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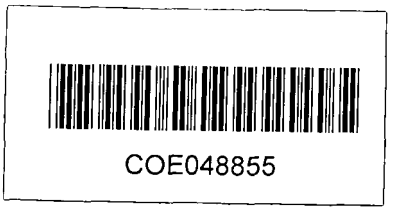

COMMITTEE FOR GENERAL AND TECHNICAL EDUCATION

Course on

"THE INTERPENETRATION OF SUBJECTS AT TECHNICAL AND VOCATIONAL SCHOOLS"

Bad Hofgastein, 8 - 15 October 1967

REPORT

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(1) English and French copies of the unabridged speeches are available at the Bundesministerium für Unterricht (Ministerialrat Dr. Karl Koweindl), Minoritenplatz 5,A/1014 VIENNA I.

I. GENERAL INTRODUCTION

The Committee for General and Technical Education of the Council for Cultural Co-operation of the Council of Europe was happy to accept the invitation of the Austrian Government to organise a course on "The Interpenetration of Subjects at Technical and Vocational Schools".

All member countries of the Council of Europe, as well as the Holy See and Spain sent representatives to the meeting, which was held in Bad Hofgastein from 8 to 15 October 1967. The course was organised and chaired by Dr. Koweindl, Ministerialrat at the Austrian Federal Ministry of Education. In the work of organisation he was assisted by Dr. Ginsel, Landesschulinspektor, Salzburg.

The full programme as well as the list of participants will be found in Appendices B and C.

The work of the course was organised as follows:

(1) The opening session. Sektionschef Dipl.-Ing. Georg Golser, the representative of the Austrian Federal Minister of Education, conveyed the Minister's greetings. He stressed the importance of the present course and the interest of the Federal Ministry of Education in it.

(2) An introductory lecture by Mr. Bemtgen, Head of the Section for General and Technical Education, Council of Europe, on "Educational activities of the Council for Cultural Co-operation in the field of technical and vocational education".

(3) Talks introducing discussion on specific aspects of the interpenetration of subjects in technical and vocational schools.

(4) Working groups on the interpenetration of subjects in technical and vocational schools chaired by Dr. Schleimer, Luxembourg, (Group A) and Mr. Rommes, Netherlands, (Group B).

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(5) Plenary meetings for mutual information and for the adoption of conclusions and recommendations proposed by the working groups, followed by a closing session.

(6) Visits to schools, including attendance at various types of lessons.

(7) Exhibition of books and other publications used in technical and vocational schools of member countries. The exhibition displayed examples of technical and artistic works by pupils as well as photographs and statistical surveys illustrating the level of interpenetration of school subjects achieved in Austria with a view to shaping the pupils' personality. This part of the exhibition was arranged by Dipl.-Ing. Dr. Peydl (Höhere technische Bundes-Lehr- und Versuchsanstalt, Vienna I.)

(8) Film shows.

The main outcome of this course was the conclusions and recommendations adopted by the plenary session.

In the closing session Dr. Koweindl expressed his thanks to the delegates for their participation in the course. He also thanked their governments for their valuable contribution to the success of the course, in particular for sending books and other publications for the exhibition.

On behalf of the delegates, Mr. Laid, United Kingdom, expressed his appreciation of the work done by the Chairman, the organisers, and all the others who had taken an active part in the course. He expressed the delegates' thanks for the hospitality of the Austrian Government.

In his final address Mr. Bemtgen pointed out that this course had shown once more that all European countries were faced with similar problems in education. He was very glad to see that all European countries were determined to co-operate in the field of education for the benefit of Europe.

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II. SUMMARIES OF THE SPEECHES MADE DURING THE COURSE

THE MALAGA COURSE AND ITS LINKS WITH TECHNICAL AND VOCATIONAL EDUCATION

(by J.G.M. Allcock)

At first sight the connection between the two courses is far from obvious: those of us who went to Malaga in April of this year were not for the most part concerned with technical or vocational education and our discussions took place almost entirely within the framework of what might be called secondary education of a general, not to say, traditional type. The more, however, we discussed the problems which the opening lectures set before us, the more obvious did it become that, in the particular context of the way in which our discussions developed, the barriers between general secondary education and all other kinds of secondary education were as artificial as those traditionally existing between different groups of subjects in a general secondary school.

Let me make it clear from the outset that what we were concerned with at Malaga was not the position of the humanities (however they might be defined) within the school curriculum, but the much wider and more fundamental problem of the humanistic approach in all secondary education. The question to which we were trying to find an answer was something like this: "How can we, as educators, help to ensure the survival and future development of the human personality in a society increasingly dominated by the achievements and demands of science and technology?"

We sensed, I think, a two-fold danger or even threat: on the one hand, there is a natural and inevitable tendency towards the deliberate pursuit through educational processes of further technological achievement in a context entirely devoid of any humanistic influence and, on the other hand, there is the equally natural and unavoidable tendency to concentrate more and more on the purely vocational aspects of education. Both of these tendencies are, in some sense, irresistible: they spring from the nature of the world in which we live, and the problem before us was to discuss possible ways of coming to terms with them and even of turning them to educational advantage.

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Three things in particular, which emerged from those discussions, seem to me to have some bearing upon the discussions here this week - firstly, the need for some unifying basis for all secondary education and the possibility that such a basis can most logically be sought in a broadly humanistic approach interpenetrating the teaching of all subjects and springing, in particular, from an awareness of the whole range of European experience and achievements; secondly, the implications of all this for those mostly concerned with staffing the greatly expanded provision of secondary education (so much of which is technical and vocational in character) in so many countries; thirdly, the question of teacher training viewed in its broadest and most fundamental terms. In all these areas of discussion, technical and vocational education has its own special contribution to make arising partly from the fact that it is a rightful and integral part of the whole process of secondary education and, partly, from its closer and more immediate context with the world outside school, with the realities of vocation and employment, and, therefore, from its more obvious relevance in the eyes of the pupil to his professional and personal development as an adult citizen, not only of his local community, but of the wider European community as well.

THE HUMANIST APPROACH IN TECHNICAL EDUCATION

(by Mr. Louis Boeglen, Holy See)

I. The aim to be reached.

"The aim every true education tries to reach is to form the human personality with a view to its highest aspirations and to the well-being of the groups whereof man is a member and at the service of which he will exercise his activity when adult." (Declaration of Vatican Council II).

(a) Humanism: general culture, formation of the mind. True culture is not an accumulation of encyclopaedic knowledge, but a development of aptitudes and an organisation of knowledge that can be mobilised.

(b) Humanism: knowledge of man and formation of personality. The final objective of humanism is man, his development and self-knowledge. Humanism also means to know man as an individual as well as a member of human society.

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II. The general conditions of humanist education.

(a) The humanist approach of the teacher.
The humanist approach is rather a state of mind, an orientation of the spirit, an intention, than a pedagogical method.

(b) The teacher's knowledge of the pupil.
This knowledge is an essential condition prior to any educational activity. The teacher should know and consider the pupil's psychology, his abilities and limitations as well as his social background.

(c) The disciplines of humanist education.
Although we must underline the different values inherent in the various disciplines from the humanist point of view, we must admit that humanism is not the exclusive privilege of any one discipline or group of disciplines. It is in every discipline.

(d) Atmosphere and organisation of the humanist school.
The teacher's approach and the style of the school can greatly contribute towards creating a humanist attitude in the pupils.

III. Improved atmosphere in technical education.

Vocational training of the pupils was at first limited to a practical apprenticeship hardly affording any possibility for the pupil's cultural development.

The teaching in a technical environment calls for frequent contacts between the teachers of the various disciplines as well as a correlation between vocational training and general education. Technical teaching must have a character of its own which must harmonise with the generally accepted principles of education.

IV. Valorisation of technical education.

For too long a time it was considered that technical education could not provide a proper access to cultural life. However, the human and cultural value is essentially not in the subject but in the spirit in which it is taught.

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V. Humanist values inherent in technical subjects.

It is a fact that the teaching of technical subjects contributes to the development of the pupil's character. Hence, the teacher should stress the cultural values in his subject which lead to character shaping: spirit of observation and proper evaluation of things, appreciation of well-done work, awakening of an artistic feeling, common sense, sense of probity, sense of responsibility, sense of team work, open-mindedness to the problems of work etc.

Conclusion

Scientific discoveries have changed the face of our world. What actually threatens the European heritage is that if technical knowledge is abused it will prevent man from living a life consistent with human dignity.

Only those will be able to ward off this risk, both for themselves and for the others, who are penetrated by the well-balanced humanist spirit of ancient European civilisation.

INTERPENETRATION BETWEEN THE TWO MAIN GROUPS OF SUBJECTS (SCIENTIFIC SUBJECTS AND GENERAL SUBJECTS) IN TECHNICAL SCHOOLS IN AUSTRIA

(by Dr. Leo Kober, Austria)

The aim and the structure of Austrian technical schools is characterised by three typical Austrian features:

1. the desire to shape in the schools the future social structure of the state by preparing the future members and leaders of the state for their tasks;

2. the desire to counteract too great a specialisation of knowledge and skill and to aim instead at an overall education;

3. the desire to use the manifold opportunities existing in technical schools to overcome the various divisions in the nation and the forces that lead to those divisions.

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These ideals necessitated the development of four educational forces which acting together form the pre-conceived image of the technician.

These four operating forces are represented by:

1. the professional theoretical and practical subjects which take effect by virtue of an underlying conception of man as Homo Operator;

2. the group of general subjects represented by religion, German, foreign languages, leading those who study them towards the ideal of man as Homo Sapiens;

3. the group of the subjects geography, history, civics and economics, leading those studying them toward the ideal of man as Zoon Politicon;

4. the subjects physical training, music, art and literature which acting together form man as Homo ludens.

These different aspects also bear out clearly the legitimate claim of the technician to play a leading role in the affairs of the nation.

The world of man is best understood through the medium of professional work. The work of the professional engineer can only have one aim: the perfection of the world as seen since times immemorial. The philosophical basis of this work is the engineer's belief in mankind, the working basis is the wonderful scientific edifice that mankind has established. Thus the professional engineer is an optimist; even if he cannot conquer the tragic fate of the individual, he can make the collective life of men better by his work. This high evaluation of the professional engineer's work influences the attitude of mankind towards all kinds of work: it raises the working individual to a position of increasing importance in human society.

II.

It can be shown that all the disciplines in a technical school in Austria help each other closely.

In the workshop a pupil learns to be severely critical of his own work; and unconsciously - or so we hope - he applies this to all the other subjects he has to master. Every technical project conceived by the mind has to pass

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the ordeal of materialisation - the cogent co-operation between practical and theoretical subjects. The workshop with its tools makes the pupil understand the rise of man in history as the rise of man the toolmaker. He will finally see that languages - that even the brain he works with - are fascinating and complex tools, to be used with as much care as a complex and expensive tool in the workshop. Here the student learns that nothing is more ridiculous than to look down upon manual work from the pretended heights of intelligence and intellectuality. Thus one of the possible divisions in the nation - the division between intellectual and manual workers - is overcome.

The interpenetration of theoretical subjects takes an even subtler form. Imparting the theories of one subject fertilizes the mind, makes it grow and thus enables it to comprehend the next more difficult step, although this step be a subject not directly interrelated with the preceding one.

Engineering leaves no room for personal vanity, for it goes beyond the strength of the individual, demands team-work in face of the great risks it brings with it, and calls for the control of the individual through the collective mind. Nowhere else is man better prepared for his role as zoon politicon than here. The theoretical professional subjects teach the student the limits of man's power and show him the boundless realm of human thinking. They endow him with the eager mind of the explorer, with the ability to transform ideas into visible and faultlessly operating constructions and structures. Thus the professional subjects can be seen as vehicles for the perfection of the world.

This has a direct and immediate bearing on all the general subjects. History, geography, economics, civics and related subjects - all the subjects that claim to transform the individuals into citizens of the state - find the greatest aid in the professional subjects. The young learn here - as previously stated - to understand the world of man through the medium of working. Real life penetrates these schools through many channels and so technical institutes are a very thorough preparation of the young for life outside school.

The general subjects, on the other hand, give much to the technical subjects. The conception of the principal purpose of engineering - to help in perfecting the world - does not stem from the engineering sciences themselves, but

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was offered to them as a postulate by the general subjects. It is a philosophical postulate, and therefore the other group of the so-called general subjects - mathematics, linguistic disciplines and religion - are involved in formulating it, as part of their task, as vehicles in the search for truth. Here the deepest interpenetration is to be established. A profound consciousness of responsibility has to be implanted in the young students. Thus, the printed letter of their books becomes alive. Abstract teaching is paralleled by personal insight. The scholastic subjects are implemented by private experience.

III.

Technical education is stern. Therefore a protected area must exist in the pupil himself, so that he may be able to withdraw there from time to time. The supreme ruler in this refuge is beauty. Gymnastics, music, art and literature offer the student this refuge, teach him to find happiness in self-control and self-abnegation, form outlets for his sentiments and show him the way to self-expression. No questions of usefulness are raised, no problems of morality exist. The playing man - homo ludens - may then enjoy his existence for a short while, man's highest form of development. Here indeed is a supreme means of education.

IV.

Education is a whole and cannot be split up into professional and general education. The technical schools have long since realised this and they may be called the advance guard of educational institutes. They have the tremendous task of synthesising the discoveries of science into the cultural and scientific object material in such a way that it can be taught and worked with, and thus help to continue our culture. The interpenetration of all the subjects helps to ease the heavy burden that is laid on the teachers of these schools: to create a type of man that is to the best of their knowledge and ability equipped to master the future, and to be wise leaders of men in their untiring efforts to build a better, an ideal world.

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THE TEACHING OF MODERN SCIENCE IN SECONDARY TECHNICAL SCHOOLS AS AN AID TO THE FORMATION OF MODERN THINKING

(by Dipl.-Ing. B. Deutsch, Austria)

It is the paramount task of science firstly to contribute to a correlation of the different educational fields and secondly to train people in modern thinking.

I. Engineering is applied science.

At technical secondary schools the teaching of physics and chemistry not only makes important contributions towards the general education of pupils (as is the case in any other secondary school), but also plays an essential role in helping to prepare them for their technical professional career.

A modern technical plant is inextricably bound up with pure physics, and the equipment of modern physical laboratories is so technical that professional engineers are virtually compelled to apply the knowledge they acquired in the physics class at school.

For instance, in performing experiments where the problems of the technique of measurement become obvious, it is necessary to prepare the pupils very thoroughly for their future career. The actual applicability of scientific knowledge will occasionally be proved during school lessons, viz., in such cases where reference is made to it in the teaching of a technical subject.

II. Science is excellently suited to train pupils in logical thinking.

The grasping of causes and effects in natural phenomena as well as the classification of causes as "necessary" and/or "sufficient" contribute in an important way towards training pupils' logical thinking. Yet here it is essential that pupils not merely receive information, but are also induced to think problems over.

Pupils' linguistic training is inseparably associated with their training in logical thinking. Educating pupils with a view to enabling them to express themselves clearly and unmistakably is not the sole task of the language teacher.

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This is to be practised in every school subject, particularly in mathematics and science, since clear thinking and clear speaking are interdependent.

III. Natural-philosophical aspects inherent to modern physics and chemistry must not be neglected in educating young people. The profound inner changes science has undergone have altered man's position in nature to such an extent that future engineers should not start their professional career without having a certain idea of natural-philosophical problems. In spite of the fact that such problems cannot be dealt with in physics thoroughly enough, pupils should be enabled to penetrate into them so far that cross connections with their professional work become evident. Future engineers' education and specialised training are, of course, greatly determined by utilitarian considerations; yet it must be remembered that one of the foremost objectives of European education is to encourage philosophical thinking. Particularly physics lends itself to arousing pupils' interest in non-material problems.

Also our pupils may be trained to see the role played by probability in natural proceedings and thus to turn away from looking at them from a merely mechanistic point of view.

Quantum physics, the theory of relativity, wave mechanics, and other fields of modern physics make us give up the hope of ever really understanding nature in her entity.

WORKSHOP INSTRUCTION, LABORATORY WORK, DESIGNING AND CONSTRUCTING AND THEIR SHARE IN THE OVERALL EDUCATION OF THE SECONDARY TECHNICAL SCHOOLS

(by Dipl.-Ing. Dr. Schlöss, Austria)

To provide a basis for judging the results of the training given to young people, we have, first of all, to state the objectives of an engineer's training and education. Next, we shall have to investigate at what age pupils should receive such training.

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A broad general education is indispensable for successful educational work. Based on this general education, a specialised training in the field chosen has to be given. It is, however, not enough for an engineer to have a purely theoretical knowledge; he also needs practical workshop training, systematic instruction in design work, and laboratory training.

The training of the future mechanical engineer can be given as a typical example of how these educational objectives can be achieved. It will be seen that the above-mentioned three big training categories shape the pupil's character in rather the same way, though from different approaches. It is easy to recognise their interdependence and correlation.

The pupil's training takes place in the period of his life when he can be most easily influenced and educated. This training method appears superior to separating practical and theoretical training as is usual in some other countries.

On the whole, it may be said that the set aim of education may be reached in the indicated way. The excellent professional results attained by pupils trained in the manner described prove the efficiency of their training.

THE CORRELATION BETWEEN THEORETICAL EDUCATION IN ENGINEERING AND GENERAL EDUCATION

(by Dipl.-Ing. W. Molzer, Austria)

Let us investigate the correlation between subjects of theoretical education in engineering and those of general education and compare the main lines of study in compliance with the Austrian School Organisation Act of July 1962 and the curricula for secondary technical and vocational schools in Austria.

The level and the volume of the technical knowledge taught can only be as high as the pupils are able to grasp in virtue of their general education. The pupils should be enabled to recognise the interdependence of the different subjects as often, and in as many variations, as possible, until they are able to recognise them independently.

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The interpenetration of engineering subjects - in most cases a given necessity - appears to be a matter of course; yet their correlation with the subjects of general education is so important that it may be considered the corner stone for a really successful overall education for an engineer.

All the curricula of the Austrian secondary schools mirror the principle that in the first form only basic general education is given, whereas pupils attending the fifth (=last) form receive almost exclusively instruction in engineering subjects. In the forms two to four there is a gradual transition which gives due consideration to as intense a correlation of subjects as possible. The interpenetration of engineering subjects being comparatively obvious, the correlation of natural science subjects (e.g. mathematics, physics, descriptive geometry, chemistry) is considered particularly important in both teaching and educating pupils. Particular reference may be made to the position of mechanics or statics respectively as links between natural science and theoretical engineering subjects, since in these subjects logical thinking is taught and developed, thus preparing the pupils' minds for their tasks in their future engineering careers.

In addition, mention must be made of the cross-connections existing between the various departments in Austrian secondary technical schools. Examples of such cross-connections are the subject "mechanical engineering" taught in the departments of electrical engineering and civil engineering, or the subject "electrical engineering" taught in the department of mechanical engineering.

Similarly, attention should be paid to the correlation between general humanist subjects with regard to the requirements of the syllabus and with special emphasis on the pupils' education towards humanitarianism and tolerance. Here the teaching of German has to play a paramount role.

There is another point worth stressing: the correlation between engineering education and modern language instruction. Here a close co-operation between modern language teachers and teachers of engineering subjects as well as workshop instructors is essential.

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As to secondary technical and vocational schools for employed persons the pedagogical requirements for successful instruction are the pupil's readiness to study and his grasping what is important as well as his comprehension of the subject-matter taught.

To sum up, it may be said that five years of training in Austrian secondary technical and vocational schools with their closely interrelated general and engineering subjects and with their capacity for shaping the pupils' minds in cultural and humanist fields undoubtedly turns out pupils of a high educational standard.

Such a high educational level not only makes possible successful studies at institutes of higher learning, but also meets the requirements of the engineer who has to occupy an executive position in industry and to overcome difficulties both in his work and in his private life.

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DISCUSSIONS

All the lectures were followed by discussions giving an opportunity for an exchange of views and varied information.

Main points raised in the discussions

(1) Organisation of school workshops:

It is advisable to provide workshop training for small groups (5 - 6 pupils), each under the supervision of a specialist teacher. Varied machines, at which all pupils are trained, imitate successfully factory work. Pupils are, however, not given a specialised training; they receive a broad overall education. It may be predicted that the workshop of the future will not differ essentially from the type actually existing in Austria and other European countries: standard machines will have to be set up in school workshops, whereas very expensive machines are considered unnecessary. Pupils attending Austrian secondary technical schools have to do work as holiday trainees in industry, which familiarises them with special machines and the working conditions existing in factories.

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(2) Advisability or non-advisability of teaching pupils manual skills:

In Austria it is thought advisable to provide workshop training and theoretical instruction parallelly. Workshop training lasts for years, not just a few weeks. Excursions and visits to industrial plants are arranged from time to time. In this way pupils become acquainted with the latest industrial developments. In France practical work in secondary technical schools starts right away with machine tools, previous work at the vice is considered unnecessary. In Austria there is a tendency towards cutting pupils' training at the vice in favour of their training at machine tools. There is constant collaboration between schools and industry. Many teachers at technical schools are also employed in industry. Representatives of all kinds of enterprises are invited to leaving examinations.

(3) Attitude of industry and trade to the productivity of school workshops:

In Austria there are no difficulties with industry and trade unions, since school workshops produce only small-sized machines in small numbers. The returns from workshop goods never balance the sum necessary for equipping the workshops.

(4) Educational background of the teachers of mathematics and science at secondary technical schools in Austria:

Such teachers are university graduates, some of them industrial engineers.

(5) Percentage of pupils attending Austrian secondary technical schools that leave with a diploma:

Approximately 80%.

(6) Preliminary working-paper:

A preliminary working-paper containing statistical material was prepared by Mr. Koweindl and made available to all delegates before the meeting. This working-paper will provide answers to other pertinent questions.

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III. CONCLUSIONS AND RECOMMENDATIONS OF THE COURSE

STUDY GROUP "A"

Chairman: Mr. P. Schleimer (Luxembourg)
Rapporteur: Mr. L. Géminard (France)

I. INTRODUCTION

Since education in technical and vocational schools aims at developing the human personality as well as at preparing the pupil for professional activity, the programme, both theoretically and practically, must be drawn up from a humanist point of view.

If the different factors in education are not all taken into account, we run the great risk of splitting up instead of building up the person. Educationalists must always be aware of the fact that a school subject is not an end it itself, but that all subjects are a common means towards one goal.

This shows the need of bringing about a co-ordination and an interpenetration of the subjects to ensure the unity of the teaching and to make it really cultural and humanistic and adapted to its vocational objectives. This is all the more necessary because in technical and vocational education there is a risk of conflict between specialisation and such an overall education.

II. NEED FOR A BASIC GENERAL EDUCATION

The co-ordination of subjects and their interpenetration call for a basic general education which allows both pupils and teachers to set up the necessary interconnections.

This general education must include amongst other things:

(a) a thorough education in the pupil's mother tongue as a vehicle for the expression of his thoughts. It should enable the pupil to express his ideas correctly and concisely in both speech and writing. In addition, this education should make the pupil open-minded enough to understand and appreciate the cultural values of civilisation;

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(b) the study of at least one foreign language with the dual objective of using it in everyday conversation and of acquiring the technical vocabulary essential to his professional life. Thus, the interpenetration between the general and technical subjects is set on its way;

(c) the teaching of general history in its cultural aspects and the teaching of scientific and technical history may be integrated with the teaching of scientific and technical subjects in the form of a historical survey of the great periods of their evolution;

(d) a general artistic education generally supporting a study of technical subjects, insofar as it may be integrated within the different subjects;

(e) physical education, which is essential for the formation of the pupil's character and the general development of his personality and poise, and which may be used as a form of therapy.

The general education of a pupil may be greatly influenced by extra-curricular activities and out-of-school activities. These are particularly important and their interpenetration with the other school activities is all the more useful, since the trend in modern life is towards more and more leisure time.

It must be borne in mind that the fundamental problem for the educationalist lies mainly in the need to instil in the pupil a desire for acquiring knowledge and thus, to a certain extent, to educate himself, not only in school activities, but also in out-of-school activities.

III. CONDITIONS AND METHODS OF INTERPENETRATION OF SUBJECTS

1. The co-ordination of the syllabuses of different subjects is a fundamental principle for interpenetration.

It must take into account the amount of the material taught and the quality as well as the continuity of the programme, which should be reflected in the school text-books.

2. The interpenetration of different subjects implies a feeling of mutual trust among the various members of the teaching staff.

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The part played by the headmaster is essential in the development of such a relationship.

The objectives of this relationship are threefold:

(a) a better mutual understanding and appreciation among teachers;

(b) their recognition of the need for interpenetration of different subjects;

(c) a general study, by all teachers, of the problems arising in this connection.

3. Among the methods to be used, we might mention the following:

(a) periodical meetings of all the teaching staff of a class;

(b) meetings of teachers of the same subject or of a group of subjects;

(c) a general meeting of all teaching staff of a school;

(d) attendance of a teacher at a lesson given by his colleague who teaches a different subject;

(e) team-work of teachers concerning a common topic; possibly making use of closed-circuit television;

(f) the setting up of a bureau and a library of technico-pedagogical documentation;

(g) the teaching of two or more connected subjects by one teacher.

4. Every teacher should be aware of his dual responsibility:

- in his own subject,
- in the overall development of the personality of the pupil.

This is perhaps particularly important for teachers of practical technical subjects, who may have a major educational influence on their pupils.

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IV. TRAINING OF TEACHERS

Any recommendation concerning the interpenetration of subjects would be virtually in vain if the training of teachers of all subjects were not orientated towards this end.

V. RECOMMENDATIONS

Group "A" suggest the following recommendations for the future training of teachers:

A. Initial training for future teachers

(1) It is highly desirable that, at every stage of their training, teachers of scientific subjects are kept up to date with information regarding the technological development of their special subjects and they should also receive such information of an economic and sociological nature as is necessary.

(2) It is desirable that the teachers in general subjects also receive some scientific and technological information at some time during their training.

(3) It appears necessary for teachers of practical subjects (workshops) to receive sufficient scientific and general education to enable them to discuss intelligently any problem with their colleagues with a view to co-ordinating the training and education of their pupils. Every country will determine the best possible method of achieving this.

(4) The Group recommend the establishment of schools for the training of technical teachers in the countries where this type of school does not yet exist.

(5) The Group believe that the co-ordination of institutes for the training of teachers should be investigated both at national and international level.

(6) The Group believe that every teacher should receive psycho-pedagogical instruction which, amongst other things, will make him conscious of the need for interpenetration of subjects.

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B. Further training

(1) Insofar as the further training of teachers of all subjects is concerned, international, national and regional courses and seminars as well as pedagogical meetings arranged within the school itself should be held in order to acquaint them with the latest information relevant to their particular fields.

(2) For teachers of practical technical subjects, courses in factories, industry and commerce, either in their own country or abroad, will enable them to bring their knowledge up to date. This might be organised on the basis of exchange programmes. When there is a new development in a teacher's special field, he should be made aware of it.

(3) For teachers of non-technical subjects, visits to factories should be organised to keep them in contact with the outside world.

VI. OBSERVATIONS

In the course of the debates, it became evident that the problem of training the teaching staff of technical and vocational schools, particularly in the practical, technical disciplines, is extremely complex. This problem should be regarded as one of the major concerns of the Committee for General and Technical Education.

STUDY GROUP "B"

(Scientific and technical subjects)

Chairman: Mr. A.J.W. Rommes (Netherlands)
Rapporteur: Mr. H. Aigner (Austria)

CONSIDERING that in order to train technicians of a high level of professional competence as well as to give them a sound general education, the curriculum of technical and vocational schools at the secondary level ought to include instruction in general subjects, in the sciences, and in technical subjects (theoretical and practical);

CONSIDERING further that a close interpenetration of all the subjects taught at these schools is required both for an integrated development of the individual pupil's character and for reasons of teaching efficiency;

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The participants of Group "B" have agreed on the following recommendations:

1. Laboratory work Physical and chemical laboratory work form an integral part of technical education, both because of the nature of scientific method and of the necessity of developing certain skills to be used by the technician in industry and because of their generally accepted values in contributing to the formation of character. Instruction in this field ought to feature a maximum amount of pupil activity.

2. Descriptive geometry The subject-matter of descriptive geometry may be required to a greater or lesser degree in technical curricula, depending on the specialisation. It is not to be taught as a separate subject, but rather as an integral part of technical drawing.

3. Biology Certain aspects of biology and psychology (e.g. effects of radiation, ergonomics) may be required parts of a technician's instruction for professional reasons and should be dealt with by the teachers of the relevant technical subjects. Other aspects of biology (e.g. evolution, ecology) may be required for reasons of general education. They should not be covered by a separate subject but by guest lecturers and/or by teachers of other subjects who take an extended interest in these matters.

4. Design work Design work is a core-subject at technical schools, since all theoretical technical subjects as well as the scientific subjects lead up to this proof of the pupil's creative technical ability, the proof that he himself has been seeking since he entered technical school. As the level of achievement in this field progresses, care should be taken that all the other subjects reach corresponding levels so as to make possible a maximum of co-ordination and integration. To this end, close teacher co-operation and the encouragement of team-work among the staff should be promoted by all possible means, including the contents of the syllabus as well as research on the effectiveness of integration so far achieved. Care should be taken to eradicate any isolationism and "subject chauvinism" on the part of teachers.

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5. Practical training Every future technician should receive practical training, both for reasons of personality formation and for professional interest, the latter differing somewhat for the different specialisations. The amount of such practical work must also depend on the different levels of technicians or the particular job that the trainee is intended for. Manual work, if applicable for a given speciality, should be in the nature of a brief introduction and should stress the aspect of character formation.

Practical training is most efficient from the point of view of interpenetration when it is given neither exclusively by the school nor exclusively in industrial workshops. The relative amount of practical training at the school and in industry will again depend on the speciality, as well as on the socio-economic situation in the individual countries.

6. Teacher training and further training All efforts towards an interpenetration of subjects can only succeed if the individual teacher succeeds in realising them. After due consideration of the pertinent recommendations of the Sèvres course, this Group believes that future teachers at technical schools, before being accepted into an establishment for the training of technical teachers, should undergo a short period where they follow the instruction of the type of school in which they plan to teach from the pupil's point of view, e.g. by attending all of a given pupil's classes during that period.

At the establishment for training teachers at technical schools the curriculum should take the necessity of subject interpenetration into consideration. No effort should be spared at this crucial period to instil and develop in the students an appreciation of other disciplines, of the approach to life underlying them and of the people professing them, so as to foster a true team-spirit.

These aspects of mutual appreciation and team-work should be smoothly carried over into the school to which the new teacher will be assigned and to any further training which may be deemed necessary for other reasons. They should also form an important part of formal and informal teacher's meetings.

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A P P E N D I X A

FILMS PRESENTED DURING THE COURSE

(1) Two films on secondary technical and vocational schools in Austria.

The first film showed pupils of such schools engaged in various activities of their trade or craft. It was seen how, in addition to the basic training given to them, they gain valuable experience by operating the most up-to-date machines manufactured by well-known firms all over the world.

The second series of short films concerned a training centre for handicraft masters, an Austrian University of Technology, and a centre for the training and further training of teachers, respectively.

(2) A second show of short films, this time in colour, dealt with the teaching of mathematics and physics. The subjects treated were:

"Central Angle and Peripheral Angle"
"Lissajous Curves and Application of Lissajous Curves"
"Oscillography of Relaxation-Type Oscillations"
"Experimenting with Oscillations"

The delegates were greatly interested in these films illustrating the intimate connection between fundamental sciences and their technical applications.

The projector used for the presentation of these films was of a most recent make which enables films to be projected in daylight on a glass screen similar to that used in TV. Another outstanding advantage of this new type of projector is that it is most easy to handle.

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APPENDIX B

PROGRAMME OF THE COURSE

Sunday 8 October	Arrival of delegates in the afternoon
Monday 9 October	
9.30 a.m.	Inauguration of the Course, of the book exhibition and of the exhibition concerning technical and vocational education by Dipl. Ing. Golser, Head of the Division for Technical and Vocational Education. Musical accompaniment by the choir of the hotel catering school of Bad Hofgastein
10.30 a.m.	EDUCATIONAL ACTIVITIES OF THE COUNCIL FOR CULTURAL CO-OPERATION IN THE FIELD OF TECHNICAL AND VOCATIONAL EDUCATION (Mr. G. Bemtgen, Head of the Section for General and Technical Education, Council of Europe)
11.45 a.m.	THE MALAGA COURSE AND ITS LINKS WITH TECHNICAL AND VOCATIONAL EDUCATION (Mr. J.G.M. Allcock, United Kingdom)
12.30 p.m.	Lunch
3.00 p.m.	THE HUMANIST APPROACH IN TECHNICAL EDUCATION (Mr. L. Boeglen, Director of the Ecole des Ingénieurs ECAM, Lyons)
4.45 p.m.	INTERPENETRATION BETWEEN THE TWO MAIN GROUPS OF SUBJECTS (SCIENTIFIC SUBJECTS AND GENERAL SUBJECTS) IN TECHNICAL SCHOOLS IN AUSTRIA. (Dr. L. Kober, Inspector, Austria)

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6.15 p.m.	Projection of a film on secondary technical and vocational schools in Austria (in the "Hauptschule" of Bad Hofgastein)
7.30 p.m.	Dinner

Tuesday 10 October

9.00 a.m.	THE TEACHING OF MODERN SCIENCE IN SECONDARY TECHNICAL SCHOOLS AS AN AID TO THE FORMATION OF MODERN THINKING (Dipl. Ing. Deutsch, Austria)
10.30 a.m.	WORKSHOP INSTRUCTION LABORATORY WORK, DESIGNING AND CONSTRUCTING AND THEIR SHARE IN THE OVERALL EDUCATION OF THE SECONDARY TECHNICAL SCHOOLS (Dipl. Ing. Dr. Schlöss, Austria)
11.45 a.m.	THE CORRELATION BETWEEN THEORETICAL EDUCATION IN ENGINEERING AND GENERAL EDUCATION (Dipl. Ing. W. Molzer, Director of a secondary technical school in Vienna)
1.00 p.m.	Lunch
3.00 p.m.	Setting up of Study-Groups
4.00 p.m.	Reception given by the Mayors of Badgastein and Bad Hofgastein at the Schlossalpe (1800 meters above sea-level)
7.30 p.m.	Dinner

Wednesday 11 October

6.30 a.m.	Breakfast
7.15 a.m.	Departure for Salzburg in motor coaches
9.00 a.m.	Visit of the Höhere technische Bundeslehranstalt (secondary technical school, Rudolfskai 42, Salzburg, with the possibility of attending at choice: (a) Technical English; (b) Italian in a department of architectural engineering; (c) Design practice in mechanical engineering; (d) Elements of building.

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10.00 a.m.	Visit to the Lehranstalt für Fremdenverkehrsberufe (secondary school for the catering trade), Schloss Klessheim, where there is the possibility of visiting: (a) French for pupils of hotel catering schools in the language laboratory; (b) German for foreigners; (c) Cooking lesson (method of programmed instruction).
12.00	Lunch at Schloss Klessheim
1.15 p.m.	City tour and visit to the workshops of the secondary technical school of Salzburg
4.00 p.m.	Reception given at Schloss Mirabell by the Government of the Province of Salzburg and by the Mayor of the City of Salzburg
about 5.30 p.m.	Mozart Serenade at Schloss Mirabell. Afterwards return to Bad Hofgastein
about 9.00 p.m.	Dinner at Bad Hofgastein

Thursday 12 October

9.30 a.m.	Study-Groups
12.00	Projection of short colour-films for the teaching of mathematics and physics (in the "Hauptschule" of Bad Hofgastein)
1.00 p.m.	Lunch
3.00 p.m.	Study-Groups
7.00 p.m.	Dinner

Friday 13 October

9.30 a.m.	Study-Groups
1.00 p.m.	Lunch
3.00 p.m.	Study-Groups
7.00 p.m.	Dinner

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Saturday 14 October

9.30 a.m.	Study-groups
12.30 p.m.	Lunch
3.00 p.m.	Plenary session. Recommendations
7.00 p.m.	Farewell dinner
Sunday 15 October	Departure of delegates after breakfast

A P P E N D I X C

B. LIST OF PARTICIPANTS
LISTE DES PARTICIPANTS

Bad Hofgastein (Austria/Autriche)

AUSTRIA AUTRICHE	Mr. H. ROTTER	Ministerialrat, Dipl.-Ing., Bundesministerium für Unterricht, Minoritenplatz, 5 A/1014 WIEN
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	Mr. P. BAILLY	Inspecteur de l'Enseignement technique, 37 rue de Boussu, SAINT-GHISLAIN
	Mr. P. POUMAY	Ingénieur Inspecteur à l'enseignement technique, libre subventionné, 63 Boulevard Léopold, TOURNAI
CYPRUS CHYPRE	Mr. N. HADJINICOLAS	Director of Technical Education, Ministry of Education, NICOSIA
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ICELAND ISLANDE	Mr. B. KRISTJANSSON	Dipl. Ing. Headmaster of the Technical College, REJKJAVIK
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	Mr. M. Ó CONGHAILE	Chief Executive Officer, Co. Louth Vocational Education Committee Technical School, DUNDALK Co. Louth

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	Mr. P. MAZZAROL	Ispettore centrale Ministero di Publica Istruzione, Viale Trastevere, ROMA
	Mr. D. VINCIARELLI	Direttore di Sezione presso la Direzione Generale dell'Istruzione professionale, Viale Trastevere 209/IV ROMA
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MALTA MALTE	Mr. C. CUSCHIERI	Headmaster secondary Technical Schools, PAOLA, President, Malta Society of Arts, Commerce and Manufactures VALLETTA
	Mr. A. RAIMONDO	Headmaster Technical Institute and Government Industrial Training Centres, PAOLA, MARSA
NETHERLANDS PAYS-BAS	Mr. A.J.W. ROMMES	Inspector of technical and vocational education, 31 Rijksweg, EMPE (Post Voorst)
	Mr. A.J. DUERMEYER	Inspector of technical and vocational education, Van Dorpstraat 7 THE HAGUE
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UNITED KINGDOM ROYAUME-UNI	Mr. L.S. LAID	Her Majesty's Inspector of Schools, "Greystones", 36, Ridings Mead, CHIPPENHAM Wilts.
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	Mr. H. SCHLOSS	Fachvorstand, Professor, Technologisches Gewerbemuseum, Währingerstrasse 59, A/1090 WIEN
	Mr. B. DEUTSCH	Professor, Technologisches Gewerbemuseum Währingerstrasse 59, A/1090 WIEN
ORGANISERS OF THE COURSE ORGANISATEURS DU STAGE	Mr. K. KOWEINDL (Directeur du stage) (Director of the course)	Ministerialrat, Bundesministerium für Unterricht, Minoritenplatz 5, A/1014 WIEN

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	Mr. J. GINSEL	Landeschulinspektor, Gorianstrasse 22 A/5020 SALZBURG
	Mr. H. AUBELL (minutes) (procès-verbal)	Fachinspektor, Oberstudienrat, Kroatengasse 16 A/4020 LINZ a.d.D.
	Mr. A. EBNER	Direktor der Höheren Lehranstalt für Fremdenverkehrsberufe Schloss Klessheim A/5072 SIEZENHEIM
	Mr. F. PEYDL (Exhibition) (Exposition)	Architekt Oberstudienrat, Dipl. Ing., Höhere Technische Bundes-Lehr- und Versuchsanstalt, Schellinggasse 13 A/1010 WIEN
	Mr. A. DURSTMÜLLER (Book Exhibition) (Exposition des livres)	Fachvorstand, Professor, Höhere Graphische Bundes-Lehr-und Versuchsanstalt, Leysergasse 6 A/1140 WIEN
	Mr. A. RICHTER	Akad. Maler, Oberstudienrat, Höhere Technische Bundeslehranstalt, Rudolfskai 42 A/5020 SALZBURG
	Mr. R. KULHANEK (minutes) (procès-verbal)	Professor, Höhere Technische Bundeslehranstalt A/4020 LINZ a.d.D.

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