THE CO-OPERATIVE PLAN OF ENGINEERING EDUCATION SPECIFICALLY APPLIED

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THE CO-OPERATIVE PLAN OF ENGINEERING EDUCATION SPECIFICALLY APPLIED.

INTRODUCTION.

One of the most significant trends in American industry during recent years has been the growing attention that is being given by industrial executives to the problems of personnel and particularly to the training and development of man-power for their organizations. Changes in industrial organizations and methods have lessened greatly the opportunity for development of employees in the regular processes of industry. As a result, the problem of obtaining properly trained personnel for the more highly skilled and more responsible positions has become one of outstanding importance.

For a great many years education has been regarded as a thing apart from industry. The need for the development of young people as they grow up has been recognized as a problem to be delegated to the schools and colleges. It also has been recognized that there is need for the development of men for industrial operations, and this has been regarded as the problem of the shop. The first has been thought of as "education", the second largely a matter of "experience".

With the rapid growth of industry and the increased emphasis upon machinery and highly specialized methods and systems, difficulty has been experienced in both the school and industrial sides. Graduates of schools and colleges, even engineering colleges, frequently find difficulty as they try to adapt themselves to the highly specialized organizations in which they must find their place. They lack experience and specific training.

On the other hand, within industry the securing of employees for positions requiring skill and ability, and particularly leadership and executive ability, has become a vital problem. Industry needs a constant supply of recruits of "education" and is also faced with the problem of making adequate provision for the development of employees within its organizations, including the recruits, to meet the demands of present highly specialized conditions.

Out of this condition, there has grown a movement in organized research, experiment and development in the field of industrial personnel, corresponding in a measure to the organized research, design and experimental work in material products. This newer movement is not without promise that in the future it may produce results comparable in importance to the great advances that engineering research has brought to American industry.

In this movement, recognition has been given to the importance of academic and technical training as well as practical experience in the development of industrial personnel. It is resulting in programs of various forms including training in the more highly skilled trades, training for positions requiring special technical ability, programs of training for college graduates, foremanship and executive training programs, and a growing emphasis in recent years upon training of young men of future potential. In this latter work, increasing attention is being paid to the co-operative principle of education and training.

This paper presents in outline a development of this character and of some of the more significant features of an application that has been made of the co-operative principle in a comprehensive program

of education and training for the organizations and employees of the General Motors Corporation. It has been the privilege of the writer to organize and direct the operations of this program during the past ten years.

ORIGIN AND DEVELOPMENT OF CO-OPERATIVE ENGINEERING EDUCATION.

Before discussing the program referred to, it will be helpful for purposes of background to trace briefly the origin and early history of co-operative engineering, outline its fundamental principles, and summarize the advantages to student and industry which have been claimed for it by its advocates.

It is generally agreed that the co-operative plan as applied to engineering education, had its inception in the work of Dean Herman Schneider at the University of Cincinnati beginning in 1906. The basic idea of combining practical experience with theoretical training was not entirely new. It had long been advocated as a desirable educational method, and a number of early efforts are on record. The so-called "Sandwich Plan" applied to engineering apprentices in Scottish industries is one example, and Dean Schneider himself is authority for the statement that the plan is so very old that it can be traced back to Julius Caesar's engineers who introduced the training for architecture.

These early efforts did bring about a certain combination of theory and practice, although the plan was little more than an idea. At Cincinnati, the plan was first introduced as an option in the regular curriculum and was elected by a relatively small proportion of the students. There followed years of development characteristic

of a pioneer movement, a plan gradually establishing itself first as a promising experiment and then as a recognized part of the program of the University. In 1919 the all-resident engineering curricula of the University of Cincinnati was discontinued and it became entirely co-operative.

In recent years the number of co-operative engineering schools has increased to twenty-four, or approximately 15% of the educational institutions of college grade which offer curricula in engineering. The number of students enrolled in co-operative courses is also not far from 15% of the total enrollment of engineering students in the country. Whatever may or may not be the merits of the plan, it has passed through the period of trial and now has a definite place in the field of engineering education.

PRINCIPLES AND OBJECTIVES.

The co-operative plan as applied generally to engineering education, is, of course, based on the principle that the engineering student should obtain practical experience as well as theoretical technical training and that these two should be given "concurrently and co-ordinated".

C. F. Kettering in discussing co-operative education some time ago, stated that modern psychology teaches that experience is not merely the best teacher, but the only possible teacher. All that any instructor can do is to select and provide the conditions necessary for appropriate experience and to make the most of them. The ignorant is changed into the learned by means of the utilization of proper experience.

There is no conflict between theory and practice. The most

valuable experience demands both, and the theory should supplement the practice. The environment most conducive to securing the most valuable experience is in the work-a-day world, but this is the environment in which men often become engulfed in the practical and neglect the theoretical. Advancement is dependent upon the proper utilization of practical and theoretical experience -- upon practical experience which is adequately interpreted.

Co-operative education attempts to accomplish this by alternate periods of work and instruction. Under the usual plan, the students are divided into two sections, one-half of the students during a given period being at work obtaining a practical experience while the other half are receiving instruction at the school. At the end of the period the conditions are reversed, those who were in school going to work and those who were at work attending school.

ADVANTAGES CLAIMED FOR STUDENT AND INDUSTRY.

The advantages which this plan seeks to bring to students and co-operating industries have been variously stated by advocates of the plan. These statements were summarized by the Society for the Promotion of Engineering Education in its recent survey, as follows:

To Student --

The Co-operative plan provides systematically co-ordinated instruction in principles, and practical training in their application. The relationship of theory to practice is shown. The student is trained in the use of knowledge. Respect for and interest in the principle is thereby increased and the learning process is accelerated. Many details and methods of practice which cannot be taught adequately

in the classroom are learned in industry.

Periods of practical industrial experience develop the student's personality and strengthen his character. His courage, resourcefulness and stamina are tested; his sense of responsibility is brought into play; self-confidence and initiative are developed. The student learns to see things in their true light and to value them accordingly; in particular, he is more likely to appreciate the value of his education.

Practical work is the best form of educational and vocational guidance. The student acquires a knowledge of one or more lines of work through first-hand experience. He is thus able to choose his field of work with some discrimination and is prepared for transition to practical life.

Through intimate contacts in industry, the student obtains an insight into labor problems and a knowledge of the reactions and psychology of the working man. He thus learns to appreciate and respect the problems of the men with whom he works and may subsequently direct. The best time to acquire this point of view is while still young.

The student learns to get along with others, to work under supervision, to follow instructions and to abide by the decisions of his superiors. Thus from the discipline of obeying instructions, he learns how to direct the work of others.

The student learns business organization and procedure through actual observation and practice. He is brought face to face with the economic as well as with the technical side of manufacture and engineering. He also observes and learns up to date shop practices and

methods.

In addition, the co-operative plan enables the student to earn a large part of his expenses.

To Co-operating Industries --

An opportunity is afforded to try out the students, to observe their ability and traits of character and to choose those of greatest promise for permanent employment. The students are more easily assimilated into the organization and are inculcated with a spirit of loyalty to it.

Co-operative students may be placed with small industrial concerns which do not see the necessity or advantage of employing technically trained men. Such firms are educated to the value of technically trained personnel and of scientific methods, and are thus included among those benefiting from results of engineering education.

Industries have found it more difficult to obtain suitable personnel for the operations of plants and processes than they have to obtain competent designers. The co-operative plan furnishes men having a background of experience and point of view which is indispensable in the line of operating work. Technically trained men will be required more and more for work of this character.

THE PLAN IN OPERATION.

In thus emphasizing the principles of co-operative education and the advantages claimed for it by its advocates, it is, of course, recognized that the full accomplishment of the objectives outlined depends upon a careful organization of the school and plant phases of

the co-operative program and a close correlation of the technical training and practical experience obtained by the student. In operation the degree to which this has been accomplished by different institutions has varied from cases where the co-operative work appeared to have had little value aside from providing an earning power to enable the student to continue his college work, to cases where there have been well organized school and plant programs, closely co-ordinated.

Among the factors influencing the effectiveness of the co-operative program, none is more fundamentally important than the relationship between the school and the plant and the relationship of the student to the school and the plant. In adopting the co-operative principle for the part of its educational program dealing with the training of young men of future potential, the General Motors Institute of Technology has had the advantage of unique relationships which gave it a very constructive setting.

The program of what is now the General Motors Institute of Technology was originated for the industries of Flint and was organized as the Educational Department of the employees' organization (now known as the Industrial Mutual Association) with the sponsorship of the manufacturers association consisting almost entirely of the managers of the industries of the city. It thus had a close and constructive relationship with the managements of the industries with which co-operative relations were established, and also with the employed personnel of those industries through its connection with the employees' organization.

BEGINNINGS OF THE PROGRAM.

The Co-operative Engineering Course of this institution is an outgrowth of the foremanship development program originated for Flint under these auspices in the early stages of the foremanship training movement and continued and extended as one of the pioneer programs in the field. This foremanship program was developed with the active co-operation of an advisory committee of leading executives of the plants. After it was well established, consideration of the problem of potential for future responsible positions led to several years of what was really research and experimental work in this branch of training, and finally to the establishment of the co-operative program.

The development work was started without any preconceived idea as to the nature and extent of the training that would be required. It was approached from the standpoint of the plant and the requirements of the positions, both present and potential, for which training should be given. As finally organized, it consisted of a four-year program of college grade for admission to which high school education, or equivalent, was required.

The periods of alternation were set at four weeks, and from the beginning the principle was established that the students would be selected by the plants in co-operation with the Institute. The first two years of the Institute program covered the fundamentals of engineering, and during the last two years major emphasis was placed upon the principles of industrial engineering and their application to the manufacturing phases of the automobile industry. Work schedules were organized for the plant periods, in which careful consideration was

given to correlation with the Institute training and the accomplishment of the fundamental objective of the program.

This objective or aim of the course as originally expressed was "to develop an engineer with training in both the theory of engineering and its practical application in the factory, so that the student fits himself for various types of engineering positions in the industries with such a foundation that as he gains experience, he might qualify for responsible positions of an executive type."

The first class was started in the fall of 1924 and consisted of twenty students. The following year the entering class numbered thirty-eight. The three General Motors units in Flint -- Buick Motor Company, Chevrolet Motor Company, and A C Spark Plug Company -- co-operated , and during the first year the Flint Varnish and Color Works also co-operated.

It was during the second year of the co-operative program that the General Motors Corporation became interested in the Institute, provided a campus of approximately ten acres, a building of sixty thousand square feet of floor space (since increased to over one hundred thousand square feet) and arranged for the extension of the program to all the Divisions of the Corporation under the present name.

During the four years since that time the Co-operative Engineering program has been rapidly extended. Practically all the Divisions of the Corporation are now co-operating, the number of students has increased to over six hundred, and there has been an extensive development of the program to take full advantage of the close relationship between the Institute and the Divisions of the Corporation in making the training as effective as possible. The balance of this discussion

will deal with the more significant features of the work of development and of the program in its present form.

PRELIMINARY REVISED AND EXTENDED PROGRAM.

The program in its present form is the result of an extensive study and investigation of the engineering curriculum and, in fact, the entire program in the light of the experience of the first six years and its relation to the various Divisions of the Corporation. The original program had been organized for the industries of Flint and then extended to the entire Corporation. The aim of the study was to make such revisions and extensions as were necessary to serve more adequately the needs of all the Divisions of the Corporation.

This study was initiated with a committee of executives and engineers from the plants, and resulted in setting up a preliminary program in the general form indicated in Chart I,with a corresponding preliminary schedule of courses.

It will be noticed that this program divides itself into two main parts:

(1). The first two years designed to give a basic engineering training followed by,

(2) The third and fourth years offering the choice of three courses: Plant Engineering, Industrial Engineering, or Product Engineering, the latter divided into two sequences covering the Body or Automotive phases of the work.

In planning the program, it was recognized that to be of greatest value, it should be flexible to meet the varying conditions in the training problems of the Divisions of the Corporation. In some cases,

conditions would make it advisable to enter students for periods less than the full curriculum. For example, students might be entered for the first two years of basic training. In other cases plant conditions or the situation and training of the student might make it advantageous to both plant and individual to arrange for the completion of the co-operative training at the end of a period of work such as the first, second, or third year.

It has been common experience in all schools that a certain number of students find it either desirable or necessary to leave before the completion of their courses. It was the aim of the development of the program to give all students who, for any reason, would be leaving before the completion of the full course, consideration in their training program so that they would be prepared for effective employment in the plants at the end of any school year, in general increasingly so with the number of years spent in the program.

The program, therefore, was planned to provide in the first two years a training of such a nature that the student who ends his course at the end of this period may be prepared immediately for work of a technical nature, and in some cases for skilled mechanical, or minor supervisory positions.

Similarly in the organization of the curriculum for the first year, attention was given to providing the student ending his course at this point with a well rounded training of practical value for employment in mechanical and in some cases detail drafting work in the plants.

The curricula for the third and fourth years was laid out to meet the objectives which their names would indicate, and, in addition, give consideration to the organization of the third year subjects so as to provide the most effective training for the student who finds it advis-

able to terminate his course at the end of this year.

Terminal points were thus provided at the end of the first, second, and third years, making the program flexible as to time. The different sequences for the third and fourth years, and in some cases detail course organization, were designed to make it flexible as to subject matter. At the same time the curriculum was, of course, so planned as to provide a program of consecutive years in which each builds on the foundation laid by the preceding year.

PLAN OF PROGRAM DEVELOPMENT.

In the work of program development, it was recognized --

(1). That the purpose of the Institute is to serve the Divisions of the General Motors Corporation, and the work of program development, therefore, should be so directed in the first place as to meet the needs and objectives of all the Divisions insofar as they could be determined.

(2). That the course organization should be so directed that:

(a) The material covered in each course should be of greatest functional value considered from the standpoint of the training the student needs to meet the demands of his situation in the plant.

(b) The instructions given in each department should be so correlated with that given in other departments and the experience gained by the student in the plant as to form a unified program of maximum value.

The work of curriculum development, therefore, naturally divided itself into two parts --

(1) A general survey to determine the needs and objectives of the Divisions with reference to Co-operative Engineering and the extent to which they needed to avail themselves of the various features of the revised program.

(2) The work of detail course organization in accord with the findings of the plant survey and the objectives outlined above.

PLANT SURVEY.

A general plant survey therefore was conducted. Conferences were held with the managements of the Divisions covering points regarding which information was needed for an intelligent detail program development. These points, in a general way, may be summarized as follows:

I. Types of Students and Methods of Selction.

(A) Criticisms and suggestions growing out of experience to date.

(B) Types of entering students to be selected by the Divisions.

(C) Standards of selection and methods used.

II. Number (approximate) of students (graduates) needed annually who have completed two or the full four years of the program. (The one and three-year terminals were for the purpose of the survey considered special cases.)

(A) How determined as to numbers and individuals.

(B) Departments of work to which they will be assigned

on completion of their course.

(1).Types of beginning jobs in each department.

(2) Most probable types of jobs in each department for which it is desirable that they qualify in the future.

(C) Number of those carried through four years assigned to --

(1) Plant Engineering

(2) Industrial Engineering

(3) Product Engineering.

(D) Work Schedules for men in each branch of the program.

(1) Variations from regular schedule for first two years, if any.

(2) Amount of basic and general shop training in last two years.

(3) Special training directed in field or department of work for which student is being trained.

(E) Curriculum.

(1) Points of special emphasis in general and basic courses.

(2) Special emphasis desirable for all or any groups of students of Divisions.

Growing out of these conferences, a detail survey was instituted in the departments in which co-operative engineers of the right type might be placed to advantage upon completion of their training. This survey covered not only the types of jobs for which the student might be expected to qualify after completion of his training, but also the suggestions of the head of the department as to points that should be emphasized in plant work schedules and in courses of instruction at the Institute in order that the student might be prepared for the work of the department.

In some Divisions the department survey has led to the formation

of more or less formally organized committees or councils of department heads for joint consideration of the training problem, follow-up and improvement of the program in the light of experience. In other cases the management itself performs this function.

The department survey has accomplished a number of important results.

(1) It has set up a "training pattern" for each Division with reference to the Co-operative Engineering program.

(2) It has provided definite information and suggestions of department heads as to the plant and Institute phases of the program to serve as a basis of program improvement.

(3) It has enlisted the interest and co-operation of the men through whom the program must function, if it functions at all and, therefore, a means through which it may be improved constantly from year to year in the light of experience.

DEVELOPMENT OF PROGRAM FOR 1930-31.

With the findings of the plant surveys organized and related to the preliminary program as a basis, the revised and expanded Co-operative Engineering program has been organized in final form for the year 1930-31. The objectives were reviewed and restated, the schedule of courses in the curricula was arranged with each course outline fully detailed, and the plant phases of the program given careful consideration. A Manual covering points and procedures involved in the plant phases of the program and their co-ordination with the Institute training, has been issued and also a Standard Practice for student co-ordination reports.

The cardinal point kept constantly in mind in this development has been to so formulate the program as to best serve all the Divisions of the Corporation by providing a training for the students covering the essential technical fundamentals and practical training closely correlated with plant conditions and work so as to prepare him to meet the demands made upon him by his Division.

Fortunately it has been possible in one program as finally organized (see Charts I to V) to meet, with one possible exception, every important objective indicated so far either by the Advisory Committee or through the plant surveys. The one possible exception needs further study and may require either a number of electives or another third and fourth year sequence to adequately provide for it.

The survey indicated that the Industrial Engineering Sequence is still the important field from the standpoint of numbers, with the Product Engineering and Plant Engineering following in order. Considerable interest is indicated in the possibilities of the sequence in Body Engineering. A field for a considerable number of two-year men and some three-year men was indicated, as well as for the four-year men. The total figures from the survey (not entirely complete) are: two-year men, 64; three-year men, 12, (Industrial Engineering Sequence); four-year men, (Industrial Engineering), 179; (Product Engineering), 41; and (Plant Engineering), 18. These figures are considered relative in character, Actual annual requirements depend upon factors, many of which are variable. These factors are considered when the annual quotas are set each year.

PURPOSE OF THE PRESENT PROGRAM.

The statement of the purpose or objective of the program has not been changed greatly. As now stated, "The purpose of the Co-

operative Engineering Program is to give young men entered in the course by Divisions of the Corporation, a training in both the theory of engineering and its practical application in the factory, so that they will be prepared at the completion of their course for positions in various phases of work in industry with such a foundation that, as they gain experience, they may develop and qualify for more responsible or technical positions in the future."

RELATIONSHIP OF THE STUDENT TO THE PLANTS AND THE INSTITUTE.

The relationship of the students to the plants and to the Institute remains unique and of such a character as to contribute to a close co-ordination of these two agencies of training. Students admitted to the course are selected by the Divisions of the Corporation, in co-operation with the Institute, and throughout their course are recognized at the Institute and at the plant as employees of the Divisions in training for future responsibilities in their organizations rather than students of the Institute for whom arrangements have been made for certain practical experience in the plants. This relationship is fundamental in the program as organized and is a most important factor in the effectiveness of the training that is given.

THE CURRICULA.

The courses included in the curricula have been carefully planned and arranged with due consideration to instruction results, administration and employability of the student. Emphasis has been placed upon making the program flexible and readily adaptable to varied

conditions as to students or plants. Full advantage has been taken of the suggestions and advice of interested engineers, technical experts and executives in positions to evaluate, from a plant standpoint, the essential requirements for their special fields. These suggestions have been particularly valuable in the applied phases of the program.

The resulting curricula has a number of features which are worthy of mention.

Reference has already been made to the employability of the student at the end of any year, with increasing effectiveness as the years advance. This is accomplished through emphasizing subjects of a very practical nature in the beginning years, without omitting any of the essential fundamentals of engineering and also by a rearrangement of the order of sequence of subjects as more usually given.

For example, the fundamentals of chemistry and that part of physics dealing with the principles of mechanics are placed in the first year, with the result that the student is equipped with those fundamentals of the subjects of most probable value, should he find it desirable, expedient or necessary to terminate his course at the end of the first year.

The science courses of physics and chemistry are continued through the second year with similar considerations for the student who might terminate at the end of that year, as well as for preparation for following sequences of courses. Emphasis in these and other advanced courses has been placed upon the tie-in with other departments of work and the correlation of the principles of the physical sciences in their

various branches together with their practical application to engineering and industry.

Mathematics courses have been organized on a flexible unit basis with attention to correlation with other courses, particularly science, shop, and drawing, and with the introduction of engineering problems obtained from the plants and other departments.

More than usual attention has been given to mechanical drawing and applied courses in this field, and to the use of practical problems from Divisions with which the students co-operate, so as to make it possible to definitely tie in his training with the practical types of work met with in the plant of his division. Attention has been given to the craftsmanship side of these courses as well as the technical.

Emphasis in the English courses, particularly in the early years, has been placed upon co-ordination report writing and assisting the student to make these reports a more constructive factor in his training and through this means more definitely vitalize the training of this department.

In the advanced courses of the third and fourth years, and particularly the more directly applied courses, attention has been given to utilization of the experience of the student during his work periods and also to maintaining a very close tie-in with the plants,using where practical, problems and projects supplied by the plants, closely related to plant conditions and methods so that the student will be prepared to perform the work that he will be called upon to do as indicated by the surveys. In this, the importance of thorough training in fundamental principles has not been overlooked.

In this development work, interesting confirmation was found

of many of the principles applied in the original program. The wider field, the increased contacts, and the more extensive survey led to changes and extensions, making possible broader applications, and also laid the foundation for constant improvement based upon experience from year to year.

THE PLANT PHASE OF THE PROGRAM.

An important factor in the effectiveness of any co-operative plan of engineering education is the way in which the work schedules of the students are arranged and the co-ordination of the practical experience there obtained with his technical instruction.

The relationships of the student in the program under discussion are such as to make for a close co-ordination. As previously explained, instead of being considered students of the Institute placed in the plant to obtain some practical experience, as in the case of the usual co-operative course, the students are recognized as employees of Divisions of the Corporation entered in the program for training for future responsibilities in the organization of the Division that enters them. In each Division one executive, usually connected with the personnel department, is assigned the responsibility for the functioning of the program in the plant. There is, therefore, in effect a resident co-ordinator at each plant co-operating.

In the organization of the program, it was recognized that the effectiveness of co-ordination depends upon --

(1) Well organized work schedules.

(2) Well planned schedules of co-ordination reports.

(3) Full reports of progress of the students in the plant and

in the Institute.

(4) Co-ordination follow-up and guidance of the students.

WORK SCHEDULES.

The students' work in the plant must be as carefully planned as the curriculum in the school if they are to receive maximum benefit from the co-operative plan. Individual differences between students and differing conditions in the plants may, of course, make variations in training programs advisable, but these changes should be made from definite work schedules determined in advance.

One or more work schedules have, therefore, been planned for each plant by the management of the Division with the advice of the Institute staff. There has been a review of work schedules each year for the past three years at conferences of representatives at all co-operating divisions. This year, careful consideration is being given to experience requirements indicated by the department surveys. In the case of some smaller plants, the experience of the students is broadened by schedules arranged by mutual agreement between two or more plants. Sample work schedules are attached. (Charts VI to VIII)

These work schedules are organized with a view to --

(a) Provide definite work for the student and give him the opportunity to make good as a workman on the job.

(b) Provide a thorough, basic mechanical and technical training as a foundation for future work in the student's Division.

(c) Provide a broad experience to aid in determining the lines in which the student will most likely succeed.

(d) Provide for some practical experience directed into the fields of the student's respective choice.

While the co-operative program covers a period of four years, the full program in reality contemplates a fifth year in full time training following a schedule of work directed into the field of the student's choice or such part of this fifth year as may be necessary to provide for qualification in natural course of development for a beginning job in this field.

CO-ORDINATION REPORTS.

In order to contribute to the effectiveness of the training which the student receives during his work periods, co-ordination reports are required. These are written during the periods in the plants and upon some phase of the work upon which he is engaged during that month. This normally means one written report each month the student is in the plant, or six per year. Topics are suggested by the foreman and plant representative and are definitely formulated so as to co-ordinate with the program by the co-ordination staff of the Institute.

The completed reports are read by the student's foreman or some other person in the plant well versed in the technical contents of the reports, and are graded by them on definiteness with which the topics have been covered, accuracy of technical content, and completeness.

Also, in the plants the reports are read and graded by the plant representative with reference to their merits from a plant standpoint.

At the Institute, the reports are read and graded by members of

the Co-ordination and English instruction staffs.

PROGRESS REPORTS.

Reports of plant progress are made to the Institute by the plants at the close of each four-week work period, and to the plant by the Institute at the close of each four-week school period. (See forms IX and X attached).

CO-ORDINATION CONFERENCES:

Co-ordination conferences are held each week during school periods under the direction of the Co-ordination staff. At these conferences, school and shop problems as they pertain to co-ordination, are discussed and the students helped to better understand their relation to their co-operative program.

RECORDS, STUDENT FOLLOW-UP and GUIDANCE.

In this program of co-ordination, information concerning the student's grades and experience in his course is collected and recorded at the Institute, forming a history of each student. This is a valuable aid in determining the true standard of performance of the student and his possibilities for the future.

Through this close check of the student's job and school records, together with close personal contact of the co-ordination staff of the Institute and the plant representative, it is possible to determine early those students who, because of lack of ability or

otherwise, do not measure up to the standard desired. Frequently these students drop out of their own initiative. If they do not, consideration is given by Institute staff and plant management for completion of their training in regular order at the first or second year terminals. Students who for other reasons should terminate at these points, are also given similar consideration by Institute and plant.

Toward the end of the second year, a complete survey of the student's record is made by the Institute and plant management to determine whether it would be most constructive for the student to terminate or continue into one of the third and fourth year programs. In case it is decided that he should be continued, decision is made as to the program he should follow at the Institute and corresponding arrangements made in his work schedule. The part of this procedure dealing with the three Junior and Senior sequences was, of course, followed for the first time this year.

Toward the end of the third year, another check is made as to the student's record and promise for the future, and toward the end of the fourth year a survey is conducted among members of the Institute staff of points that should, in their judgment, be considered by plant and student as arrangements are made, looking toward his placement in a special field of work.

SCOPE OF THE PROGRAM.

The scope of the Co-operative Engineering course and its relation to the full educational and training program of the General Motors Institute of Technology probably can be shown best by the

following tables from the annual report for the year 1929.

I. ENROLLMENTS (Number People Reached) DURING 1929.

(a) Co-operative Engineering		619
(b) Co-operative Trades		92
(c) Buick-Marquette Authorized Service		92
(d) Co-operative Buick-Marquette; Oakland-Pontiac		100
(e) Spare Time Program --		
Winter Term	1425	
Spring Term	1335	
Summer Term	320	
Fall Term	2106	5186
(f) Conference Leadership Training Program (Executive Training Program)		81
(g) Conference Leadership Training Program (General Motors Export Company)		11
Total Enrollments at Institute		6182
(h) Extension - General Motors Executive Training and (general) Training Programs		5295
Grand Total		11,477

II. ENROLLMENTS IN CO-OPERATIVE ENGINEERING.
By Plants and Classes -- Year 1929-30.

Plant or Division	Classes 1st Year	2nd Year	3rd Year	4th Year	Total
A C Spark Plug Co.	8	3	1	2	14
Armstrong Spring Co.	1	1	0	0	2
Brown-Lipe-Chapin Div.	4	4	2	0	10
Buick Motor Company	34	26	18	18	96
Chevrolet Motor Co.	24	25	14	8	71

Plant or Division	Classes 1st Year	2nd Year	3rd Year	4th Year	Total
Cadillac Motor Car Co.	19	14	9	3	45
Chevrolet Motor Ohio Co.	6	4	1	2	13
Chevrolet, Bay City	2	0	1	1	4
Delco-Light Company	4	4	2	0	10
Delco-Remy Corporation	11	11	3	2	27
Delco Products Corp.	8	5	3	0	16
Fisher, Cleveland	4	10	0	0	14
Fisher, Detroit	16	5	1	0	22
Fisher, Flint	5	3	10	1	19
Fisher, Lansing	1	1	0	0	2
Fisher, Pontiac	4	5	3	0	12
Fisher, St. Louis	0	1	1	0	2
Frigidaire Corporation	12	6	2	6	26
General Motors of Canada	19	14	12	0	45
General Motors Export Co.	2	0	0	0	2
General Motors Truck Corp.	12	8	0	0	20
Harrison Radiator Corp.	1	3	4	0	8
Inland Mfg. Company	1	2	1	0	4
Jaxon Steel Products	5	5	2	0	12
Muncie Products Div.	6	5	1	0	12
Oakland Motor Car Co.	12	9	5	3	29
Olds Motor Works	7	7	5	1	20
Saginaw Grey Iron Foundry	8	3	1	0	12
Saginaw Crankshaft Division	1	0	2	1	4
Saginaw Malleable Iron Div.	3	2	1	0	6
Saginaw Steering Gear Div.	3	1	2	0	6
Ternstedt Mfg. Co.	7	7	0	0	14

RESULTS.

The results that have been derived from this program may be classified under two heads -- indirect and direct.

The indirect results have been largely in the effect that the co-operative program has had in increasing the interest of executives throughout the Corporation in personnel and in developing a training consciousness throughout the organization. This has been a big factor in the effectiveness of direct training programs for regular employees of the Divisions.

The direct results must be measured in terms of the accomplish - ments of those who have completed the program. It is as yet too early to obtain a very accurate and reliable measure of this, but the facts that are so far available are favorable in nature, in some cases remarkably so.

There were seventeen graduates in the first class and thirty-three in the second. All are still working for the Divisions with which they co-operated, with five exceptions; one left the Corporation to be with his mother who is ill, and five have transferred to other Divisions of the Corporation. Eight are serving in supervisory positions, two in personnel, twenty-one in technical positions, one in sales, one in service, and the remainder in continuing (fifth year) training.

A regular check is made semi-annually of the record of the graduates. In this survey, the immediate superior of the graduate and other executives in a position to be familiar with the work of the individual, are interviewed as to his record and the promise shown

for the future. The graduate himself is also interviewed to determine his personal view of his experience and the direction in which it is taking him. Points of importance to either the individual or the management, growing out of the survey, are brought to their attention in the proper way. The findings of this survey also are evaluated from the standpoint of their suggestions as to improvement of the program.

CONCLUSION.

Representing, as it does, a development covering six years of work and experience in the operation of the program and in its present form a composite of the suggestions of engineers and executives from all the Divisions of the General Motors Corporation, correlated and organized into a unified program in the light of this experience by the Institute staff, the Co-operative Engineering program gives promise of insuring to the Divisions of the Corporation a source of young men technically trained, specifically for their own organizations. The fact that the training combines technical instruction closely applied to the practical problems of the plants with the experience in the factory organized and directed by the executives of these organizations, makes it possible, as indicated by experience so far, for these young men, upon completion of their training, to fit naturally into the factory organizations, quickly qualify for various types of technical positions in the plants, with such a foundation that as they gain further experience and maturity, they become good potential material for executive

positions.

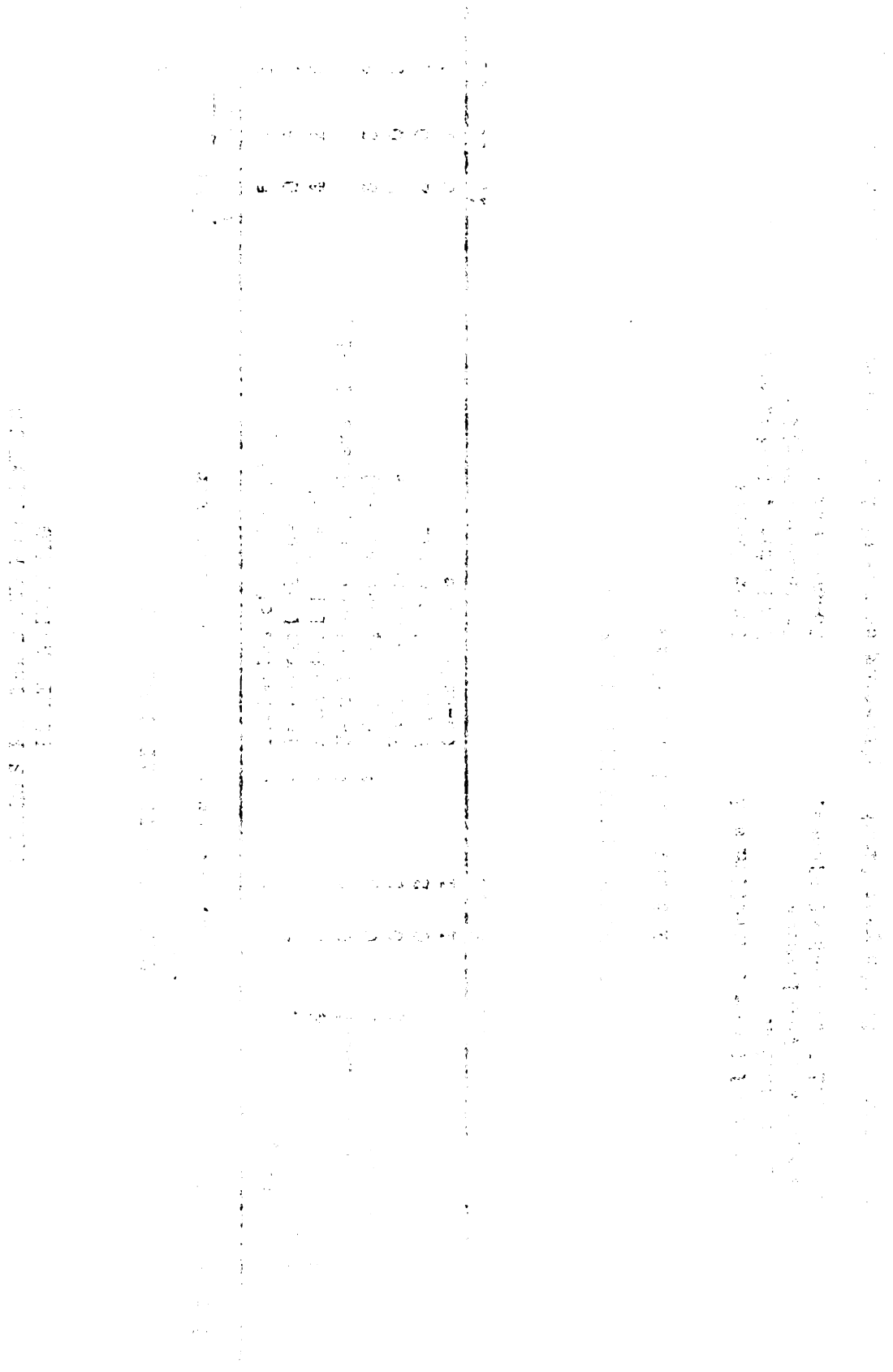
While it is felt that the present program is probably the most effective that could be organized at this time for the purpose in view, the foundation also has been laid for constant improvement based upon experience and the suggestions of large numbers of men in the Divisions who have been brought in touch with the program and its operations and are thus in a position to contribute to its improvement.

The program, therefore, gives promise of contributing to a considerable degree to the solution of the personnel problem referred to at the beginning of the discussion, insofar as potential for future technical and responsible executive positions is concerned.

What its future development will be -- in fact, what the future of the entire program will be -- can be determined only by time. Alfred P. Sloan, Jr., President of the Corporation, referred to this point in a recent letter to the stockholders regarding the Institute. He said:

"The Institute is but in its beginning. It has not arrived at the ultimate. That will take time. It must be developed by evolution as experience proves the needs. Measured in terms of what may be done through the courses of study made available to selected employees of General Motors, just a step in the right direction has been taken. It is not possible to measure the results in dollars, but what has been done proves that the Institute is an investment in man power, earning and paying real dividends directly to our men in the form of opportunity for progress and advancement, and therefore it is an intangible but a valuable asset of General Motors."

C H A R T S



WORK SCHEDULE FOR CAR DIVISION

Industrial Engineering Sequence.

YEAR	WORK MONTH	DEPARTMENT	NATURE OF WORK
First	1st Month	Tool Room, Die Room	Machine Tool Oper.
	2nd Month	or Machine Rep.	Machine Tool Oper.
	3rd Month	" "	Machine Tool Oper.
	4th Month	" "	Machine Tool Oper.
	5th Month	" "	Machine Tool Oper.
	6th Month	" "	Machine Tool Oper.
	Objective for Year - Basic Training.		
Second	1st Month	Tool Room, Die Rm.	Mach. Tool Oper.
	2nd Month	or Machine Rep.	Mach. Tool Oper.
	3rd Month	" "	Bench Work
	4th Month	Tool Drafting Room	Board Work
	5th Month	Tool Drafting Room	Board Work
	6th Month	Tool Drafting Room	Board Work
	Objective for Year - Basic Training.		
Third	1st Month	Tool Drafting Room	Board Work
	2nd Month	Tool Drafting Room	Board Work
	3rd Month	Tool Drafting Room	Board Work
	4th Month	Mfg. Planning	Board work
	5th Month	Mfg. Planning	Board work
	6th Month	Mfg. Planning	Board work
	Objective for Year - Basic Training		
Fourth	1st Month	Foundries & Heat Treat.	Foundry & Heat Tr.
	2nd Month	Foundries & Heat Treat.	Foundry & Heat tr.
	3rd Month	Prod. Assemblies	Assembies
	4th Month	Prod. Assemblies	Assembly
	5th Month	General Offices	Specialized
	6th Month	General Offices	Specialized
	Objective for Year - Basic & specialized training for permanent positions.		

WORK SCHEDULE FOR CAR DIVISION

Product Engineering Sequence.

YEAR	WORK MONTH	DEPARTMENT	NATURE OF WORK
First	1st Month	Machine Repair	Lathe Oper.
	2nd Month	Machine Repair	Lathe Oper.
	3rd Month	Machine Repair	Mill Oper.
	4th Month	Machine Repair	Mill Oper.
	5th Month	Machine Repair	Shaper Oper.
	6th Month	Machine Repair	Shaper Oper.
	Objective for year - Basic Training		
Second	1st Month	Tool & Die Room	Planer Oper.
	2nd Month	Tool & Die Room	Planer Oper.
	3rd Month	Tool & Die Room	Grinder Opr.
	4th Month	Tool & Die Room	Grinder Oper.
	5th Month	Tool & Die Room	Bench Work
	6th Month	Tool &Die Room	Bench Work
	Objective for year - Basic Training.		
Third	1st Month	Production	Production
	2nd Month	Production	Production
	3rd Month	Plant Layout	Plant Layout
	4th Month	Plant Layout	Plant Layout
	5th Month	Time Study	Time Study
	6th Month	Time Study	Time Study
	Objective for Year - Basic Training.		
Fourth	1st Month	Experimental	Experimental
	2nd Month	Experimental	Experimental
	3rd Month	Experimental	Experimental
	4th Month	Engineering	Specialized
	5th Month	Engineering	Specialized
	6th Month	Engineering	Specialized
	Objective for year - Basic and Specialized Training for Permanent Position.		

WORK SCHEDULE FOR ACCESSORY DIVISION

Industrial Engineering Sequence.

YEAR	WORK MONTH	DEPARTMENT	NATURE OF WORK
First	1st Month	Production	Production
	2nd Month	Production	Production
	3rd Month	Production	Production
	4th Month	Production	Production
	5th Month	Inspection	Inspection
	6th Month	Inspection	Inspection
	Objective for Year - Learn to be a good workman - better understanding of worker - acquaint themselves with our product.		
Second	1st Month	Tool Room	Tool Room
	2nd Month	Tool Room	Tool Room
	3rd Month	Tool Room	Tool Room
	4th Month	Tool Design	Tool Design
	5th Month	Tool Design	Tool Design
	6th Month	Tool Design	Tool Design
	Objective for year - Get a good foundation along machine and tool work to serve as a basis to build on later.		
Third	1st Month	Plant Layout	Plant Layout
	2nd Month	Plant Layout	Plant Layout
	3rd Month	Production	Prod.with Plant Supt.
	4th Month	Production	Prod.with Plant Supt.
	5th Month	Production	Prod.with Plant Supt.
	6th Month	Production	Time Study
	Objective for year - Become better acquainted with the aims and methods of organization - An opportunity to discover the line of work they are best suited. Make contacts that will enable him to sell himself upon graduation.		
Fourth	1st Month	Engineering Lab.	Engineering Lab.
	2nd Month	Engineering Lab.	Engineering Lab.
	3rd Month	Service	Service
	4th Month	Service	Service
	5th Month	Production	Prod.with Plant Supt.
	6th Month	Production	Prod.with Plant Supt.
	Objective for Year, (Same as for third year)		

GENERAL MOTORS INSTITUTE OF TECHNOLOGY
FLINT, MICHIGAN

STUDENT PROGRESS REPORT

DATE_____

STUDENT_____

COURSE_____

SCHOOL PERIOD ENDING_____

SUBJECT	MTH.	SEM.	FIN.

THE ABOVE REPORT IS SUBMITTED FOR YOUR INFORMATION.

ALBERT SOBEY, DIRECTOR.

KEY—E EXCELLENT—G GOOD—F FAIR—D DEFICIENT—
S NOT PASSING—INC. INCOMPLETE

15M-10-29-34199-BMF

GENERAL MOTORS INSTITUTE OF TECHNOLOGY
PROGRESS REPORT—CO-OPERATIVE ENGINEERING STUDENT

Mr._____ Department_____ Division_____

Kindly fill out the following report of the work and conduct of the indicated Co-operative Engineering Student who has been working in your plant during the period indicated. This information is requested to assist the Institute in determining the student's progress and also his capacity and aptitude in practical work. The report will form a part of the student's permanent record at the Institute.

It is suggested that the person having the most intimate knowledge of the student's work make the rating by comparing him with the average man in the same department. The relative position of the check in the space provided will give the student a definite grade for each characteristic.

Student_____ Year_____ Period_____ to_____

Plant_____ Dept._____ Clock No._____ Rate_____

Nature of job to which student was assigned for the period_____

CHARACTERISTICS	INDICATE STUDENT'S RATING WITH CHECK MARK				
ATTITUDE TOWARD WORK	ENTHUSIASTIC	INTERESTED	AVERAGE	INDIFFERENT	NOT INTERESTED
WORKMANSHIP	EXCEPTIONAL	ABOVE AVERAGE	AVERAGE	FAIR	POOR
COOPERATION	EXCELLENT	WILLING	AVERAGE	INDIFFERENT	OBSTRUCTIVE
CONDUCT	EXCEPTIONAL	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	TROUBLESOME
FITTING INTO DEPARTMENT	EXCEPTIONAL	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE	MISFIT
EVIDENCE OF FUTURE VALUE	EXCEPTIONAL PROMISE	Learns Readily Good Timber	AVERAGE PROMISE	Learns Slowly Quest. Promise	NO FUTURE PROMISE
ATTENDANCE	REGULAR ☐	IRREGULAR ☐	NUMBER OF DAYS ABSENT		
PUNCTUALITY	REGULAR ☐	IRREGULAR ☐	NUMBER OF TIMES LATE		

Remarks_____

Suggested Subjects for Coordination Report Assignments for Next Work Period_____

Date_____ Signed_____

GENERAL MOTORS INSTITUTE OF TECHNOLOGY
Department Survey - Co-operative Engineering Program

Division _____ of General Motors Corporation.

Department _____ Job Sequence No. _____

Following is a list of the jobs in this department for which co-operative engineering graduates might be expected to qualify. These jobs are arranged in the probable order of advancement in future years as the man gains experience. Recommendations regarding various feature of the training in the plant and Institute during the co-operative period are given below.

Job Sequence

_____

_____

_____

_____

_____

_____

_____

Approximate number of graduates needed annually to start on this sequence _____

Length of co-operative training required for this sequence. . . 2 yrs.___ 4 yrs.___

If 4 years' training is required, check branch of engineering curriculum which student's training at Institute should follow during the last two years. (Plant Eng. ____ (Indus. " ____ (Product " ____ (Automot. ____ (Body ____

If special training not covered by these courses is desired, kindly include with your recommendations in space below.

Points which should be emphasized in plant work schedule for men in training for this department, or necessary changes.

Points which should be emphasized in course of study specified above for men in training for this department.

Date _____

Signed _____

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4/2011