

Technical Training In Industry

A Survey of Professional Up-Dating in Twenty-Five Companies

JACK ROCKETT

During the month of May, 1964, the Esso Research and Engineering Company undertook a survey of technically-oriented companies to determine what kinds of educational programs were being offered to the technical employees. The purpose of this survey was to determine the types of program which were being pursued and the particular differences which occurred from one company to another. Also, it was of interest to determine whether any patterns of difference might emerge from one industry to another. Responses to the questionnaire were obtained from three aerospace organizations, nine chemical companies, nine petroleum companies, and four electrical companies. This report will summarize the data which was obtained from these 25 companies.

Training in the various areas of business administration and sales work has long been accepted by the business community for the development of the executive and sales staff. The introduction of technical training for the tech-

nical staff is newer, but its acceptance is now reasonably complete.

The scope of the training effort, it was found, varies considerably from one company to another. Whereas a few content themselves with tuition refund plans, others are deeply committed to continuing education on a broad scale. Graduate school at company expense is no longer a novelty. Courses on the company site, both academic and company oriented, are to be found more often than not. The concept of technical education provided by the employer for the employee is growing, and management, it appears, is not dissatisfied with the results.

Summary of Findings

The questionnaire indicated six predominant types of educational programs.

1. A formal program leading to a degree
2. A program of technical courses which do not lead to a degree
3. A program of courses which are specific to the company technology

DR. JACK ROCKETT is a graduate of C.C.N.Y. and has an M.S. and Ph.D. in chemistry from the Pennsylvania State University. He was a research chemist for the Olin-Mathieson Chemical Company and for Esso Research and Engineering Company, during which period he obtained twelve patents. Two years ago he stepped into the role of Training Supervisor for the Esso Research and Engineering Company and has developed a program of graduate education for the technical employees.

4. A tuition refund program
5. A sabbatical leave program
6. Other non-degree educational programs

If we arbitrarily give one point for participation in each type of program, then a maximum score of six is possible for any company. The average values obtained for each of the four industries are as follows:

Electrical Industry — 5.3

Aerospace Industry — 5.0

Petroleum Industry — 4.0

Chemical Industry — 3.1

The overall average for the 25 companies is 4.0. These numbers, of course, do not reflect the quality or the scope of each training program. However, in broad perspective, they do indicate the relative commitment of each industry to technical training.

Formal Program Leading to a Degree

One of the more interesting developments in industrial training is the growth of the program leading to an advanced degree. Some companies have found that the engineers and scientists hired with B.S. degrees are not adequately prepared for the work which they are required to do and that training to the M.S. level would be desirable. However, there is a distinct shortage of M.S. technical men. This shortage exists, to some extent, because men who take the M.S. degree tend to stay on for Ph.D. training.

A cooperative plan with a university, whereby the company makes it possible and/or mandatory for the B.S. employees to upgrade themselves has therefore been adopted by a number of industrial companies. A company-financed educational plan whereby B.S. technical

men are given graduate training to the M.S. level, assures that company of a dependable supply of well-trained employees.

Formal programs which lead to a university degree have been adopted by seven of the 25 companies. This type of educational assistance appears to be most popular in the aerospace industry (where all three companies report a program), and in the electrical industry (where three out of four report affirmatively). Only one petroleum company and none of the chemical companies report such a program.

In all seven of these companies, the programs are designed to train men to the M.S. level. However, three of the programs also give training to the B.S. level and four are extended to the Ph.D. level. Six of the companies involved here have affiliated with one or more universities to carry out their program. A total of 31 universities were mentioned as participating in these programs. Teaching is actually done either on the company site, at the university, or both. The teaching staffs are university professors, although three of the companies include non-degree courses taught by their own employees.

In all but one case the programs are undertaken voluntarily by the employee. In one company, the course is obligatory. The courses are the standard academic university courses, but four of the seven have added company courses to the curriculum. University credit is not given for these courses. They are "extras" required by the company.

A company counselor or committee assists each student in his selection of courses at six companies, and six of the seven report that the student is given

some choice in the courses he takes. At three companies there is a basic curriculum which must be taken.

All seven companies report that grades are given for the school work, six of the seven being A, B, C grades. Two companies also report using a pass or fail system. Three of the seven put the grade on a man's record, and four of the seven make the grade available to the supervisor. Three companies report that they consider these grades for the performance appraisal of the individual.

Three companies give university work on company time, using some definite formula. One allots three days per week the first year, two days the second year, and one day the third year for courses. The other two give four hours and eight hours per week respectively. All seven companies give courses in off hours.

In six cases, all of the tuition is paid by the company. The other company pays between 75% and 100%. The payments for fees, books and travel vary; six pay fees, three pay for books and two pay travel expenses. Only three companies replied that they paid full salary, one paid 70%, and another paid no salary, while the employee attended school. Two companies did not reply to this question.

Only one company attempts to obligate the employee to remain with the company at the conclusion of his training. This is formalized by a contract which obligates the employee to work for three times the length of his training.

Program of Technical Courses Which Do Not Lead to a Degree

Another interesting development in technical training is the presentation of academic technical courses, on the com-

pany site. These courses are generally not offered for credits at any university. They are simply arranged by the training department of the company for the sake of the knowledge to be derived.

Of the 25 reporting companies, 19 provide non-degree technical courses for their employees. All three of the aerospace companies, six out of nine chemical companies, five out of nine petroleum companies, and all four electrical companies are in this category. All of the 19 give courses on the company site. Thirteen also give courses at some other location. All of the 19 use company instructors. Eighteen also use university professors and eight companies also use consultants as instructors.

These programs are generally voluntary for their employees. However, three companies reported that employees are sometimes requested to take courses. Three companies make it obligatory for an employee to complete a course once begun.

Nine companies give course grades. This is particularly true in the aerospace (three companies) and electrical industries (three companies). Ten enter the grade on the personnel record and make it available to the supervisor. Seven stated that it would be used for performance appraisal.

Three companies give courses on company time exclusively and four give them on off hours exclusively. Twelve companies give courses in a combination of the two. Nine companies limit the number of courses taken simultaneously. The time schedule for a course may be two hours per week for 10-20 weeks, all day sessions for one or two weeks, all morning sessions for several weeks, etc.

Full salary is paid by 15 of the companies. The other four did not reply to this question.

Some typical courses which have been given in this category are listed in Exhibit I.

Program of Courses Specific to Company Technology

Another category of education which is offered technical employees is instruction specific to company technology. These courses differ from those in the previous category in that they are less academic and more concerned with company products and procedures. As might be expected, such courses have been in the industrial curriculum for even longer periods than were the academic courses.

Twenty-one of the 25 companies reporting have courses in this category. Only in the chemical industry were there companies which did not answer affirmatively in this category.

Nineteen of the companies give these courses on company time. Eleven companies also give them in off hours. The courses are voluntary in 15 companies. In 11 companies there are mandatory courses. Obviously, a number of companies have both voluntary and mandatory courses. Eleven require employees to complete these courses. Nine companies give grades in these courses, five being A, B, C grades and three being "complete" or "incomplete."

Some of the typical courses given in these programs are listed in Exhibit II.

Tuition Refund Program

Twenty-four of the 25 companies report that they offer tuition refund to their employees for courses taken at

universities. It is generally available to people at all levels of education.

The refund is complete in only seven companies. The remainder state that it is a partial refund, four giving 50%, five giving 75%, and three giving 67%. The maximum allowable for tuition refund also varies, figures of \$150, \$225, \$250, \$300, \$400 and \$500 being quoted by various companies.

Twenty stated that the refund depends on the grade. Six stated that at least a "C" must be obtained while nine require a "passing grade." One company gives 100% for an "A", 75% for a "B", and 50% for a "C". Another gives 100% for either an "A" or "B", and 50% for a "C".

Eight companies stated that they will give time off from work with pay to attend classes. In three of these companies the time allowed is 2 hours, 4 hours, and 7½ hours per week, respectively. The other five leave the time off allowance to the discretion of the supervisor.

Ten companies pay the registration and lab fees, three pay for books and fees, one pays 2/3 of books and fees, and one pays half of all of the extra expenses. One company pays for all of the extra expenses and six state that they will not pay any of the extra expenses.

Sabbatical Leave Program

A relatively new development in the industrial training picture is the sabbatical leave for graduate training. Generally speaking the companies that give them are quite selective in their choice of employees to receive this benefit. It is generally given to the higher rated technical people who still lack the M.S. or Ph.D. degree.

The sabbatical, of course, takes a different form in each company. Sometimes it amounts to a leave of absence, without pay or tuition payments. Generally speaking, however, there is financial help given.

Of the 25 reporting companies, 12 offer sabbatical leaves. Seven reported that they give sabbaticals to employees who request it. Nine companies give a salary to employees on sabbatical leave, seven are full salary, one is partial (70-80%), the other did not specify.

Five companies pay tuition, books, fees and moving expenses. One company pays tuition, books and fees; another pays tuition and fees only; one company pays tuition only. One company pays half of tuition and fees and all of moving expenses. Two companies pay none of these expenses. One company gives a \$2,500 fellowship in lieu of any other support.

Eight companies limit the sabbatical to one year. One allows up to 3½ years. Three companies state that they require their employees to return to the company after they have completed their sabbatical. All three formalize this with a contract.

The number of sabbaticals per year varies rather considerably from one company to another. A company with 4,500 technical employees gives 15 to 20. Another, with 3,800 gives 30. A company with 1,500 gives two and another with 2,000 gives five.

Other Non-Degree Educational Programs

Seventeen companies indicated that they give other types of education to their employees. Some of these are uni-

versity special courses, professional society meeting attendance, company orientation programs, company seminars, lectures, summer short courses, lectures by outside experts, and re-training for engineering supervisors.

Conclusion

The concept of technical education sponsored by industry for its own employees, is rapidly gaining recognition and acceptance. The type of program varies from company to company to suit the particular needs of each. However, there are certain patterns emerging along the principal lines indicated in this report—graduate training for a degree, technical academic courses, company oriented courses, tuition refund plans, and sabbatical leaves. Tuition refund has been known to industry the longest and has gained the widest acceptance. Company-sponsored courses, both academic and company oriented, are now becoming very popular as well.

The problem of technical obsolescence is of serious concern to all of the technical industries. It represents a challenge both to the technical employee and the technical employer. Some technical men, to be sure, will maintain their capabilities by diligent study of the current literature. Most of them, however, are frank to admit that it takes more than that to remain current with the extraordinary growth of scientific information. New fields of study are coming into existence which did not exist ten, or even five, years ago. Organized courses with expert instructors are the surest way to master these new areas of knowledge. There can be no substitute for education, and industry, it would appear, is rising to the challenge.

EXHIBIT I
TECHNICAL COURSES GIVEN BY INDUSTRY
WHICH DO NOT LEAD TO A DEGREE

Aerospace Industries

Contemporary Optical Physics, Cryogenics in Space Vehicle Design, Plasma Physics, Circuit Theory, Microwave Techniques, Analog Computation, Environmental Biotechnology, Heat Transmission, Thermodynamics, Theory of Plates and Shells, Wave Propagation, Atomic and Nuclear Physics, Elasticity and Hydrodynamics.

Chemical Industries

Lectures on Morphology of Crystalline Polymers, Phosphate and Carbamate Insecticides, Organic Semiconductors, Inductive Effects in Organic Chemistry, Novel Reductions With Metal Hydrides, Relation Between Wetting and Constitution, Cage Compounds, Phosphorus Chemistry, Alkylation of Ambident Ions, Advances in Photochemistry. Courses on Mechanisms of Organic Chemistry, Polymer Extrusion, Molecular Orbital Calculations, Organic Chemistry.

Petroleum Industries

Modern Organic Chemistry, Engineering Economics, Fractionation, Structure of Matter, Mechanical Properties of Polymers, Surface Chemistry, Advanced Inorganic Chemistry, Reactor Design, Heat Transfer, Rheology of Non-Newtonian Fluids, Advanced Hydrocarbon Chemistry, Chemistry of Organo-Metallic Compounds, Operations Research, Transport Phenomena.

Electrical Industries

Economics in the Modern World, Solid State Switching Circuitry, Technical Mathematics, Probability and Statistics, Basic Electronics, Microwave Transmission Lines, Feedback Systems, Transistor Electronics, Electromagnetic Fields and Waves, Calculus and Analytic Geometry, Differential Equations, Systems Engineering, Programming, Semiconductor Physics, Engineering Drawing.

EXHIBIT II
TRAINING COURSES WHICH ARE SPECIFIC
TO COMPANY TECHNOLOGY

Aerospace Industries

Electronics, Fortran, Analysis by Mechanized Methods, ASW Familiarization, Pop-Up Antenna Systems, Minuteman Control Systems, Launch Facility Check-Out, Celestial Mechanics, Engineering, Design and Operation of Manned Spacecraft, PERT Workshop, Procurement Management, Computer Programming, Report Writing, Correspondence Procedures.

Chemical Industries

Marketing, Technical Report Writing, Statistics, Organic Chemistry, Unit Processes in Chemical Engineering, Functional Areas of Operation, Management and Human Relations.

Petroleum Industries

Catalytic Cracking, Linear Programming, Statistics, Plastics, Economic Evaluation, Report Writing, Engineering Process, Chemical Processes, Control Systems, Professional Engineering License, Petroleum Chemistry, Electronics, Refinery Economics, Polymer Characterization, Fortran.

Electrical Industries

Solid State Devices, Color T.V., Computer Programming, Systems Engineering, Switching Theory and Practice, Transmission Systems, Signal Theory, Semiconductor Technology, Probability and Traffic, Logic.