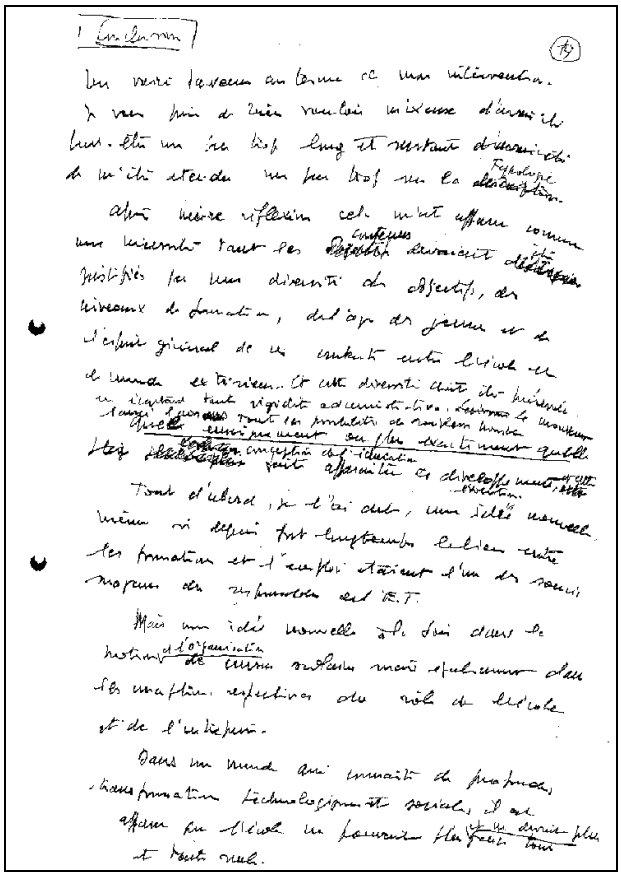

The Last Illustration

**For the creation of this publication,
three powers needed to concur:
the power of the original handwriting,
the power of the editor, and the power of the computer**