THE ORGANIZATION AND CONTENT OF SEMI-PROFESSIONAL ENGINEERING CURRICULA IN JUNIOR COLLEGES

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CHAPTER I

THE PROBLEM

The purpose of this study is to determine what should be the organization and content of engineering curricula on a semi-professional level for junior colleges.

IMPORTANCE OF THE PROBLEM

The importance of the problem is evident for the following reasons:

Poor organization of present curricula. Semi-professional engineering education as it is now offered is not well organized. The curricula for the most part are centered around the shop courses of the high schools. There is no definite sequence of courses that go to make up the individual curriculum.

Lack of aims. There seems to be a lack of understanding of the aims of this type of education. Without a complete understanding of what the curricula is aiming to do for the student, success of the work in semi-professional engineering cannot be accomplished.

Demands of industry. In attempting to supply a need, it is necessary to fully understand what is wanted. It is essential to have a definite understanding of the demand of industry for men with a semi-professional engineering training.

Present offerings in institutions of college grade. In order to profit by the experiences of other institutions, it is necessary to understand that which has been done in the field of semi-professional engineering. Since this type of education is new, so far as the junior college is concerned, consideration of what has been done by the four-year colleges, technical institutes, and the public junior colleges is essential for the proper organization of engineering curricula.

In the study of the average junior college catalogue, it is evident that there is a place in the program for curricula of a pre-engineering nature. This type of curricula is not to be confused with what is termed semi-professional engineering. The former comes under the function of college preparatory, which today is acknowledged as an important reason for establishing a junior college. It has been very convenient for the junior college curriculum builder to list certain courses of the first two years of the professional college and feel that the junior college is meeting all the needs of the community. Consequently, little consideration has been given to the problem of the young man who is mechanically inclined but finds it impossible to spend four years in college. In view of these facts nothing has been done toward offering a curricula that will meet his needs. Thus, we find that the semi-professional engineering curriculum of the average junior college is poorly organized.

The four-year engineering institution has not in the past, nor can it be expected in the future, to prepare for the entire field of engineering. It has been the general feeling in the

past that this type of institution supplied all the technical men necessary for industry. From a consideration of this statement in the light of the distribution of the technically trained men, we find that the engineering college graduate fills the positions of the technical staff, while the production positions are filled inadequately by men not technically trained, but who have come up from the ranks of the workmen. The four-year graduate of an engineering school is not inclined to enter the field of production. This condition is perhaps due to the type of instruction given by the four-year institutions, and further, industry has found it more convenient to draw from graduates of schools of shorter intensive engineering training, such as the technical institutes.

THE HISTORY OF THE PROBLEM AS REVEALED BY RELATED INVESTIGATIONS

As the junior college movement is rather young, investigations of any phase of its work are few in number. Especially is this true in the field of semi-professional engineering education. There are many opinions concerning the program of the junior college but these are merely the expression of an individual's feeling on the matter rather than the opinion based on the results of a survey or study of the question.

A study by Koos. One of the early studies in the field of the junior college is that conducted by Dr. Leonard V. Koos, Professor of Education at the University of Chicago.[1]

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[1] Leonard V. Koos, The Junior College. University of Minnesota, Minneapolis, May 1924, p. 144-46.

This investigation has to do with the junior college movement in general, but contains a chapter in which there is presented considerable valuable data concerning semi-professional engineering in the junior college. While the study was conducted in 1922, the results as presented by Dr. Koos stand out at this date as most valuable.

From the data as found in this study, it is evident that the logical place for the development of semi-professional engineering education is in the junior college. Another phase of the survey conducted by Koos was the establishing of a list of occupations of a semi-professional nature for which the junior college could train.

Technical Institutes. Another study of more recent date, though not in the junior college field, was that conducted by the Society for the Promotion of Engineering Education. This study is entitled A Study of Technical Institutes. The report of this survey is very complete and covers all phases of the work of this type of institution as found in the United States. The conclusions brought out as a result of this study are as follows:

> A need in our post-secondary scheme of education for a large number of technical schools giving a more intensive and practical training than that now provided by the engineering colleges.
>
> These schools should train principally for supervisory work and technical positions in particular industries; and to a less extent, for engineering work of a general character.

Industry, trade and technical services could absorb in an average year, from 40,000 to 50,000 men so trained to good advantage.

For many young men, this training should follow a period of industrial experience and orientation.

This need should be met principally by day schools, working on a full-time or half-time (Cooperative) schedule. Evening schools should also be widely provided, both under the same and separate auspices; and correspondence instruction should be provided to fill in the remaining gaps.

In the light of experience, a training period of or equivalent to two school years to meet the largest group of individual and industrial needs, should be arranged.

The curriculum and teaching processes, should be based to a large degree on actual analysis of industrial usage.

In the light of experience, both in America and Europe these schools should have their own distinctive character and direction in order to achieve a permanent success.

The name 'technical institute' is proposed as the most suitable inclusive term for these schools.[2]

It is evident from a study of these conclusions, that the work of the technical institute and that of the junior college, so far as the semi-professional engineering is concerned, are similar in their objectives. This study will be given further consideration in a later chapter.

Bennett's study of vocational education of a junior grade. In 1928, Dr. Bennett[3] published the results of a study he made, together with a list of occupations of

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2 R.H. Spahr. Study of Technical Institutes. The Society for the Promotion of Engineering Education, Feb. 1931.p.17.

3 G.V. Bennett. Vocational Education of Junior College Grade. University Research Monographs, no.6, 134. Warwick and York, Baltimore, 1927.

a semi-professional nature for which the junior college could train. On the basis of a detailed analysis of the occupations by states, Dr. Bennett estimates that to supply the need in 28 semi-professions which he studied, 190,000 new recruits would be required annually, and further, to maintain such a number of graduates would require an enrollment each year in two-year colleges, of 471,000 students.

In this list of semi-professional occupations, there are many that would require technically trained men. Thus, the junior college would be called upon to offer curricula of a semi-professional engineering nature. As a public educational institution, the junior college will be required to fill the need now taken care of by the technical institution.

Summary of related investigations. The general spread of the investigations concerning the junior college has been somewhat limited. The survey conducted by Dr. Koos was made some time ago and it is evident that many changes have taken place since the study was made. However, the results, as set forth by the author, seem to establish the fact that the community felt the need and desired a type of education in line with what today is termed semi-professional, and further that there are certain occupations in the field of industry for which the junior college can train by means of suitable

curricula, if constructed on the base of job analysis. Without doubt, the results of Koos's survey makes certain the fact that the junior college is the proper place for instruction in the semi-professions.

The study conducted by the Society for the Promotion of Engineering Education and published under the title "A Study of Technical Institutes", is a most valuable contribution to the cause of semi-professional education. The data as reported in this survey, while concerning the technical institute, are applicable in a large degree to the junior college field, in so far as the construction of a semi-professional engineering curricula is concerned. The position that the technical institute holds in regard to industry makes the construction and organization of the curricula rather simple. This condition is due to the fact that the demand on part of the student is an indicator as to what industry is in need of so far as technically trained men are concerned. All phases of the work of the technical institute are covered in this survey, including the technical training needs in industry; the part that technical institute graduates play in the field of industry; occupational responsibilities as an aid in curriculum building; and many other facts of great value and interest to the junior college.

The survey conducted by Dr. Bennett had to do with the demand for technically trained men and the occupations

that could be considered as being semi-professional in nature and on a junior college level. The results of this study tend to show that the junior college is in a very favorable position for offering the training necessary for such occupations as enumerated by Bennett.

SCOPE AND METHOD OF THIS INVESTIGATION

Scope of study. The study is a research and sets forth results as obtained from an examination of the catalogues and other publications of educational institutions beyond the high school grades, in which semi-professional engineering curricula on a junior college level are offered. Additional information and data were sought from a study of the professional literature having a bearing on the problem under consideration.

Sources of information and method of treatment. As possible sources of data pertaining to the problem under consideration in this study, an examination was made of the curricula offered by the four-year engineering colleges, technical institutes, and the public junior college. In View of the fact that many colleges and universities have offered two-year curricula in engineering, it was felt necessary to make a study of the offerings of such institutions in order to determine whether these curricula are of the semi-professional type. Since the technical institute contributes to a need of industry with a considerable de-

gree of success, and as the junior college as a public institution must contribute to this need, it was felt necessary that the curricula of the technical institute be given a large part in the investigation of the problem of this study.

As this study is made for the purpose of determining what should be offered as semi-professional engineering curricula in junior colleges, consideration of the organization and content of the curricula as offered at the present time by, at leat the junior colleges of the state of California, was thought essential.

ORGANIZATION OF REMAINING CHAPTERS

In consideration of the data pertaining to the problem under investigation, the results and findings will be presented in the following chapters.

In chapter II, consideration will be given to the place that semi-professional engineering education has in the junior college program. A study of the function of the junior college, as commonly accepted, will be presented and discussed as to their bearing on the problem under consideration. Next in order for study, the aims of semi-professional education will be dealt with as to the part they play in the construction of the necessary engineering curricula. As a further step in the solution of the problem of this study, a presentation will be made of the types of semi-professional education to be found in the junior college field.

Chapter III will deal with the data and results of the study in so far as the demand for semi-professional engineering graduates is concerned. On the basis of the demand of industry for men so trained hinges the whole problem of semi-professional engineering curricula. If there is no demand for men with this type of education, the junior college is not justified in offering curriculum of this nature. In carrying on the study of this phase of the problem, a study will be first given to a consideration of the attitude of the employer toward the semi-professional graduate in engineering. Next in order, there will be presented data covering the matter of semi-professional occupations for which the junior college can train. As another important phase of the study, the status of the semi-professional graduate will be discussed in the light of the data and results as obtained in this investigation.

Chapter IV will deal with the results of the study as it is concerned with the curricula offered by educational institutions beyond the high school grades. This step will carry the investigation into the field of the four-year institutions and also that of the technical institute. It will be necessary to give consideration to the engineering curricula as offered by the junior college at this time. While there may be a few other institutions of learning that may seem to offer instruction of the

type that is under consideration, it is thought advisable to confine the investigations to the three indicated fields.

Chapter V will summarize conclusions as drawn from the data presented in this study, and submit recommendations.

CHAPTER II

THE PLACE OF SEMI-PROFESSIONAL ENGINEERING EDUCATION IN THE JUNIOR COLLEGE

In any scheme of education, the question of what type or kind of curriculum is to be offered, must be considered. The junior college being a comparatively young institution, much confusion has occurred due to the lack of a definite understanding as to what types of education belong under jurisdiction of this school. In other words, what are the real functions of the junior college.

Purpose of this chapter. It is the purpose of this chapter to bring together all data that will permit the determination as to whether or not the semi-professional engineering curriculum should be a part of the junior college program. To arrive at a logical conclusion, it is proposed to consider first the functions of the junior college in order to determine if there is any function that gives this institution the right to offer the engineering curricula of a semi-professional nature. As the next step in the purpose of this chapter, a study will be made of the aims proposed for the type of education under consideration in this investigation. As the problem of this study covers the organization and content of suitable curricula of a semi-professional nature, it is necessary to establish the right of the junior college even to consider the offering of such curricula.

THE FUNCTIONS OF THE JUNIOR COLLEGE

General uncertainty prevailed for some time regarding the real functions of the junior college. The situation was such that little could be expected of this institution until a critical study was made of all the proposals which were set forth establishing the right of the existence of the junior college.

In attempting to judge the basic functions, Frank W. Thomas set up three tests, which are as follows:

a) Has the proposed function played any influential part as a recognized aim in the establishment of existing junior colleges?

b) Does there now exist a marked social or educational need not met by other institutions, which would be satisfied through the fulfillment of the proposed function by the junior college?

c) Has this function been advocated or approved by educators of sufficient standing and familiarity with college problems to merit consideration on such grounds? [4]

These tests seem to be broad enough to include all purposes and aims that may be suggested and yet rigorous enough to exclude any selfish community proposal. Great care should be exercised in regard to the latter caution as it is evidenced by the study of Koos, who found twenty-one different functions for the junior college.[5]

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4 Wm. M. Proctor. The Junior College. Its Organization and administration. Chap. II, The Function of the Junior College. Stanford University Press. 1927. pp. 9-11.

5 L.V. Koos. The Junior College Movement. Ginn and Company, Boston, 1925. pp. 19-27.

From a consideration of the functions suggested for the junior college, there seem to be four basic ones which meet these tests. They are generally designated as (1) the "preparatory function"; (2) the "popularizing function"; (3) the "terminal function"; and (4) the "guidance function". Further consideration of each of these functions as to its justification is necessary.

Preparatory function. One of the early developments in the junior college movement had to do with offering organized courses which duplicated those of the first two years of the university high schools and the smaller colleges. The idea back of this undertaking was the desire of smaller institutions to retain their students and prepare them for the advanced work of the upper classes of the university. It is of importance to note that considerable encouragement was given the high schools and smaller colleges in the development of this idea by the large universities. As far back as 1892, we find the University of California recognizing officially the distinction between the upper and lower division work of that institution. In a letter to superintendent McLane of Fresno, President David Starr Jordan expressed his approval of the new junior college in the following terms:-

> I am looking forward, as you know, to the time when the large high schools of the state, in conjuntion with the small colleges, will relieve the two great universities from the expense and from the necessity of giving instruction of the first university years. The instruction of these years is of

necessity elementary and of the same general nature as the high school itself. It is not desirable for the university to have more than 2,000 students gather together in one place, and when the number comes to exceed that figure, then some division is desirable. The only reasonable is that which will take away students who do not need libraries or laboratories for their work.[6]

Dr. Koos, in commenting on the results of his study of the junior college in connection with its work of preparing students for the upper division work of the university, has the following to say:

The most obvious point of significance in the findings just presented as to the mental character of the junior college students is that the authorities in higher institutions, more especially our state universities, have little or no grounds for fear that the junior college in its present state of development brings into their upper years a flood of mentally incompetent students. These data make clear that junior college students are in this respect about on a par with the students of the same classification in most colleges and universities.[7]

Dr. Ells in dealing with the preparatory function of the junior college, has the following to say:

The junior college will need to continue to maintain high standards of instruction and selection in order to keep the reputation which it has gradually established in so many universities during the period when its product has been looked upon with doubt and skepticism on the part of so many university administrators. It has made good as a preparatory institution so far---it must continue to do so.[8]

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6 Quoted by C.L. McLane in School Review, March 1913, p. 166.

7 L.V. Koos. The Junior College. University of Minnesota, Minneapolis, May 1924, p. 103.

8 Walter C. Ells. The Junior College. Houghton, Mifflin Company, New York, 1931, p. 230.

The popularizing function. The friendliness of the universities was not in itself sufficient to bring about the great development of the junior college that was evident in many communities. It was the added stimulant found in the local demand that pupils graduating from the high school have an opportunity to continue their education on a college level, while remaining under the direct guidance and shelter of the home.

An early recognition and advocate of this community service as a legitimate function of the junior college is noted in the writings of E. J. James, J. Stanley Brown, Will C. Wood, James R. Angell and others. Doubtless, the outstanding statement along this line is to be found in an address by Dean A. F. Langes, delivered before the National Educational Association in 1915, and reads as follows:

> In California, the upward trend of the high school was from the first urged along with the other, in the educational interest of the great mass of high school graduates, who cannot, will not, should not become university students. Such extension, it was urged, might and should make it possible for the small minority to enter a university. In a narrow sense, at the end of two years, the controlling educational purpose should be to provide for a reasonably complete education whether general or vocational.
>
> It is coming to be generally understood that the junior college cannot serve its complex purpose if it makes preparation for the university its primary object. For the great majority of the junior college students, courses of instruction and training are to be a piece with what has proceeded, they are to be culminal rather than basal; they are not to result in a "deferred education". The junior college will function adequately if its first concern is with those who will go no further, if its system meets local needs efficiently, if it turns many away from the university into vocations for which training has not hitherto been afforded by our school system.[9]

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[9] A.F. Langes. The Junior College. Proceedings of the National Educational Association, 1915. pp. 119-24.

The terminal function. Any outstanding attempt to make the junior college serve the higher needs of the community reveals another function which demands recognition as peculiar to the province of this institution. This function is that of providing terminal courses, usually vocational in character and complete in two years.

From a study made by McDowell, as to the reasons for establishing junior colleges, it was found that the reason "To provide a completion school for those who cannot go farther" stood second in relative importance. It is evident that this aim has played an important part in the development of the junior college movement. Educators, who have carefully studied the possibilities of the junior college in this vocational field, are generally agreed that the terminal function can be carried out by this institution better than any other.

Dr. Koos has the following to say regarding the two-year vocational courses of the junior college:

> The hope must rest not in readjustments within colleges and universities of current type, but in institutions in which the first two years under consideration are terminal grades. That is to say, it rests in the utilization of the junior college idea. Our assurance that the interest of those who will not or should not go beyond the first and second years will be better conserved in such an institution is grounded in the fact that the lower schools with which this work should be associated have already made protitious beginnings toward differentiating work for those who can and should continue their education and for those who should not continue it.[10]

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[10] L. V. Koos, The Junior College Movement. Ginn and Company, Boston. 1923. p. 120.

The most convincing argument, which has been presented in favor of the two-year terminal courses of the semi-professional type, was that given by R. J. Leonard, Director of the School of Education of Teachers College, Columbia University, in an address before the National Association of Junior Colleges, in February, 1925. After distinguishing between occupations and the higher professional levels which require at least four years of training of university grade, and those on the semi-professional level, Dr. Leonard says:

> In so far as the universities concern themselves with professional education, their efforts will be confined to the higher levels. Those who are the leading factors in university fields, realize that no other institutions can perform these services satisfactorily. And, in so far as the junior colleges concern themselves with occupational education, their efforts will be confined to the middle level and in like manner, this will be their permanent field.[11]

Dr. Ricciardi, the vocational expert of the California Department of Education, made the following statement in 1928:

> That 60 per cent of the 9,000 junior college students then in the state, could best be trained through terminal courses.[12]

Dr. Eells in commenting on the junior college functions has the following to say:

> It is rapidly becoming the people's college. Where a local junior college is established, probably the number of people who "go to college" is at least doubled. It would be unwise and unfortunate if all of these tried to enter a uni-

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11 R. J. Leonard. Teachers College Record. May 1925, p. 724.

12 W. C. Wells. Op. cit. p 289.

versity and prepared for professions which in most cases are already overcrowded, and for which their talents and abilities in many cases do not fit them. Federal census figures indicate that less than ten per cent of the population of the country is required for the professions. The junior college must offer something more than a simple university preparatory course, if it is to live up to its true destiny. The development of the terminal function is an essential corollary of the success of the popularizing function. [13]

Langes back in 1915 expressed his feeling concerning the terminal function of the junior college as follows:

The junior college will function adequately if its first concern is with those who will go no further, if it meets local needs efficiently, if it turns many away from the university into vocations for which training has not hitherto been afforded by our school system. [14]

The guidance function. The vast amount of evidence pointing to the need for guidance is recognized by the college and university alike. These institutions of higher learning through the many devices as "Freshmen's Week", orientation courses, advisory systems, and other schemes for assisting the students in finding their proper place in life through the proper selection of courses, recognizes and assumes their responsibility. As the junior college takes its place in the educational scheme, a like responsibility will fall to its lot as far as guidance is concerned. Under conditions such as are found in the state of California, where the state university selects those students of high standing but leaves for the junior college the non-recommended students,

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13 W. C. Eells. op. cit. p. 280

14 A. F. Langes. The Junior College. Proceedings of the National Educational Association, 1915. pp. 119-25.

the matter of guidance presents a serious problem for the junior college. This latter type of student, forming the larger part of the enrollment, presents a real challenge to the junior college administrator.

Eells in speaking of the objectives of guidance has the following to say:

> The objective of all guidance work is, briefly, to enable the student fo find himself, and to find his place in the complex society of which he is a part. More specifically, it is to give information and counsel along four different lines, failure in any one of which may spell disaster and unhappiness for years to come. These four are:
>
> Vocational. To furnish information about himself and about vocations which will enable him more intelligently to make a choice of a life work for which he is fitted and in which he will be successful and happy.
>
> Educational. To assist him in the correct choice of courses in junior college, with due regard to immediate value in securing a well-balanced education, and to future training which he may undertake in some more advanced institution.
>
> Social. To further desirable types of social choices, adjustments and attitudes; to stimulate effective leadership, democratic participation, and wholesome standards in social organizations, athletics, and other activities.
>
> Physical. To assist him in the necessary physical adjustments, to secure and maintain good health.[15]

"The greatest single need in vocational guidance" according to the report of the Vocations Guidance section of the White House Conference of 1930, "is more guidance--the extension to boys and girls everywhere, of what is known and practiced in a comparatively few favored communities." [16]

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15 W. C. Eells. The Junior College. Houghton, Mifflin Company, 1931. p. 318.

16 James L. Robb. Guidance in the Junior College. vol 3, May, 1932. p.427.

THE AIMS OF SEMI-PROFESSIONAL EDUCATION

As was noted, in dealing with the functions of the junior college, one had to do with the matter of semi-professional education. In other words, a special purpose of this new unit is the provision of occupational training of a junior college grade.

Koos found that the terminal function was the aspiration entertained by approximately half of all the sources examined in his search for claims for the junior college.

In speaking of this phase of his survey, Dr. Koos has the following to say:

> The authors of the statements analyzed have in mind here preparation for occupations, the training for which is to be concluded during the junior college period, and which are, from the standpoint of the period of training, SEMI-PROFESSIONS. Such occupations are to be distinguished, on the one hand, from the trades, the training for which is concluded during the secondary school period, and on the other, from the PROFESSIONS, adequate preparation for which requires four or more years of training beyond the high school.[17]

Here we see that this field of endeavor lies between the trades, the training for which the trade schools will have to supply, and the professions, the training for which the professional schools and universities will take care of. Between these two limits or extremes, the gap is very wide and it is in this gap that the semi-professions are to be found. If the junior college does not consider the semi-professional field as its own, where is the cast number of young people, who cannot go to the university, to obtain sufficient education of a

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17 L. V. Koos. op. cit. p. 144.

specialized character to enable them to find their place in life.

With the above conception of what is understood by the term semi-professional education, let us consider what are the aims set forth for this type of education. Dr. Snyder, in speaking of the aims of the semi-professional work as offered at his institution, has the following to say:

> The Los Angeles Junior College is endeavoring especially to meet the needs of this second group (semi-professional). We are convinced, however, that the semi-professional curricula should not in any way become similar to those of trade or vocational schools. If the junior colleges are to maintain themselves as collegiate institutions, they must develop in their students an orientation in the social, economic, and spiritual life of the age. This has always been the prime function of a college education and has been attained by the study of the liberal arts. Therefore, these semi-professional curricula must contain such subjects. Because of limits of time, the academic studies offered in the junior college must be more exploratory and less intensive than those of the four-year college. This is not, as a rule, a disadvantage to the semi-professional students, because they are not usually academically-minded and more interested and inspired by a bird's-eye, rather than a detailed view. Those who desire detailed work should unquestionably arrange to pursue the curricula of the universities and four-year colleges.
>
> In order to help in economical adjustment, the junior college must also aid in the attainment of some skill which will enable the graduate to enter productive employment.[18]

The Pasadena Junior College in describing its semi-professional curricula has the following to say regarding the aim of the courses:

> The definite aim of each curriculum is to prepare the student at the end of the 14th year to enter the world of

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[18] Wm. H. Snyder. A New Type of College Education. Los Angeles Junior College Publication, January 1932.

industry and business with technical training and a developed sense of responsibility and self-reliance which will halp carry him on to a successful career.[19]

The following statements cover the aims as set forth for semi-professional curriculum. These expressions were taken from the indicated junior college catalogues.:

Fullerton Junior College. Diploma courses are intended primarily for students who are likely to complete their formal education in the junior college and who wish to find their way directly into business or industry. The subjects are arranged and conducted with a view to preparing students for individual efficiency and service in society and not for advanced study in the professions.

Sacramento Junior College. This course (engineering drafting) is planned especially for the student who finds himself unable to continue his engineering course at the University and who desires to enter that branch of the engineering profession dealing with drafting and design.

Santa Ana Junior College. The diploma curriculum is organized to meet the needs of students who do not intend to continue their college study beyond the junior college. These courses are so organized that each is a unit in itself and preposes that the students enrolled will do no further work in that field.

Glendale Junior College. Those students who do not desire or plan to attend a university, but desire an additional two year cultural course or vocational training beyond the courses offered in high school.

While each junior college catalogue sets forth the aim in its own particular words, the above statements are typical of the fundamental aims of all.

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19 New Opportunities Open for Technical Training. Pasadena Junior College Publication, September, 1931.

TYPES OF SEMI-PROFESSIONAL EDUCATION

In the general field of semi-professional education, there are many types of what may be termed curricula. The Table I, given on page 25, gives a list of seven commonly acknowledged fields which form the basis for the training as offered by the work of these courses. The author, in commenting on the data of Table I, felt that perhaps not all of the work was of a terminal character, nevertheless the basis material used was that out of which terminal courses may be built.

Vocational junior colleges. From a study of this type of junior college, it was found that there are a few, all of the state type, that are definitely organized on the vocational basis. These may be classified roughly as vocational, and academic, and are shown in Table II, given on page 26. It is evident from the data there given, that approximately 60 per cent of the offerings can be classified as vocational in nature. In addition, much that is classified as academic would be used in building up the complete curriculum of a vocational character.

In California Junior Colleges. While a detailed consideration of the different curricula of the outstanding junior colleges of the state will be given in Chapter IV, a brief summary of a few of the district junior college offerings are as

TABLE I

NUMBER OF JUNIOR COLLEGES OFFERING CERTAIN COURSES AND AVERAGE NUMBER OF SEMESTER HOURS FOR EACH [20]

(Total Colleges examined, 279)

Subject	Number of Colleges	Average Semester Hours
Education	180	16
Music	160	31
Commerce	134	30
Home Economics	131	21
Art	124	15
Engineering	109	21
Agriculture	46	23

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20 W. C. Eells. The Junior College. Houghton, Mifflin Company, New York, 1931. p. 230

TABLE II

SEMESTER HOURS OFFERED IN GENERAL AND SPECIAL COURSES [21]

Vocational		Academic	
Engineering	39.4	Science	39.8
Agriculture	33.8	Modern Languages	18.2
Commerce	33.7	Mathematics	15.6
Home Economics	27.1	Social Studies	14.4
Education	23.9	Ancient Languages	13.3
Music	23.4	English	11.4
Art	8.5	Psychology	5.2
		Physical Education	4.7
		Public Speaking	3.7
Total	189.8	Total	126.3

21 W. C. Eells. The Junior College. Houghton, Mifflin Company, New York. 1931. p. 230.

follows:

CHAFFEY: Agriculture, Commerce, Home Economics, Mechanic Arts.

COMPTON: General Arts, and Sciences, General Business, Practical Engineering, Practical Home-Making, Journalism, and Writing, Mechanic Arts, Pre-Nursing.

FULLERTON: General Business, Secretarial, Mechanic Arts.

GLENDALE: Commerce and Business, Bookkeeping and Accounting, Stenographic, Practical Engineering, Home Economics, Liberal Arts, Mechanical Arts, Vocational Music, Pre-Nursing.

LONG BEACH: Architectural,Art, Engineering, General Business, Home Economics, Journalism, Liberal Arts, Pre-Nursing, Secretarial.

PASADENA: Art, Commerce, Household Science, Household Art, Building Art and Design, General Mechanics, Music, Landscape Gardening.

RIVERSIDE: Engineering, Nursing, Library Work, Architecture, Home-Making, Hotel Management.

LOS ANGELES: Accounting, Aeronautics, Art, Banking, General Business and Business Law, Civic Health, Civil Engineering, Community Recreation, Drama, Electricity, Liberal Arts, Mechanics, Music, Nursing, Publications, Radio and Sound, Secretarial, School Service, Social Arts.

While not all of the courses noted above that have to do with mechanics can be called a semi-professional and engineering curricula, it is evidence that the junior college is feeling its way along this educational path.

CONCLUSIONS

In a study of the data presented in this chapter in the light of the question as to whether or not semi-professional engineering curricula has a place in the junior college program, the conclusions to be drawn are as follows:

1. The terminal function, which is one of the commonly accepted functions of the junior college, seems without a doubt, to place the responsibility of offering curricula suitable for meeting the needs of the community, up to the junior college. These curricula are to be complete in themselves, that is, they are to be terminal in character, and not merely preparatory for the work of the last two years of the university.

2. One type of curricula of a terminal nature, that comes under this function, is that of semi-professional engineering.

3. That the aims underlying the semi-professional or terminal curricula have to do with offering to those students, who do not care to go on to the university, the opportunity of acquiring a skill in some semi-profession, and at the same time obtain a real vision of life.

CHAPTER III

THE DEMAND FOR SEMI-PROFESSIONAL ENGINEERING GRADUATES

Purpose of this chapter. The purpose of this chapter is to give consideration to that phase of the problem under investigation which is the fundamental reason for the junior college offering semi-professional engineering. This phase, the demand on the part of industry for men with this type of training, is of the most importance in the matter of curricula organization. If there is no occupational field where semi-professional engineering graduates can find employment, then there is no need for this type of curricula.

The method of study of this part of the problem was confined to a consideration of the professional literature and surveys bearing on the question.

ATTITUDE OF EMPLOYER

As to the attitude of the employers toward graduates of semi-professional engineering curricula little or no data have been published. However, as the work of the technical institute is in a field similar to that for which the junior college will contribute, it was thought advisable to give consideration to the data available concerning the attitude of the employer toward the technical institute graduate.

Spahr, in his report regarding the attitude of the employer toward technical institute graduates, presents the

following statements:

From a well-known metal and equipment manufacturing company:

> There is a need for educated men in manufacturing circles today in the capacity of foreman, superintendent, and plant manager. Any course of study tending to develop such men would offer manufacturers an opportunity to operate more economically. [22]

The works manager of a large manufacturing company comments as follows:

> We believe that there is a need for a type of engineering education 'intermediate' between the practical training given apprentices in technical lines, and the usual engineering courses offered by the colleges and universities and in our opinion such schools as Pratt and Newark Technical Schools are working in a field of great usefulness. Technical courses beginning where the high school leaves off and covering several years of specialization would meet an ever increasing need. [23]

The above statements are typical of the opinions regarding the attitude of employers concerning the technical institutes endeavors. These opinions are typical of the general attitudes as expressed by sixty-nine companies with a total of nearly 100,000 employees.

In regard to the demand for semi-professional engineering graduates by concerns other than manufacturing companies the following question was asked with the idea of obtaining some additional data:

> In order to maintain the efficiency of your organization, what percentage of your employees ought to possess a technical education or training of each of the following areas? [24]

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22 W.H. Spahr. A Study of Technical Institutes. Society for the Promotion of Engineering, 1931. p. 56

23 ibid. p. 56

24 ibid. p. 57

The following was a reply from a large public utility organization:

The Ratio of Technical Institute Men to Four-Year College Men:

Composite Reply	Area of Education: Technical Institute		Four-Year College
Percentage of total employees	8.3		3.1[25]
Thus giving a ratio of	2.7	to	1.0

In order to check further the question of whether there is a demand for technical institutes throughout the country, the committee in charge of this study conducted by the Society for the Promotion of Engineering Education, obtained the opinions of fifteen represented companies in different sections of the country. These concerns were asked whether from their experience, they felt that an area of terminal technical education, intermediate in years, between the vocational colleges and the trade schools on the one hand, and engineering colleges on the other, should be encouraged and developed in America. The replies were unanimous in the affirmative.

A large manufacturing company employing semi-professional graduates in considerable numbers, comments as follows on the need for such graduates:

We have many supervisory and technical routine jobs for which technical training is necessary, but for which college men are overtrained. These men are more likely to be permanently satisfied on such work that the college graduates who consider these as training jobs for engineering, would not not be contented with.[26]

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25 R. H. Spahr. Op. cit. p. 57

26 Ibid. p. 58

From a textile Manufacturing Company:

We feel that there is a very decided field for a course of the technical training which is between the vocations and trade schools on the one hand, and the engineering colleges on the other. We are certain that the young man who would have this background would be precisely the type to become the foreman and junior executive of industry.[27]

From a study of these replies, an idea of the relative importance of the aims as held by the companies supplying the data, can be gained.

Aims for Technical Institutes.

Composite Employer's Estimation of Tentative Importance.

(a) To qualify for supervisory positions in operating departments.....1.00

(b) To qualify for technical service, such as drafting, designing, testing, inspection, etc.....74

(c) To qualify for commercial positions relative to the sale of technical products and services.....56[28]

From the foregoing statements setting forth the opinions of industry, it is evident that there is a real demand for men with an education of a technical nature that lies between the training for trades on the one hand and the instruction of the four-year college on the other. Industry finds itself in need of men to fill certain positions in the technical field for which the four-year engineering college graduate is considered as over-trained while the mechanic is trained sufficiently as to the trade but not in a technical sense. This condition

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27 R. H. Spahr. Op. cit. p. 62.

28 Ibid. p. 63.

leaves a gap in the industrial field for which no public educational institution is offering the necessary training.

OCCUPATIONS OF A SEMI-PROFESSIONAL NATURE

Since it is evident that there is a demand for semi-professional engineering graduates in industry, so far as the attitude of the employer is concerned, it is of interest to know in what positions or occupations this need is found.

Perhaps the most outstanding study concerning the occupations that could be listed as semi-professional in nature was that of Koos.[29] In order to secure the opinions of educators as to which occupations were semi-professional and which were not, Dr. Koos sent to 128 deans of engineering schools and colleges a list of 104 occupations and requested that they be allocated as to whether the particular occupations was a trade, a semi-profession, or a profession. In order to establish a common basis for this judgment, Dr. Koos set up the following definitions:

> PROFESSION. An occupation for which the training should be that given by an institution requiring for entrance at least graduation from an accredited secondary school, and offering a course of college grade of no less than four years in length and culminating in an appropriate and recognized degree.
>
> SEMI-PROFESSION. An occupation in order to enter upon which one should prepare himself with a course of training approximately two years in length with a high school education or its equivalent as a prerequisite.

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29 L. V. Koos. The Junior College. University of Minnesota, Minneapolis, May 1924. p. 147.

TRADES OR CLERICAL OCCUPATIONS. These occupations in order to enter upon which one should be trained in a public or private high school, trade, commercial school or other institution which presupposes as training, a knowledge of the common-school subjects and gives education on a level of less than college grade.[30]

Upon an analysis of the list of occupations submitted, it was evident that there were, in addition to the important and unimportant occupations, in widely scattered fields, three main classes, namely: commerce, engineering, and agriculture. To obtain a collective opinion of the training levels necessary for the three main fields of occupations, check sheets were sent to deans or directors of schools in these fields.

These replies received by Dr. Koos comprised the judgments of from 60 to 84 deans and directors of engineering colleges on the allocation of occupational level of 104 selected occupations in engineering fields.

In the construction of Table III, given on pages 35 to 38 inclusive, which shows the allocation of the judgments for which the various occupations are supplied, column 1 shows for each occupation the percentage of judges locating it as a profession; column 2 shows the percentage who placed the occupation either as a profession or a semi-professional trade; column 3 shows the percentage placing it as a semi-profession; column 4, the percentage checking it as either a semi-profession or trade; column 5, those that placed it on a trade level; column 6, those who checked it as being on all three levels; Column 7 shows the percentage of institutions represented by judges, whose college is equipped to offer semi-professional training in the occupation.

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30 L. V. Koos. Op. cit. pp. 158-160

TABLE III

PERCENTAGE DISTRIBUTION OF JUDGMENTS ON THE ALLOCATION OF OCCUPATIONAL LEVELS [31]

No.	Occupations	1	2	3	4	5	6	7
1.	Archit. Super.	22.8	3.8	67.1	1.3	5.1	0.0	20.5
2.	Assayer (Analyst)	32.4	1.3	65.0	0.0	1.3	0.0	20.5
3.	Cement Tester	2.6	1.3	54.0	2.6	39.5	0.0	30.8
4.	Chem. Lab. Worker	6.5	0.0	57.2	5.2	29.9	1.3	36.0
5.	Gen. Con. Bldr.	19.2	2.7	59.0	2.7	16.5	0.0	12.8
6.	Drafts. Bldr.	4.8	2.4	59.5	1.2	32.1	0.0	29.2
7.	" Civil Engin.	8.7	1.2	72.5	0.0	17.5	0.0	69.3
8.	" Mechanical	10.8	3.6	71.2	0.0	15.7	0.0	59.0
9.	" Structural	12.3	3.7	69.2	2.5	12.3	0.0	53.9
10.	" Architecture	11.2	3.8	68.8	0.0	16.3	0.0	43.6
11.	" Sheet Metal	1.2	2.5	71.6	0.0	24.9	0.0	33.4
12.	" Topographical	9.9	2.5	71.7	1.2	14.8	0.0	64.2
13.	" Marine & Ship	5.0	1.3	71.5	0.0	12.5	0.0	20.5
14.	" Mine	5.3	1.3	79.0	0.0	14.4	0.0	25.7
15.	Electrician Dis.	5.7	0.0	61.0	2.8	30.0	0.0	12.8
16.	" Estimator	15.5	1.2	64.0	0.0	20.0	0.0	15.4
17.	" Inspector	5.2	1.3	64.4	0.0	28.9	0.0	23.1
18.	" Magneto, Igni.	4.0	0.0	52.6	1.4	42.0	0.0	10.1
19.	Estimator Steel	31.5	5.5	52.0	5.5	5.5	0.0	12.8
20.	Inspector Build.	17.5	2.5	56.3	3.8	20.0	0.0	25.7
21.	" Plumbing	2.6	1.3	62.0	3.9	30.3	0.0	12.8
22.	" Sanitary	8.9	1.3	62.0	3.8	21.8	0.0	15.4
23.	" Bridges	24.3	3.8	56.4	2.6	12.8	0.0	10.2
24.	" Boiler	7.6	1.3	64.6	5.1	21.5	0.0	17.9
25.	" Electrical	9.0	2.6	65.0	2.6	20.8	0.0	25.7

No.	Occupations	1	2	3	4	5	6	7
26.	Inspector: Loc.	13.9	1.3	56.9	3.8	24.0	0.0	7.7
27.	" Metal Mines	13.9	0.0	64.0	2.8	19.5	0.0	5.1
28.	" R.R. Signals	13.9	0.0	62.2	1.4	23.0	0.0	5.1
29.	Head Miller	4.5	1.5	67.3	3.0	23.8	0.0	5.1
30.	Millman, Ores.	6.4	1.6	52.5	4.8	35.5	0.0	7.7
31.	Mineral Survey	35.7	2.8	57.2	2.8	1.4	0.0	12.8
32.	Superin. Co.	4.7	7.8	59.9	0.0	7.8	0.0	15.3
33.	" Mach. Shop	31.2	2.6	57.2	0.0	7.8	1.3	20.5
34.	" Textiles	38.5	1.4	52.9	0.0	7.8	0.0	2.6
35.	" Flour Mill	21.5	3.1	58.5	1.5	15.4	0.0	5.1
36.	" Mine-Quarry	32.0	2.8	50.0	2.8	10.5	0.0	0.0
37.	Surveyor: Land	36.6	5.1	57.0	0.0	1.3	0.0	61.5
38.	" Highway	38.5	5.1	55.0	0.0	1.3	0.0	59.0
39.	" Instrument	17.7	3.8	73.4	0.0	5.1	0.0	74.5
40.	" Mines	34.7	5.3	58.6	0.0	1.3	0.0	41.0
41.	" Railroads	35.5	6.6	55.3	0.0	1.3	0.0	43.5
42.	Topographer	33.8	6.5	57.3	1.2	1.2	0.0	51.4
43.	Wire Chief, Tel.	12.5	0.0	70.9	2.8	13.9	0.0	17.9
44.	Subcontractor	2.5	0.0	40.6	4.9	52.0	0.0	15.4
45.	Designer, Mach.	53.7	1.2	38.8	2.5	3.7	0.0	12.8
46.	Dist. Chief, Tel.	34.2	2.5	48.0	1.2	13.9	0.0	17.9
47.	Elec. Power Sta.	9.1	0.0	35.0	5.2	50.6	0.0	25.9
48.	Distr. Engin.	51.4	1.3	42.1	0.0	5.3	0.0	10.2
49.	Ship	9.3	0.0	41.0	0.0	44.0	0.0	2.6
50.	Switchboard	8.3	1.4	41.1	0.0	49.3	0.0	12.8

No.	Occupations	1	2	3	4	5	6	7
51.	Storage Bat. Exp.	9.4	1.3	46.7	1.3	41.4	0.0	7.7
52.	Plant, Factory or Mill	9.4	1.3	49.3	0.0	40.0	0.0	7.7
53.	Crane Expert	9.2	0.0	38.1	1.3	42.4	0.0	2.6
54.	Engin. Switchbd.	48.6	3.9	37.8	0.0	10.5	0.0	12.5
55.	" Tel. Const.	42.3	3.8	35.0	3.8	14.1	0.0	17.9
56.	" Ast. Field	28.8	3.7	48.6	1.2	17.5	0.0	33.4
57.	Millwright, gen.	4.3	1.4	44.4	1.0	40.0	0.0	5.1
58.	Mine Cap. Metal	3.3	3.3	48.4	5.0	40.0	0.0	5.1
59.	Mine Vent. Expt.	49.4	7.1	36.6	0.0	7.1	0.0	2.6
60.	Sample, ore	3.0	0.0	38.8	1.5	57.0	0.0	7.7
61.	Signal Sup. R.R.	14.9	4.5	46.3	1.5	32.8	0.0	12.8
62.	Super Gas & Elec.	48.2	2.5	44.3	0.0	5.1	0.0	2.6
63.	" Tele. Co.	46.1	2.6	46.1	0.0	5.3	0.0	10.6
64.	" Iron or Steel	54.0	5.1	36.0	0.0	5.1	0.0	5.1
65.	" Wood Logging	10.0	1.4	47.2	4.3	37.2	0.0	2.6
66.	Ap; Public Utili.	72.5	1.3	23.7	0.0	2.6	0.0	10.3
67.	Archit. Designer	79.2	1.2	18.3	0.0	1.2	0.0	10.3
68.	Chemist, Food An.	75.6	3.8	20.5	0.0	0.0	0.0	15.4
69.	" Paint Mill	66.7	1.2	30.9	0.0	1.2	0.0	25.7
70.	" Metallurgi.	79.5	1.2	19.2	0.0	0.0	0.0	7.7
71.	" Gas & Elec.	67.6	2.7	29.8	0.0	1.3	0.0	20.5
72.	" Flour Mill	63.5	2.5	31.6	0.0	1.3	0.0	17.9
73.	" Paper Mill	56.5	1.3	30.3	1.8	0.0	0.0	17.9
74.	Engineer: Main.	77.4	1.3	17.7	0.0	3.8	0.0	2.6
75.	" Tele. Equip.	66.7	5.1	23.0	0.0	5.1	0.0	2.6
76.	" Const. Erec.	59.0	5.1	30.8	0.0	5.1	0.0	7.7

No.	Occupations	1	2	3	4	5	6	7
77.	Testing, elec. mg.	59.5	6.3	30.4	0.0	3.8	0.0	10.2
78.	Erecting, elec.	55.7	5.1	29.1	1.3	8.9	0.0	12.8
79.	Designing, elec.	88.7	2.5	6.3	1.2	1.2	0.0	0.0
80.	Marine	86.0	0.0	9.9	1.4	2.8	0.0	2.6
81.	Sanitary	93.5	1.3	3.8	1.3	0.0	0.0	0.0
82.	Heat & Vent.	86.0	3.8	8.9	1.3	0.0	0.0	2.6
83.	Structural	83.4	1.3	5.1	1.3	0.0	0.0	0.0
84.	Highway	88.8	2.5	7.5	2.3	0.0	0.0	7.7
85.	Concrete	88.7	2.5	7.5	1.2	0.0	0.0	0.0
86.	Bridge	93.6	1.3	3.8	1.3	0.0	0.0	0.0
87.	Railwy. Const.	88.7	2.5	7.6	1.3	0.0	0.0	5.1
88.	Railwy. Divi.	86.0	1.3	11.5	1.3	0.0	0.0	2.6
89.	Auto Consul Des.	90.0	1.3	7.6	1.3	0.0	0.0	0.0
90.	Oper. power plant	59.1	6.2	29.6	2.5	1.2	1.2	15.4
91.	Refrigeration	83.8	3.7	10.0	1.3	0.0	1.3	5.1
92.	Manager, Mine	60.6	3.9	31.6	0.0	3.9	0.0	2.6
93.	Master Mech, R.R.	50.0	6.7	31.1	1.4	1.8	0.0	2.6
94.	Meterologist	69.3	6.7	22.6	0.0	1.3	0.0	0.0
95.	Airplane Mechanic.	1.2	0.0	23.8	1.2	7.9	0.0	7.7
96.	Dispatcher, train	0.0	1.3	27.2	2.6	69.0	0.0	2.6
97.	Elec. Arm. Winder	1.3	0.0	30.2	7.6	59.5	0.0	0.0
98.	Engine: Marine	1.3	1.3	30.3	7.6	62.0	0.0	5.1
99.	Engineman: Refrig.	0.0	1.3	29.1	7.6	67.0	0.0	5.1
100.	" Station,steam	0.0	0.0	27.3	6.5	66.2	0.0	10.2
101.	" Pipe layer	0.0	0.0	8.4	5.6	86.2	0.0	0.0
102.	" Roadmaster,R.R	1.3	2.8	27.2	2.8	63.1	0.0	10.2
103.	" Rodman	1.4	0.0	29.7	2.7	66.2	0.0	28.2
104.	" Shift Boss	3.1	1.5	17.2	3.1	75.0	0.0	0.0

Dr. Koos in commenting on the results of his study as to the allocation of these occupations, seemed very optimistic in regard to these being a need for semi-professional engineering training for which the junior college could prepare. He doubts that there could be found a more competant group of judges than these leaders in their respective fields of training; therefore, Dr. Koos gives great weight to the judgments presented in these data. The evidence, as here presented in the above tabulations, points very decidedly to the desirability of providing semi-professional engineering education, in the general scheme of training, with the junior college field as the logical place to offer such curricula.

From the report covering "A Study of Technical Institutes," there is to be found a most interesting statement concerning semi-professional occupations, as follows:

> In 1926, a list of positions were furnished twelve employment managers of the same number of large corporations in California, and each was asked to indicate the number of employees in his company for each position listed. The list contained seventy-five different positions, thirty-two of which were believed to require four years of college preparation and forty-three were believed to require, in the language of the questionnaire, only two years of college work. The tabulated report from the twelve companies showed 755 employees in positions believed to require only two years of college, and 289 in positions believed to require four-years of college work. [31]

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31 op. cit. pp. 158-60

STATUS OF THE SEMI-PROFESSIONAL GRADUATE

Little or no information is at hand regarding the status of the junior college graduate of the semi-professional engineering curricula; however, in the field of the technical institute, we find some data that will throw light on the status of the semi-professional engineering graduate.

Spahr presents some figures pertaining to this phase of the question as it affects the technical institute. In Table IV, on page 41, we have data concerning the status of the technical institute graduate as represented by conditions found at the plant of a large manufacturing company. If the status of the technical institute is so favorable in the large company, it is evident that his status in the case of the small companies is likely to be more so.

It is of interest to analyze the figures here given and note the real significance of them. In the case of the area listed as General Officers, we find that the four-year college men rank the lowest in percent. This condition is due to the fact that these positions are filled with business men for the most part, rather than with technically trained men. To the college men with four years of engineering training, this type of position is looked upon as that with no future.

TABLE IV

DISTRIBUTION BY FUNCTIONS OF GRADUATES OF COLLEGES AND TECHNICAL INSTITUTES

	15.090 College men in Tech. & Supervisory positions.	1.389 shorter course men in Tech. Insts. in Tech. & Elect. Sup'y positions.	325 shorter course Tech. Inst. men & Super'y positions.
General Officers.....	9.9 %	11.1 %	22.5 %
Engin. & Technical.....	33.0	26.0	20.0
Production.....	9.0	33.0	24.3
Sales and Advertising..	38.1	66.1	10.1
Miscellaneous.....	10.0	23.8	23.1

[32]

[32] R. H. Spahr. Engineering Education on the Junior College Level. American Assoc. of Junior Colleges, 1929 p. 50

In the next area, that of Engineering and Technical, the work comprises the design of complicated machines which is more in line with the training of the four-year graduate. In the field of production, it is to be noted that the technical men far out number the college men. In this area, we find that the institute men have been trained especially for the work of this field while the training of the four-year college men is not in line with the work. Furthermore, the men of the last class, cannot see the future in the field of production that they hope for. Here, again, it is to be noticed that the ratio is almost 4 to 1 in favor of the institute men. In the next class or field, we find that the college men have the larger percentage. This condition is doubtless due to the fact that the college graduate is better fitted, because of his highly cultural education, to meet the buying public, which is made up of men of like education. In the last class, listed Miscellaneous, we would probably find positions that do not appeal to the college men even as a starting point in their engineering life, while to the institute men these positions furnish only place where they can find an entrance into industry.

The general feeling on the part of the employer regarding his choice of the college men or the institute men seems to be that he would rather have in production a well-trained institute man, than a half-developed college man.

CONCLUSIONS

The general conclusion to be drawn from the data presented in this chapter is to the effect that there is a definite need on the part of industry for men with a semi-professional training in engineering.

In the first place, the opinions, as expressed by representatives of industry, show that there is a definite place for the man with an engineering education of two years in length but intensive in character. The data shows that the four-year college graduate does not look with favor upon certain positions in industry as being on a level with his training. In other words, it is beneath his education as an engineer to start in at certain levels.

In the second place, the data presented in this chapter give evidence that certain occupations are semi-professional in character and can be filled by men with but two years of technical training. No manufacturing concern would finish their product beyond the demand, so why should all technical students be educated beyond the demand, as engineers, when but a small percentage of them will find employment as such.

Finally, from the experience of the technical institute it is seem that there is a place in the educational field for the institution that will take care of the needs of industry. As a public institution, the junior college is the logical place for offering semi-professional engineering curricula.

CHAPTER IV

SEMI-PROFESSIONAL ENGINEERING CURRICULA OFFERED BY EDUCATIONAL INSTITUTIONS BEYOND THE HIGH SCHOOL

Purpose of this chapter. The purpose of this chapter is to make a study of the engineering curricula of a semi-professional nature as offered by educational institutions beyond the high school grades. It is important to the problem under investigation that a complete understanding be had as to what is being offered as semi-professional curricula by these institutions.

The method of study of this phase of the investigation will consist of an examination of the catalogues of the four-year colleges, the technical institutes, and the public junior colleges of the state of California.

THE FOUR-YEAR ENGINEERING COLLEGES

With the wide experience of the professional college, it was thought necessary to complete the solution of the problem under investigation, that a consideration be given the engineering curricula of the four-year professional college.

From a study of the semi-professional engineering curricula of the four-year institutions some light is obtained concerning the part that the colleges are playing in meeting the needs of the community in an educational way. In the study conducted by Koos, in which he sent out 128 letters to heads of standard engineering colleges requesting data as to the different engineering curricula of a semi-professional

grade that the institution was offering, he received 103 replies. From this number of replies, but six institutions stated that they were offering one-year, two-year, or three-year curricula of college grade in engineering or allied industrial activities.

The name of the institutions and the particular semi-professional curricula offered are as follows:

Alabama Ply. Institute
- Two-year courses in
  - Applied electricity
  - Architecture
- One-year courses in
  - Wireless telegraph

University of Alabama
- Two-year technical courses designed to fit men for such positions as:
  - Analytical chemist
  - Structural and Topographical draftsman
  - Land, city, topographical and railway surveyor
  - Superin. of road and pavement construction
  - Power plant assistant
  - Mill electrician
  - Assistant shop foreman
  - Mine and Quarry Superintendent, etc.

Des Moines University
- One-year courses in
  - Electrical construction and repair
  - Surveying and Highway Construction
  - Concrete construction
  - Contracting and building
  - Steam engineering, power plant operation
  - Farm mechanics
  - Mechanical drafting
  - Structural drafting
  - Automobile industry

Georgia School of Technology
- Two-year courses in
  - Architecture (61) and Textiles (11)

University of South Carolina
- Two-year courses in
  - Highway Engineering

State College of Washington
Two-year courses in
Automobile engineering
Highway engineering
Architecture for draftsmen and building contractors [33]

The number of students enrolled was stated by only one institution, the Georgia School of Technology, this enrollment being indicated by the number in parenthesis following name of course. As indicative of the feeling of the four-year college administrators towards the semi-professional or the two-year curriculum, Koos reports that the dean of the College of Engineering at the University of South Carolina made the following statement concerning the two-year curriculum in highway engineering:

> We have had a number of men enroll for this course but in every instance they have remained and completed the full course, which is required for the Civil Engineering degree.[34]

The dean at the University of Alabama says of their two-year engineering curricula that:

> There are usually two or three students each year in these courses, and the students generally find that they want the four-year curriculum. Usually, they are able to transfer without much loss of time.[35]

Koos, in commenting on the part that the four-year engineering colleges are doing, and the part that they can

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33 L. V. Koos, The Junior College. University of Minnesota, Minneapolis, 1924, p. 147.

34 Ibid. p. 147

35 Ibid. p. 148

be counted on to do in developing the semi-professional engineering curricula, sums up the situation very nicely as follows:

> From the results of this inquiry,,we must conclude that our professional schools tend to hold closely to their professional standards, and that they are doing little in a direct way to train for occupations on the semi-professional level. The usual small enrollments in the shorter curricula and the tendency of the students to shift to the longer professional offerings are not likely to influence the authorities in such institutions to introduce more of them. It may at the same time be seriously doubted if, with the stigma which attaches to attendance upon a shorter curriculum where the longer is more honorific, these semi-professional courses in the standard professional schools can ever make much headway.[36]

To sum up the situation as to what the four-year engineering colleges are doing toward offering semi-professional curricula of an engineering nature, all that can be said is that while these curricula may appear in the catalogue, the enrollment does not justify any credit being given the colleges for offering semi-professional work. After carefully considering the situation, so far as the four-year colleges are concerned, it is possible to understand their lack of interest in developing semi-professional curricula. Their main endeavor is that of offering a complete four-year curriculum, four years, in their estimation, being the shortest required time necessary to acquire a real engineering education. In view of this condition, for the college to offer the semi-professional curricula would be direct competition in itself.

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[36] Op. cit. p. 152.

THE TECHNICAL INSTITUTE

The term Technical Institute carries with it the idea of a school that offers courses of a technical nature. This term makes a fitting distinction from that of Engineering College. The technical institute is an institution that is fulfilling a community need that will in time have to be taken over by the public junior college. The characteristics of the technical institute are in many respects similar to those of the junior college, in so far as the semi-professional curricula are concerned. In view of this fact, considerable space will be given, in this section of the chapter, to the curricula and characteristics of the technical institute.

The method of study of the technical institute has been by examination of the catalogues and professional literature. While this type of institution is a private enterprise, and consequently not in any sense standardized, the common ambition is to meet the needs of those individuals who cannot spend four years in securing the necessary education for making good in life. There is some variation in the curricula offered by the different technical institutes throughout the country but this is to be expected, since the curricula that carries the large enrollment will be so affected by the kind of industry in that locality.

Technical institute characteristics. In order to fully understand the functions of the technical institute, it is

well to study its characteristics. These are very well established by the Society for the Promotion of Engineering Education, and reported in their study of Technical Institutes. A summary of these characteristics are given below:

1. It is a school of a post-secondary character, but distinct in character from a college or university in the American sense of these terms.
2. Its purpose is to train men and women for callings and functions which occupy an area between the skilled crafts and the highly scientific professions. A fair proportion of those trained, advance in time to a professional status.
3. It caters principally to persons either through previous collateral experience in industry, have found their bearings and desire intensive preparation for chosen lines of progress.
4. It offers training for both technical pursuits, concerned with planning and control, and supervisory pursuits concerned with operation and maintenance. The engineering college more largely emphasizes the former, the technical institute the latter group.
5. Being intensive in purpose, its courses are of shorter duration than those of the professional colleges. They are essentially terminal rather than preparatory courses, though in some cases they are organized in successive units, or stages.
6. Being a school without academic standardization its admission and graduation requirements are less formal than those of the colleges and stress capacity and experience more than credit and units.
7. Its methods of teaching are relatively direct, with a strong emphasis on doing as distinct from book study; ordinarily a high proportion of the work is done on school premises.
8. Its teachers, while possessing adequate scholarship preparation are chosen primarily on the basis of practical experience, personal sagacity, and ability to teach through programs of olderly experience.
9. Its entire scheme of instruction follows much more closely the actual usage of industry than that of professional engineering schools. [37]

The present day feeling of the administrators of the engineering colleges is that the curriculum should be such that fundamentals be stressed to the limit, and little or no

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37 R. H. Spahr. A Study of Technical Institutes. The Society for the Promotion of Engineering Education, Feb. 1931. p. 17.

no specializing by students be permitted. This type of education enables the graduate to enter the broad field of engineering and in time find the particular phase that may be had to his liking, and in time, he may specialize. On the other hand, the field of technology requires a preparation for specific industries, and further, for specific jobs. It is with this field that the technical institute is concerned. As an example that would show the work of the two institutes, consider the quantity surveyor, whose duties consist of taking off plans, the complete quantities of materials, areas, volumes, number unit items, from which contractors may base their bids as to cost of construction. To perform this work one must have an intimate knowledge of a specific line. On the other hand, a limited knowledge of the design, with calculations as to stress and strain, will be sufficient. In the case of the structural engineer, who has to do with the design of the building or structure, he must have a deep knowledge of the principles of design. In the setting up of educational courses to meet such situations, it is better to work from the point of view of job analysis. Most of the specific functional jobs offer attractive outlets, which leac to posts of responsibility. From this consideration, it is seen that this type of education belongs to the technical institute rather than the engineering college.

The apparent issue between the engineering college and the technical institute, comes down to the question of

whether the by-product of the college can take the place of the technical institute graduate. The answer to this question, is to be found in the viewpoint of industry; the answer to which is:

> A thoroughly trained technician or operating supervisor ought to be more acceptable than a half-baked or ill-adjusted engineer.[38]

History of the technical institute. It is of interest to study the history of the technical institute, noting the different stages through which it has passed in comeing to its present state. The beginning of this institution cannot be traced to a definite date but most likely it had its real origin back in the 1800's. At that time, there was a movement for the education and welfare of the workmen, doubtless the out-growth of the industrial revolution. Early in 1820, mechanics institutes were established for the purpose of dissiminating scientific information among the farmers and mechanics.

In New York City, an apprentice library and a school for the children mechanics were founded in 1820. In Boston during the same year, similar library was established, followed in 1827 by the opening of the mechanics institute. Along about 1825, the Maryland Institute of Baltimore was organized to hold annual exhibitions of manufacturers, conduct scientific lectures, and maintain a library. In various cities of the country, the establishing of such institutes took place very rapidly.

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38 R. H. Spahr. Op. Cit. p. 63.

The first technical institute. However, the first technical institute to be established as such, was in 1822. This was the Gardiner Lyceum, Maine. The original curriculum of study covered two years but was later extended to three years. The content of the curriculum was as follows:

FIRST YEAR: Arithmetic, geography, bookkeeping, algebra, geometry, mensuration, and linear drawing.

SECOND YEAR: Trigonometry, surveying, navigation, applied algebra and geometry, differential calculus, integral calculus, mechanics, perspective, chemistry, and agricultural chemistry; instead of the last mentioned subject, civil engineering may be pursued by those who prefer it.

THIRD YEAR: Natural philosophy, astronomy, political economy, the federalist, history.

It is of interest to note the intensive sequence of the technical subjects of the first two years, contrasted with the liberal education of the third year.

In 1823, Stephen Van Rensselear of Albany, New York, a well-to-do man and leader in public affairs, realized the need of lecturers and teachers in the field of the technical sciences. With this in mind, Mr. Van Rensselear founded what today is known as the Rensselear College of Engineering. The original function of the Rensselear School was that of training teachers in technology. The plan of the school as specified by the founder was that:

> In every branch, of learning, the student begins with its practical application and is introduced to a knowledge of elementary principles from time to time, as his progress requires.
>
> By this method, a strong desire to study an elementary principle is excited by bringing his labors to a point where he perceives the necessity of its application to a useful purpose.

The influence of railroads on education. The country at this time was growing in phase of its life and changes were taking place at a rapid pace, so that it was to be expected that marked changes in the educational field were likely to be necessary. The first locomotive appeared about 1829, and the spread of railroads was very rapid from this time until 1836, at which time there were 29 railroads under construction. Due to this state of affairs, there at once arose a demand for engineers well-trained in railroad construction. However, aside from the few military engineers and practical surveyors, there were none to be had. This condition soon brought about a change in the status of the Rennsselear School, which evolved a definite engineering curriculum, conferring on its first graduating class the degree of Civil Engineer. By 1849, Rensselear was reorganized as a Polytechnic Institute, with the course of study lengthened to four years.

Outstanding Technical Institutes. While there are a great number of technical institutes throughout the country, there are a few that stand out as successful as a real educational institution. The best known is undoubtedly Pratt Institute, which was founded in 1877 by Charles Pratt and since his death carried on by his family. Mr. Pratt was a practical manufacturer of Brooklyn, New York, interested in the welfare of the young people of the community. He realized the need of industry and endeavored to supply this need of industry by founding a school in which the young people could obtain an education that would enable them to

obtain employment in technical fields of industry.

The Ohio Mechnaics Institute of Cincinnati and the Rochester Athenaeum and Mechanics Institute have both held fast to their early traditions of training for the technical fields of industry. Another school, that is worthy of mention, is the Wentworth Institute of Boston. This institution was founded for a definite purpose and throughout the years of its existence has held fast to the founder's idea. The school has become a vocational and technical institute of a very high order. The Bliss Electrical School located at Washington, D.C. is of a very high order. The Bliss Electrical School offers an example of an institution that is a personal enterprise and yet through prudent management is not only self-sustaining but has earned the greater part of its capital as well. Cooper Union and the Newark Technical School have both placed their day schools on the collegiate basis, but have maintained their evening departments on a strictly technical level.

Technical institute curricula. In a study of the technical institutes of this country, it is found that there is a considerable variation as to the type of curriculum offered depending upon the nature of the industrial community in which the institute is located. Furthermore, due to the fact that these institutions are not in any way controlled or are under the supervision of a central educational body, there is no standardization of curriculum, hours per week, or number of weeks per school year. In view of this state of affairs,

it is impossible to make a very direct comparison of the curricula of the different schools. However, the following summary will give some idea of the type of curriculum offered in the technical institutes as investigated in this study.

In Table V, on pages 56 to 58, inclusive, is presented data covering the name of the institution, its location, whether a private enterprise, endowed, or state supported, and the names of the curriculum offered, together with the number of years required to complete same. There are, perhaps, three different types of schools to be found under the title of technical institute, as is to be noted in this table. In the first place, there is the type that conducts the classes during the day; next there is to be found a type that is operated on a co-operative basis; then there is the last type which is characterized by the fact that the classes are conducted in the evening, and are known as "Evening Technical School."

The full time day technical school curriculum generally covers a period of from one to two years in length, while the co-operative and evening school curricula will run from three in the former, to four in the latter. The amount of work covered in a certain curriculum as offered in each of the three types of schools is doubtless the same.

It is of interest to note the variation of curricula with the location of the institution. In the case of institutes located in the very large cities, we find the different curricula covering the three general branches of engineering as civil, mechanical, and electrical, while the smaller cities some outstanding industry creates a demand for a curriculum.

TABLE V

THE CURRICULA OF THE TECHNICAL INSTITUTES
Full Time Day Courses

BLISS ELECTRICAL SCHOOL, Washington, D.C. (Private Enterprise)
1-year course in Electrical Technology

BRADFORD DURFEE TEXTILE SCHOOL, Fall River, Mass. (State)
3-year course in Cotton Manufacture
2-year course in Chemistry and Dying
2-year course in Machine Shop practice

BRADLEY POLYTECHNIC INSTITUTE, Peoria, Ill. (Endowed)
2-year course in Applied Electricity
2-year course in Machine Drafting
2-year course in Machine Shop practice

CALIFORNIA POLYTECHNIC INSTITUTE, San Luis Obispo, Cal. (State)
2-year and 4-year courses in Mechanics
2-year course in Industrial Electricity

CHICAGO TECHNICAL COLLEGE, Chicago, Ill. (Private Enterprise)
2-year course in Architectural Engineering
2-year course in Civil and Structural Engineering
2-year course in Contracting, Architectural Drawing, and Building Construction
2-year course in Electrical Engineering
2-year course in Mechanical Engineering
1-year course in Surveying, Topography, and Mapping

DUNWOODIE INDUSTRIAL INSTITUTE, Minneapolis, Minn. (Endowed)
2-year course in Building Construction
2-year course in Highway Construction, Surveying, Drafting, and Computation
2-year course in Industrial Electricity
1-year course in Surveying and Highway Engineering

FRANKLIN UNION, Boston, Mass. (Endowed)
2-year course in Industrial Chemistry
2-year course in Industrial Electricity

HEALD TECHNICAL SCHOOL, San Francisco, Cal. (Private Enter.)
2-year course in Electrical Engineering
2-year course in Mechanical Engineering

LOWELL TEXTILE INSTITUTE, Lowell, Mass. (State)
3-year course in Cotton Manufacturing
3-year course in Wool Manufacturing
3-year course in Textile Designing

MILWAUKEE SCHOOL OF ENGINEERING, Milwaukee, Wis. (Private)
2-year course in Industrial Electrical Engineering
2-year course in Commercial Electrical Engineering

TABLE V (Con.)

NEW BEDFORD TEXTILE SCHOOL, New Bedford, Mass. (State)
2-year course in Cotton Manufacturing, Designing and Chemistry
2-year courses, Junior Manufacturing and Mechanical

OHIO MECHANICS INSTITUTE, Cincinnati, Ohio. (Endowed)
2-year course in Industrial Electrical Engineering
2-year course in Industrial Mechanical Engineering

PHILADELPHIA TEXTILE SCHOOL, Philadelphia, Penn. (Endowed)
Courses in Textile Technology

PRATT INSTITUTE OF SCIENCE AND TECHNOLOGY, Brooklyn, N.Y. (End)
2-year course in Industrial Chemical Engineering
2-year course in Industrial Electrical Engineering
2-year course in Industrial Mechanical Engineering

WENTWORTH INSTITUTE, Boston, Mass. (Endowed)
2-year course in Electrical Construction
2-year course in Foundry Management and Operation
2-year course in Machine Construction and Tool Design
2-year course in Power Plant Practice

Co-operative Half-time Day Courses

OHIO MECHANICS INSTITUTE, Cincinnati, Ohio, (Endowed)
2-year course in Power Laundry Operation

ROCHESTER ATHENAEUM AND MECHANICS INSTITUTE, Rochester, N.Y. (Endowed)
3-year course in Construction, Supervision and Architectural Drafting
3-year course in Chemistry
3-year course in Electricity
3-year course in Mechanics

Evening Courses

CLEVELAND Y.M.C.A. SCHOOL OF TECHNOLOGY, Cleveland, Ohio (Y.M.C.A.)
3-year course in Chemical Engineering
3-year course in Civil and Structural Engineering
3-year course in Electrical Engineering
3-year course in Mechanical Engineering

DREXEL INSTITUTE, Evening Diploma School, Phila, Penn. (Endowed)
4-year evening course in Architecture
4-year evening course in Building Construction
4-year evening course in Chemical Engineering
4-year evening course in Electrical Engineering
4-year evening course in Machine Design
4-year evening course in Mechanical Engineering
4-year evening course in Structural Engineering

TABLE V (Con)

FRANKLIN UNION, Boston, Mass. (Endowed)
- 4-year evening course in Building Construction
- 4-year evening course in Industrial Chemistry
- 4-year evening course in Industrial Electricity
- 3-year evening course in Industrial Electricity
- 3-year evening course in Surveying

NEWARK TECHNICAL SCHOOL, Newark, N.J. (City and State)
- 5-year course in General Chemistry
- 4-year evening course in Architecture
- 4-year evening course in Automotive Engineering
- 4-year evening course in Chemical Engineering
- 4-year evening course in Civil Engineering
- 4-year evening course in Electrical Engineering
- 4-year evening course in Mechanical Engineering

NEW HAVEN COLLEGE, New Haven, Conn. (Y.M.C.A.)
- 4-year evening course in Building and Construction
- 4-year evening course in Electrical Engineering
- 4-year evening course in Mechanical Engineering
- 3-year evening course in Engineering for Industry

RHODE ISLAND SCHOOL OF DESIGN, Providence, R.I. (Endowed)
- 4-year course in Mechanical Design

WESTINGHOUSE TECHNICAL NIGHT SCHOOL, East Pittsburgh, Pa. (Corporation)
- 4-year evening courses in Engineering

Table VI, on page 60, presents data covering the number of weeks per year, the hours in class per week, and the total number of hours required for the completion of the individual curriculum. The particular institutions listed in this table were selected for the reason that they are typical of their kind. The average number of weeks per year runs about 36, while the number of hours per week will be between 30 and 36. The wide variation in the case of the Ohio Mechanics Institute is due to the fact that the numbers represent the time spent in classes only, rather than the total time devoted to the work.

Table VII, on page 61, presents data showing the time as required for the typical curriculum as offered by the Evening Technical Institutes. While there is some variation in the number of years and weeks per year, the average of 300 hours per year seems to be consistent.

Conclusions. From an analysis of the data presented in this chapter, it is evident that the curricula as offered by the technical institute, is governed by the demand of industry as made manifest by the local products manufactured. In the larger centers of population, where the kinds of industry are many, and varied, the curricula are grouped around the three main fields of engineering. In the other districts where the industry is confined to one or two lines

TABLE VI

TECHNICAL DAY SCHOOLS

Number of weeks per year, hours per week, hours per course.

No.	Institution	Wks per Year	Hrs. per Week	Hrs. per Course
1.	NEW BEDFORD TEXTILE SCH.	37.5	32.5	3657
	General Cotton Manu.			
	3-years			
2.	OHIO MECHANICS INST.	20.0	20.0	800
	Co-operative Laundry			
	2-years			
3.	AMERICAN INST. LAUNDER.	40.0	33.8	1352
	Courses in launderying			
	1-year			
4.	WENTWORTH INSTITUTE	35.0	30.0	2100
	Foundry management and operation			
	Power plant practice	35.0	30.0	2100
	2-years			
5.	CHICAGO TECHNICAL COLLEGE	36.0	36.9	2593
	Building Construction			
	Civil & Structural Eng.	36.0	36.9	2593
	2-years			
6.	PRATT INSTITUTE			
	Indus. Mechan. Engineer	36.0	36.0	2208
	Indus. Electr. Engineer	36.0	36.0	2208
	Industrial Chem. Engin.	36.0	36.0	2208
	2-years			
7.	BLISS ELECTRICAL SCHOOL	32.0	35.0	1131
	Electrical Engineering			
	1-year			

TABLE VII

EVENING SCHOOLS

No.	Institution and Curriculum	No. Yrs.	Wks. per Yre.	Hrs. per Wk.	Eve. per Wk.	Hrs. per Eve.	Total hours course
1.	NEWARK TECH.SCHOOL Elec. course	3	27	10	5	2	1080
2.	COOPER UNION Mech. Engr.	5	32	10	5	2	1342
3.	DREXEL INSTI. Mech. Engr.	4	28	6	3	2	864

of manufacturing, the curricula are more or less influenced by these lines. This condition is very evident in the curricula of the New Bedford Textile School. In this particular institution, the curricula are built around the cotton manufacturing business, since this school is located in a section whose major business is that of cotton goods manufacturing.

THE JUNIOR COLLEGE

This part of the investigation of the problem under consideration will have to do with a study of the organization of the semi-professional engineering curricula as offered by the public junior colleges of the state of California. The study is confined to this particular state for the reason that in California the junior college is considered more as a public institution that is the case in other states. Furthermore, the development of the semi-professional engineering curricula has been more marked than in other sections of the country.

The investigation of the problem will be centered around an examination of the junior college catalogues, supplemented by a study of the professional literature that has a bearing on the subject.

Engineering as offered in the junior college. There are two distinct types of engineering curricula offered by the junior college, namely, pre-engineering and semi-professional engineering. The organization and content of the former is, for the most part, adopted from the four-year professional institution, while the latter is still in the making.

There are, comparatively, few junior colleges of the state of California, that attempt to offer a curriculum that might correctly be termed semi-professional in nature. This state of affairs is due to a number of reasons. In the first place, the total enrollment of the average junior college is small, with the result that there will be but a few students who will desire to follow engineering as a vocation. Of the number of students who will desire an engineering curriculum, some will plan to complete a four-year period at the university and consequently will not be interested in a two-year semi-professional program. For those who intend to complete their engineering curriculum at the professional college, the junior college will have to be prepared to offer what is generally listed in the catalogue as pre-engineering curriculum. On the other hand, the junior college will have to be in a position to meet the needs of those whose desire is to spend two years in the junior college, but to eventually enter the engineering field. This latter group will be offered the semi-professional engineering curriculum. Due to this state of affairs, the junior college is called upon to offer the two types of engineering curricula, an undertaking that is impossible in the smaller institutions.

The junior college teacher. There is a marked distinction in the two types of teachers needed for the work of the pre-engineering curriculum and that of the semi-professional engineering curriculum. In the case of the pre-engineering instruction, the

teacher should be of the university type for the reason that the students two years of study in the junior college will have formed a foundation for his later work in engineering at the university. Furthermore, the work undertaken by the student in the junior college will have to conform to that as given in the first two years of the four-year professional college; consequently, the type of instruction should be similar. The educational requirements of the university instructor have been well established for some time, so that no further consideration will be given to his qualifications at this time.

Concerning the best type of instructor for the junior college especially in the field of semi-professional engineering, very little has been done towards establishing definite educational requirements. However, since the instruction of the semi-professional engineering curriculum concerns itself more with the doing of things rather than the theory, the teacher for this type of work should have in addition to his engineering education, considerable experience of a very practical nature in the field in which he aims to teach.

Engineering laboratories. Another matter to be considered in connection with the offering of semi-professional engineering curricula is that of suitable laboratories. A large part of the instruction of the semi-professional curriculum has to be done in the laboratory so that the best results may be obtained. The opportunities afforded the teacher, through the use of the engineering laboratory in connecting up the principle with the application, are without number. The type of student to be found in the

semi-professional group, is such that he reacts to the laboratory method of instruction with far greater results than is possible in lecture or class-room instruction only.

In the light of the foregoing discussion, regarding the laboratory requirements for the proper instruction in semi-professional curricula, it is no small wonder that so little has been attempted by the small junior colleges in offering this type of education. There is little or no information available concerning the equipment necessary for the proper instruction of the semi-professional engineering curricula. The detail requirements will depend upon the various branches of engineering that are included in the curricula. The matter of cost is a consideration that makes the offering of semi-professional engineering impossible for the smaller institutions.

Semi-professional curricula in the junior colleges. The following tables in this chapter, Tables VII and XVI, inclusive, on pages 66 to 74, represent semi-professional engineering curricula as offered by the more progressive junior colleges of the state of California. These curricula were obtained from an examination of the catalogue of the indicated institution.

TABLE VIII

LOS ANGELES JUNIOR COLLEGE

2-year Curriculum in Mechanical Engineering

First Semester	Hours		Second Semester	Hours	
English	60		English	60	
Engineering Math	60		Engineering Math	60	
Machine Drawing		120	Machine Drawing		120
Physics	60	60	Elec. Engineering	60	60
Plane Surveying	60	60	Machine Mechanics	40	60
Phys. Ed		20	Health	40	
			Phys. Ed		20
	240	260		260	260

Third Semester	Hours		Fourth Semester	Hours	
Social Science	60		Social Science	60	
Engineering Math	60		Engineering Math	60	
Applied Mechanics	60		Machine Design	20	120
Descriptive Geometry	20	120	Hydraulics	40	
Electrical Engineer	60	60	Heat Engineering	60	
Electrical Draft'g		60	Phys. Ed		20
Phys. Ed		20	Strength Materials	60	
	260	260		300	140

2-year Curriculum in Electricity, Radio and Sound

First Semester	Hours		Second Semester	Hours	
English	60		English	60	
Physics	60	60	Physics	60	60
Applied Electricity	60	60	Applied Electricity	60	60
Applied Math	60		Applied Math	60	
Engineering Drawing		120	Electrical Drafting		60
Phys. Ed		20	Elective	20	
			Phys. Ed		20
	240	260		260	200

Third Semester	Hours		Fourth Semester	Hours	
Mathematics	60		Philosophy of Law	60	
Psychology	60		Business Courtesy	20	
Economics	60		Phys. Ed		20
Health	40		Mathematics	60	
Phys. Ed		20	Dynamo-Elec. Machines	60	60
Alternating Currents	60	60	Industrial Control	40	60
Light and Power Wire	40		Heat Engineering	60	
Radio Circuits	40	120	Vacuum Tube Circuits		60
Sound	20	60	Transmitting	20	60
			Salesmanship	40	
	380	260		440	260

Note: Hours in first column, class time; second column, laboratory.

TABLE IX

LOS ANGELES JUNIOR COLLEGE

2-Year Curriculum in Aviation.

First Semester	Hours		Second Semester	Hours	
English	60		English	60	
Engineering Math	60		Engineering Math	60	
Engineering Drawing		120	Machine Drawing		120
Physics	60	60	Electrical Engineer	60	60
Engineering Aviation	40		Airplanes	60	
Health	40		Meteorology	40	
Phys. Ed		20	Phys. Ed		20
	240	200		280	200

Third Semester	Hours		Fourth Semester	Hours	
Social Science	60		Social Science	60	
Engineering Math	60		Engineering Math	60	
Applied Mechanics	60		Airplane Engines	60	
Navigation	40		Strength Materials	60	
Aerodynamics	60		Airplane Design	60	
Descriptive Geom	20	120	Aeronautical Draft		120
Phys. Ed		20	Phys. Ed		20
	300	140		300	140

2-Year Curriculum in Civil Engineering

First Semester	Hours		Second Semester	Hours	
English	60		English	60	
Engineering Math	60		Engineering Math	60	
Engineering Draw		120	Civil Engin. Drawing		120
Physics	60	60	Material Construct	60	
Surveying	60	60	Surveying	40	60
Phys. Ed		20	Land Mapping		60
			Health	40	
			Phys. Ed		20
	240	260		260	260

Third Semester	Hours		Fourth Semester	Hours	
Social Science	60		Social Science	60	
Engineering Math	60		Engineering Math	60	
Applied Mechanics	60		Strength Materials	60	
Descriptive Geom	20	120	Structural Design	20	120
Route Surveying	20	60	Engin. Calculation	60	
Astronomic Survey		60	City Surveying	20	60
Hydraulics	40		Phys. Ed		20
Phys. Ed		20			
	260	260		280	200

Table X

MODESTO JUNIOR COLLEGE

2-Year Curriculum in Aeronautics and Aviation

First Semester Hours			Second Semester Hours		
English	36		English	36	
Adv. Algebra	72		Adv. Algebra	72	
Radio Code	36		Aeronautics	54	
Weather	36		Physics	36	54
Physics	36	54	Phys. Ed		18
Phys. Ed		18	Electives	54	
Electives	72				
	288	72		252	62

Third Semester Hours			Fourth Semester Hours		
English	36		English	36	
Social Science	54		Social Science	54	
Radio Code	54		Weather	54	
Aeronautics	54		Meterology	18	
Aviation	18		Physics	36	54
Physics	36	54	Phys. Ed		18
Phys. Ed		18	Electives	36	
	252	72		252	72

Table XI

LONG BEACH JUNIOR COLLEGE
Long Beach, Calif.

2-Year Curriculum in Architectural Engineering.

First Semester	Hours		Second Semester	Hours	
English	54		English	54	
Social Science	36		Machine Drawing	18	108
Mach. Drawing	18	108	Art	18	54
Advanced Algebra	54		Electives	108	
Physics	54	108	Architect. Draw.		162
Phys. Ed.		18	Freehand Drawing.		108
			Surveying	18	108
			Phys. Ed.		18
	216	224		254	558

Third Semester	Hours		Fourth Semester	Hours	
Social Science	36		Electives	108	
Art	18	54	Architect. Drawing		162
Geometry	54		Freehand Drawing		108
Physics	36	54	Hygiene	36	
Mach. Dr.		108	Surveying	18	108
Phys. Ed.		18	Phys. Ed.		18
	194	234		162	396

Table XII

PASADENA JUNIOR COLLEGE
Pasadena, Calif.

2-Year Curriculum in Civil Technology

First Semester	Hours		Second Semester	Hours	
Technical Physics....	36	72	Technical Physics.....	36	72
Technical Math.....	36		Technical Math.....	36	
Technical Reports....	36		Business Law....Techl.		
Engineering Draw.....	18	108	Reports.....	36	72
Materials Construc...	36		Descriptive Geometry..	18	72
Geology.....	36	108	Engineering Problems..	38	
Trips and Lectures...	18	18	Indus. Administra.....	54	
R.O.T.C. or Phys. Ed.		54	Trips and Lectures....	18	18
			R.O.T.C. or Phys. Ed..		54
	226	360		234	342

Third Semester	Hours		Fourth Semester	Hours	
Technical Math.....	36		Technical Math.....	36	
Plane Surveying.....	18	90	Plane Surveying.....	18	90
Structural Stresses..	54		Advance Surveying.....	18	54
Wood Construction....	36		Strength Materials....	54	
Hydraulics.....	36	54	Materials Testing.....		54
R.O.T.C. or Phys. Ed.		54	Steel Design.....	36	
			Reinforced Concrete...	36	
			Structural Drafting...		54
			R.O.T.C. or Phys. Ed..		54
	234	198		198	306

2-Year Curriculum in Mechanical Technology

First Semester	Hours		Second Semester	Hours	
Technical Physics.....	36	72	Technical Physics.....	19	36
Technical Math.....	36		Technical Math.....	36	
Technical Reports.....	36		Engineering Problems...	36	
Engineering Draw.....	18	108	Descriptive Geometry...	18	72
Treatment Materials...	18	54	Treatment Materials....	18	54
D.C. Elec. & Lab.....	54	54	D.C. Elec. & Lab.....	54	54
Trips and Lectures....	18	18	Trips & Lectures.....	18	18
R.O.T.C. or Phys. Ed..		54	R.O.T.C. or Phys. Ed...		54
			Electives.....	36	
	226	360		235	288

Third Semester	Hours		Fourth Semester	Hours	
Technical Math.....	36		Technical Math.....	36	
Power & Indus. Plants.	54		Heat Power Engineering.	36	36
Mechanical Lab.....		54	Strength Materials.....	54	
Machine Design.....		108	Materials Testing.....		54
Mechanism.....	54		Machine Design.....		108
Metallurgy & Metals...	36	54	Mechanical Lab.....		54
Indus. Adminis.....	54		Metallurgy & Metals....	36	54
R.O.T.C. or Phys. Ed..		54	Elective.....	54	
			R.O.T.C. or Phys. Ed...		54
	234	270		162	414

Table XIII

PASADENA JUNIOR COLLEGE
Pasadena, Calif.

2-Year Curriculum in Electrical Technology

First Semester	Hours		Second Semester	Hours	
Technical Physics	36	72	Technical Physics	18	18
Technical Math	36		Technical Math	36	
Technical Reports	36		Descriptive Geom	18	72
Engineering Drawing	18	108	Engineering problems	36	
Treatment Materials	18	54	D.C.Electricity	54	
D.C. Elec. & Lab	54	54	D.C. Laboratory	54	54
Trips & Lectures	18	18	Trips & Lectures	18	18
R.O.T.C. or Phys. Ed.		54	Elective	36	54
			R.O.T.C. or Phys. Ed.		54
	216	360		206	288

Third Semester	Hours		Fourth Semester	Hours	
Technical Math	36		Technical Math	36	
Power & Indus. Plants	54		Heat Power Engin	36	36
Mechanical Lab		54	Strength Materials	54	
A.C. Electricity	54		A.C. Machinery	54	
A.C. Lab		108	A.C. Laboratory		108
Elec. Machine Design.		108	Materials Testing		54
Elective	36	72	Industrial Adminis	54	
R.O.T.C. or Phys. Ed.		54	R.O.T.C or Phys. Ed.		54
	180	396		234	252

2-Year Curriculum in Aviation

First Semester	Hours		Second Semester	Hours	
Technical Physics	36	72	Technical Physics	36	72
Technical Math	36		Technical Math	36	
Technical Reports	36		Descriptive Geom	18	108
Engineering Drawing	18	108	Engineering problems	18	
Treatment Materials	18	54	Aeronautics & Engin	54	108
Aeronautics	18	54	Trips & Lectures	18	18
Metallurgy & Metals	36	54	Elective	18	
R.O.T.C. or Phys. Ed.		54	R.O.T.C. or Phys. Ed.		54
	198	396		216	360

Third Semester	Hours		Fourth Semester	Hours	
Technical Math	36		Technical Math	36	
Mechanisms	54		Metallurgy & Metals	36	54
Astronomy	36	54	Geog. & Meteorology	36	54
Aeronautics & Naviga	54	108	Aeronautics & Indus	54	108
Industrial Adminis	54		Strength Materials	54	
Trips & Lectures	18	18	Materials Testing		54
R.O.T.C. or Phys. Ed.		54	R.O.T.C or Phys Ed.		53
	251	234		216	324

Table XIV

PASADENA JUNIOR COLLEGE
Pasadena, Calif.

2-Year Curriculum in Building Practice and Design.

First Semester	Hours		Second Semester	Hours	
Technical Physics	36	72	Technical Physics	36	72
Business English	54		Business English	54	
Residence Design	18	90	Business Law	36	
Landscape Design	36	72	Residence Design	18	90
Elementary Surveying	18	90	Buildg. and Const.		108
Trips & Lectures	18	18	Trips & Lectures	18	18
Elective	54		Elective	54	
R.O.T.C. or Phys. Ed.		54	R.O.T.C. or Phys. Ed.		54
	224	396		216	342

Third Semester	Hours		Fourth Semester	Hours	
Cost Est. & Job Mana.	54		Wood Construction	36	
Accounting		126	Steel Design	36	
Residence Design		108	Residence Design		108
Wood Construction	36		Strength Materials	54	
Interior Decoration	36		Materials Testing	54	
Structural Stresses	54		Reinforced Concrete	36	
Elective	54		Elective	54	
R.O.T.C. or Phys. Ed.		54	R.O.T.C. or Phys. Ed.		54
	234	288		216	216

Table XV

SANTA ANA JUNIOR COLLEGE
Santa Ana, Cal.

2-Year Curriculum in General Engineering

First Semester	Hours		Second Semester	Hours	
English	54		English	54	
Mechanical Drawing		108	Machine Drawing		108
Forge Shop		108	Forge Shop		108
Physics	36	54	Physics	36	54
Chemistry	54	108	Chemistry	54	108
	144	378		144	378

Third Semester	Hours		Fourth Semester	Hours	
Political Science	54		Political Science	54	
Machine Drawing		108	Machine Drawing		108
Mathematics	54		Physics	36	54
Physics	36	54	Treat. Material	36	
Treat. Materials	36		Surveying	36	54
Surveying	36	54			
	216	216		162	216

2-Year Curriculum in Drafting and Mechanics

First Semester	Hours		Second Semester	Hours	
English	54		English	54	
Mechanical Drafting		108	Mechanical Drawing		108
Mathematics	54		Machine Shop		108
Machine Shop		108	Physics	36	54
Physics	36	54			
	114	220		90	220

Third Semester	Hours		Fourth Semester	Hours	
English	54		English	54	
Mechanical Drawing		108	Mechanical Drawing		108
Mathematics	54		Machine Shop		108
Machine Shop		108	Physics	36	54
Physics	36	54			
	144	220		90	220

Table XVI

SANTA ANA JUNIOR COLLEGE
Santa Ana, Calif.

2-Year Curriculum in Geological Engineering

First Semester		Hours	Second Semester		Hours
English	54		English	54	
Mechanical Drawing		108	Mechanical Drawing		108
Mathematics	54		Chemistry	36	54
Chemistry	54	108	Geology	54	
Geology	54				
	216	216		144	162

Third Semester		Hours	Fourth Semester		Hours
Political Science	54		Political Science	54	
Spanish	90		Spanish	90	
Geology	54		Geology	54	
Surveying	36	54	Surveying	36	54
	244	54		244	54

2-Year Curriculum in General Surveying

First Semester		Hours	Second Semester		Hours
English	54		English	54	
Mechanical Drawing		108	Mechanical Drawing		108
Forge Shop		108	Mathematics	54	
Physics	36	54	Physics	36	108
Chemistry	54	108	Surveying	36	54
	144	378		190	270

Third Semester		Hours	Fourth Semester		Hours
Machine Drawing		108	Machine Drawing		108
Mathematics	54		Mathematics	54	
Physics	36	108	Physics	36	108
Surveying	36	54	Surveying	36	54
			Mechanism	36	
	126	270		262	270

From an analysis of the foregoing semi-professional engineering curricula, it is evident that many of the courses that go to make up the curriculum content have been adopted from the typical engineering curriculum, but to serve as a semi-professional course it must be so in name only. In the case of mathematics, this subject as a course in the semi-professional engineering curriculum, should be presented not as an end in itself but merely as a means to an end. The same is true in the case of each subject that is found in the various curricula. The different principles forming the high lights of the engineering subjects are not to be taught for themselves but for the part and importance they have in the engineering world. The real difference between the work of the junior college semi-professional curriculum and that of the four-year engineering college is to be found, largely, in the method of instruction.

In speaking of the need of technically trained men in the field of industry and the junior college program, Spahr has the following to say:

> We probably will look to the technical institute and junior college for the training necessary to fill the need of this phase of industry, provided the latter will adjust its program to meet most effectively local needs.[35]

For the junior college to meet the needs of the community, it would do well to consider the curricula of the technical institute for ther is much in common in these two educational institutions.

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35 R.H. Spahr. Engineering Education of the Junior College Level. Presented at the 10th Annual Meeting of the American Association of Junior Colleges. Nov. 1929. p. 10.

CONCLUSIONS

In this chapter, data were presented to show to what extent the three educational institutions beyond the high school grades were offering semi-professional engineering curricula on a junior college level. The three institutions covered are the four-year engineering college, the technical institute, and the public junior college.

The four-year engineering college has not in the past, nor at the present, nor can it hope in the future, to prepare for the entire field of engineering. It was generally felt that this type of institution offered all the training necessary for the industrial world. However, a study of the conditions as found in industry has revealed that the technical staff positions in the field have been satisfactorily filled by the graduates of the four-year engineering colleges, while the technical positions in the field of production have been filled inadequately. The graduate of the professional college is not inclined to enter the production field. This condition is due, perhaps, to the type of instruction given the four-year student and, also, to the fact that industry has drawn from the schools of shorter intensive engineering courses, such as the technical institute. Their catalogues, from the comparatively few four-year colleges, that list semi-professional engineering curricula, have such a small enrollment that little can be expected of this type of engineering education.

Concerning the part that the technical institute plays in the semi-professional engineering educational field, it is very evident so far as the data presented in this chapter are concerned. One of the conclusions regarding the technical institute curricula is that it is meeting the needs of the community. The variation in the curricula depends upon the nature of the industry for that particular locality. Where the school is located in a large center of population and the type of manufacturing likely to be varied, the technical institute curricula comprises the three general branches of engineering, namely; civil, electrical, and mechanical. As the work of the technical institute has to be intensive in character many sub-branches of the above are offered as individual courses, such as mechanical drafting, structural drafting and architectural drafting. One institution may have but one curriculum such as the Bliss School, where the curriculum is that of electrical engineering. In the case of the New Bedford School the curricula are centered around the cotton goods manufacturing business. In this way, the technical institute has to be meeting a real need of the community.

From a study of the data presented in this chapter concerning the junior college curricula, it is evident that a start has been made in the developing of the semi-professional engineering curricula. The courses that go to make up the different curricula may have the same name as many offered in the university but the difference will come in the method of

instruction. The curricula content will be organized in regard to the various branches of engineering with job analysis forming the basis. The training afforded by the curricula to be specialized in character with a skill as a fundamental consideration. The method of instruction for the semi-professional engineering curriculum must embody considerable laboratory work. The type of instructor to be one with the engineering education supplemented with considerable experience in the field in which he teaches.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The problem restated. The problem which has been under investigation and reported in this study, is the organization and content of semi-professional engineering curricula in junior colleges.

The study for the most part consisted of an examination of the catalogues of educational institutions offering semi-professional engineering curricula. Supplementing this data, consideration was given to professional literature having a bearing on the problem under investigation.

In treating the problem, consideration was given to the place that semi-professional engineering should have in the educational program of the junior college. An effort was made to determine whether the functions of the junior college included any that would entitle this institution to offer engineering curricula on a semi-professional level. As a further step in the solution of the problem, a study of the aims of semi-professional education was made.

Another important consideration in the study of the problem was the question as to the demand of semi-professional engineering graduates on the part of industry. The answer to this question is of great significance to the junior college, because this institution should offer semi-professional engineering.

The main part of the study is centered around the semi-professional engineering curricula as offered by educational institutions beyond the high school grade. In this field of education, curricula of a semi-professional engineering nature were found in the four-year engineering colleges, technical institutes, and in the public junior colleges. Data concerning the organization and content of these curricula are presented.

Purpose of this chapter. Chapters II to IV inclusive dealt with the various phases of the problem under investigation. The results were presented and the conclusions drawn, but comment and discussion has been reserved, for the most part, for the present chapter, which deals with the results and implications of the investigations in a more subjective manner.

SUMMARY OF FINDINGS

The findings of this investigation seem to justify the following conclusions.

Functions of the junior college. One of the four commonly recognized functions of the junior college is that of the terminal function. In other words, it becomes the function of the junior college to offer curricula that are complete in themselves so far as the time element is concerned, or complete in two years. As Eells sizes up the situation regarding the part that the junior college must take in the matter of terminal function:

> The junior college must offer something more than a simple university preparatory course, if it is to live up to its true destiny. The development of the terminal function is an essential corollary of the success of the popularizing function.[36]

In addition to Eells quoted above, we find men like Langes, Leonard, and Ricciardi, expressing their views, as presented in Chapter II, pages 17-19, in favor of the junior college offering as its right and duty, semi-professional education. In the face of these facts, the only conclusions to be drawn is that semi-professional engineering curricula have a place in the junior college program.

Aims of semi-professional education. It is essential for the success of any undertaking that there be a fundamental aim. In the words of Dr. Snyder of the Los Angeles Junior College, the aim of the semi-professional curricula is to help the young man and young woman make good in life. In order to make good in life, the curricula must afford the student the opportunity to acquire a skill and at the same time obtain a certain amount of culture.

The demand for semi-professional engineering graduates. Even though it be the function of the junior college to offer semi-professional engineering curricula and its aim in offering these curricula be the highest, there must exist a real demand for the graduates or the work will not be a success.

In the consideration of this question, the first factor to be noted was the attitude of the employer. From the data

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36 W.C. Eells. The Junior College. Houghton, Miflin Company, New York, 1931, p. 231.

presented in Chapter II, pages 28-32, the evidence is most convincing in so far as there being a real demand for men with a semi-professional engineering training. Facts are set forth in this chapter to show that there are three positions for men with a semi-professional training to one with the regular four-year engineering training. The final conclusion to be drawn is that there is a real demand on the part of industry for men with a two-year semi-professional engineering training.

As a counterpart to the attitude of the employer, there is the matter of occupations that can be considered as semi-professional in nature. Both Koos and Bennett conducted studies that developed the fact that there are a great number of positions, the training for which can be offered by the junior college in their semi-professional curricula. In chapter II, pages 32-38, is presented data that is conclusive of the existence of occupations of a semi-professional nature.

Another point in connection with the question of demand for semi-professional engineering graduates is the matter of their status in industry. From a study conducted by Spaher, the results of which are presented on page 39, of this report, we find that the four-year college man predominated in the higher engineering positions, the two-year technically trained men held by far the larger percentage of the positions in the field of production. The facts showing that the four-year engineering graduate is in many cases overtrained for a great number of positions in industry.

Semi-professional engineering curricula offered by educational institutions beyond the high school. In this area of education, there are to be found three types of institutions that offer engineering curricula that can be considered semi-professional in nature. These institutions are the four-year engineering colleges, the technical institutes, and the public junior colleges.

The four-year engineering colleges. In the study of this part of the problem, it was found that there were six four-year institutions, that, according to their catalogue offered semi-professional engineering curricula. However, from a study by Koos, which is reported on pages 44-45, it is very evident that the success of a two-year engineering curriculum offered at a four-year engineering college is very doubtful. The enrollment at the most is very small with the result that these two-year students feel out of place in the college or are finally persuaded to change to the regular four-year engineering curricula by the same institutions has not worked very well so that little can be expected from the four-year institution in the development of the semi-professional engineering curricula.

The technical institute. This type of institution is working in the same field as that in which the junior college will be called upon to function, so that much importance is attached to the part of the study concerning the technical

institute curricula. The characteristics of the technical institute, as reported on page 47, are concise but broad enough to cover all phases of the institution. The junior college would do well to consider these characteristics.

In the technical institute field, there are three types of schools generally termed full time day schools, co-operative half-time schools, and the evening schools. The curricula as offered in these schools, and the evening schools are the same for the most part except that the length of time required to complete a particular one in the evening school will be longer than is the case in the day school. The curriculum is built around a certain phase of engineering, such as machine construction and tool design, or in other cases is somewhat more general as for instance the mechanical engineering curriculum. The outstanding thing to be noticed in the study of the technical institute curricula is that they evidently aim to meet particular needs of industry. The type of curriculum offered by a particular institute is influenced largely by the kind of manufacturing going on in that community. If the institute is located in a large city, the curricula are likely to cover the general fields of engineering, as civil, electrical and mechanical engineering. In other cases, we find that the curricula are built around the outstanding engineering lines of the community. As for the most part, a private enterprise, the technical institute must be meeting a real need or it could not exist.

The junior college. From a study of the data as presented in this report concerning the semi-professional engineering curricula, offered by the junior college, one is impressed with the few schools that offer real semi-professional curricula. As this investigation concerned itself with the curricula of the junior colleges of the state of California, the conclusions to be drawn will apply to this section of the country. However, since the junior colleges of this state are very progressive in their educational ideas, the conclusions can be taken as typical of the entire country.

The semi-professional curricula, as reported on pages 63 to 70, are typical of the offerings in this field of education by the junior colleges of this state. This data comprises the total curricula offerings of fice junior colleges with a grand total of fifteen separate engineering curricula.

The conclusions to be drawn from a study of the data in this chapter are: first, that semi-professional engineering curricula have not been sold to the students or parents; second, that a real understanding of the function of the semi-professional engineering curricula is not understood by the average junior college administrator; third, that there is a lack of distinction between the pre-engineering and semi-professional engineering curricula on part of the average junior college administrator.

RECOMMENDATIONS

It is rather presumptuous to suggest changes in the semi-professional educational field, on the basis of an investigation of such limited scope as this study, but the following suggestions or recommendations are ventured as logical outgrowths of the making of this study.

Function and aim of the semi-professional engineering curricula. That due consideration be given the function under which the semi-professional curricula finds its place in the junior college program. In other words, that it is the function of the junior college to offer semi-professional curricula. Furthermore, let the aim of the semi-professional curricula be that of helping the student make good in life; by giving him a skill to secure a living with and a contact with culture, that he may appreciate the best things of life.

Types of engineering. That there may be a distinction made between pre-engineering and semi-professional engineering curricula. These two types of engineering curricula being entirely different in so far as their purpose is concerned. The former is to prepare the student for his last two years at the university or engineering college, while the latter aims to prepare the student to enter the field of industry.

The construction of the semi-professional curricula. That the construction of the semi-professional engineering curricula be based on an industrial survey, which shows the different

lines of manufacture located in the community, from which sufficient data may be obtained for the proper construction of the curricula. Too many so-called engineering curricula of the junior colleges are built around the high school shops as it is necessary to make use of the equipment somewhere in the junior college. As was pointed out in this study, there is a real demand for semi-professional engineering graduates but the curricula from which the student graudates must furnish the training necessary to meet the demand of industry. The organization and content of the semi-professional engineering curricula should be developed with the aid of representatives from industry in order that nothing but the essential material will form a part of the curricula.

Semi-professional engineering instructor. That the instructor in semi-professional engineering curricula be a graduate of a four-year engineering college and with at least five years of experience out in industry in the field in which he intends to teach. Since a considerable part of the instruction in the semi-professional curricula is a long the line of doing, the instructor must be of wide experience in engineering fields, and in a position to do the thing as well as tell how it should be done.

Engineering laboratories. That a junior college offering semi-professional engineering curricula establish the necessary engineering laboratories for the purpose of instruction of the students in the various subjects. The average student

taking the semi-professional curricula understands the work better and progresses more rapidly when use is made of the engineering laboratories. Theirs is a better opportunity to connect the principle and the application if a suitable laboratory is available.

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....."The Municiple University and Junior College." American Association of Junior Colleges.

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