

THESIS

for

DEGREE OF BACHELOR IN ARCHITECTURE

by

THOMAS K. FITZPATRICK

1933

THESIS

SUBJECT

The organization of a course of study, as a second year subject in the curriculum of Architecture, for the correlating of Constructive and Architectural Design.

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February 14, 1933

Committee on Theses

Department of Architecture

Subject As a subject for my Thesis I propose the following: "To organize a new approach to the study of Architectural Design, maintaining as far as possible the limitations of curriculum incurred by the present course in the Theory of Architecture of the Department."

Program In formulating my Thesis I plan to progress with three separate phases of the subject simultaneously since all three phases are interdependent.

1. Written phase -- This phase will consist of a brief critical analysis of the present course as far as it has progressed during the last five years. It will then continue with an explanation of a plan for gradual revision providing for the partial introduction of modeling and color courses into the Theory of Architecture. And finally, if possible, will conclude this phase with a method of further developing this plan to make it elastic enough to cope with future needs in approaching the study of Architectural Design.

2. Modeling phase -- This phase will be an attempt to present in a specific form an introduction to the various divisions of the course as it should progress. This will not consist in a study of the technique of presenting plastic forms but rather in a study of a clear, practicable method of expressing ideas in design with the use of three dimensions. There will be a definite attempt also to relate it to the modeling course which is included in the course of study of the third year.

3. Drawing stage -- This phase will be divided into two parts. The first will consist of a presentation of methods of expressing ideas of design in the simplest terms of drafting as a basis on which to continue with the work in three dimensions. The second will be a presentation of methods of expressing these same ideas after the education acquired thru the use of plastic forms has been assimilated.

By having these three phases progress simultaneously I feel that the time allotted to Thesis work will have been spent more intelligently even if the work does not reach a completion satisfactory to me at the end of ten weeks.

I intend to include in this thesis not only my own thought pertaining to this matter but the thoughts of

several fellow students of my grade, and these thoughts having undergone constant revision for four years thru continual seminars have finally culminated in our present belief.

I will attempt to make this new approach to the study of Architectural Design practicable both from the standpoint of making it coincide with the curriculum as well as a logical introduction to the teaching of design under the present system. I will try to make any criticism I employ as constructive as possible so that those fundamentals which we in our fifth year feel we lack may not be lacking to the new student upon completing his school life.

Respectfully submitted,

Thos. K. Fitz Patrick

C O P Y

February 20, 1933

Dear Fitzpatrick:

In regard to the preliminary presentation of your thesis programme I want to put the following before you.

As to your subject, neither the purpose nor its meaning seems to me sufficiently clearly expressed. As to the method of your work, while I recognize that the student's point of view is of real interest, it is not sufficiently experienced to form the essential basis of so serious a study as a thesis requires. The attitude both in practice and opinion of other schools and educators should be inquired into and carefully weighed. The Cranbrook School, Frank Lloyd Wright's School, the work at Cornell and at Yale should all be considered. It should also be realized that architectural design to reach its most perfect expression should include many preparatory elements besides those of a graphic nature, Construction, and History, to mention only the most obvious, play a conspicuous part in creative design.

Your preliminary programme is not indicative of a sufficiently broad or intensive study to justify confidence as to the ultimate satisfactory outcome of your

thesis, and cannot be approved in its present form.

I suggest that either your approach should be on a broader and more far reaching basis, or that you should study more intensively some less comprehensive phase of your problem.

Please let me see you about this at your early convenience.

Sincerely yours,

William Emerson, Dean
School of Architecture

WE/B

March 4, 1933

Committee on Theses

Department of Architecture

Subject As a subject for my thesis I propose the following: "To organize a course of study, as a second year subject, presented in the most efficient manner, for the correlating of construction and creative design.

The purpose of this course will be to develop in the student a constructive design sense to precede the factual instruction as taught under the present curriculum in third year and known as Constructive Design.

Program In formulating my Thesis I plan to adopt the following method of approach. The thesis will consist of two major divisions. The first will be the research phase, and the second will be what might be termed the organizing phase. Briefly, outlines of these phases are as follows:

1. Research Phase

- a. A selection of a representative group of schools of Architecture both in this country and abroad.
- b. A survey of the different methods of correlating construction and creative design used in these various schools at the present time as well as

their plans for the future, having due regard toward:

1. Comparison of various curriculums with our own.
 2. Comparison of various types of schools with our own.
- c. A conclusion, summing up the results enjoyed by these various methods and the possibilities of their future success, as well as the general advancement made in this field during recent years.

2. Organizing Phase

- a. A plan for the revision of the present curriculum to include this subject or combine it with other subjects.
- b. An explanation of the method of executing this course in the most efficient manner.
- c. An execution of the course in part or wholly depending on time limitations.

Since I intend to use modeling as an instrument in presenting this course, I cannot at this time predict the manner or extent of executing this course as a part of the "Organizing Phase". That is, the method of presentation may follow one of two directions. The first, in which the students prepare the models aided by criticism from

the instructor. The second in which the instructor uses prepared models in presenting his subject to the students. The extent to which either method is practicable will depend largely on its efficiency. Thus if the first method can be used this course will not only correlate construction and creative design but will also serve as an introduction to the more advanced modeling.taught under the present curriculum in the third year.

Respectfully submitted,

Thos. K. Fitz Patrick.

C O P Y

March 17, 1933

Dear Fitzpatrick:

In acknowledgment of your favor of the 14th instant concerning the further classification and modification of your thesis, I am glad to accept this as satisfactory and to wish you all success with the development of this interesting subject.

Sincerely yours,

William Emerson, Dean
School of Architecture

WE/B

THESIS

PART ONE

A survey of ten Architectural Schools in America treating of the most advanced methods of dealing with the correlation of Constructive and Architectural Design.

INTRODUCTORY

Educators now are realizing that the architect of today and of the future must have a training vastly more extensive and exact than his predecessors, in order to progress or even hold his own in the profession. It is an established fact that during the past few years there has been a decided tendency thruout the Architectural Schools of America toward a revision of curricula, in order that the graduating student might be better qualified to enter this profession which has undergone so many revolutionary changes in the last quarter of a century. Constantly, changes are being made to give the student a chance to round out his fundamental training by means of a wider range of subjects, the knowledge of which will estimate[?] his chances of success as an architect. It has too long been the general tendency in our schools to stress one or two subjects in the curriculum out of proportion to their future value to the student, and at the same time to minimize other subjects because of the difficulty in applying them directly, or because a complete knowledge of them did not seem to be necessary to the student. To gain a more exact knowledge of the thought which goes with the planning

of an architectural curriculum it is first necessary to understand the type of subjects taught, and their relative importance in the scheme, which is governed largely by the type of school and their method of approach in that school.

DIVISION OF CURRICULUM

Generally there are five major courses which appear in the curriculum of most of the Architectural schools of America.

These divisions are:

GRAPHICS, which included graphic statics, shades and shadows, perspective, and occasionally stereotomy.

HISTORY OF ARCHITECTURE, including all historical subjects taught.

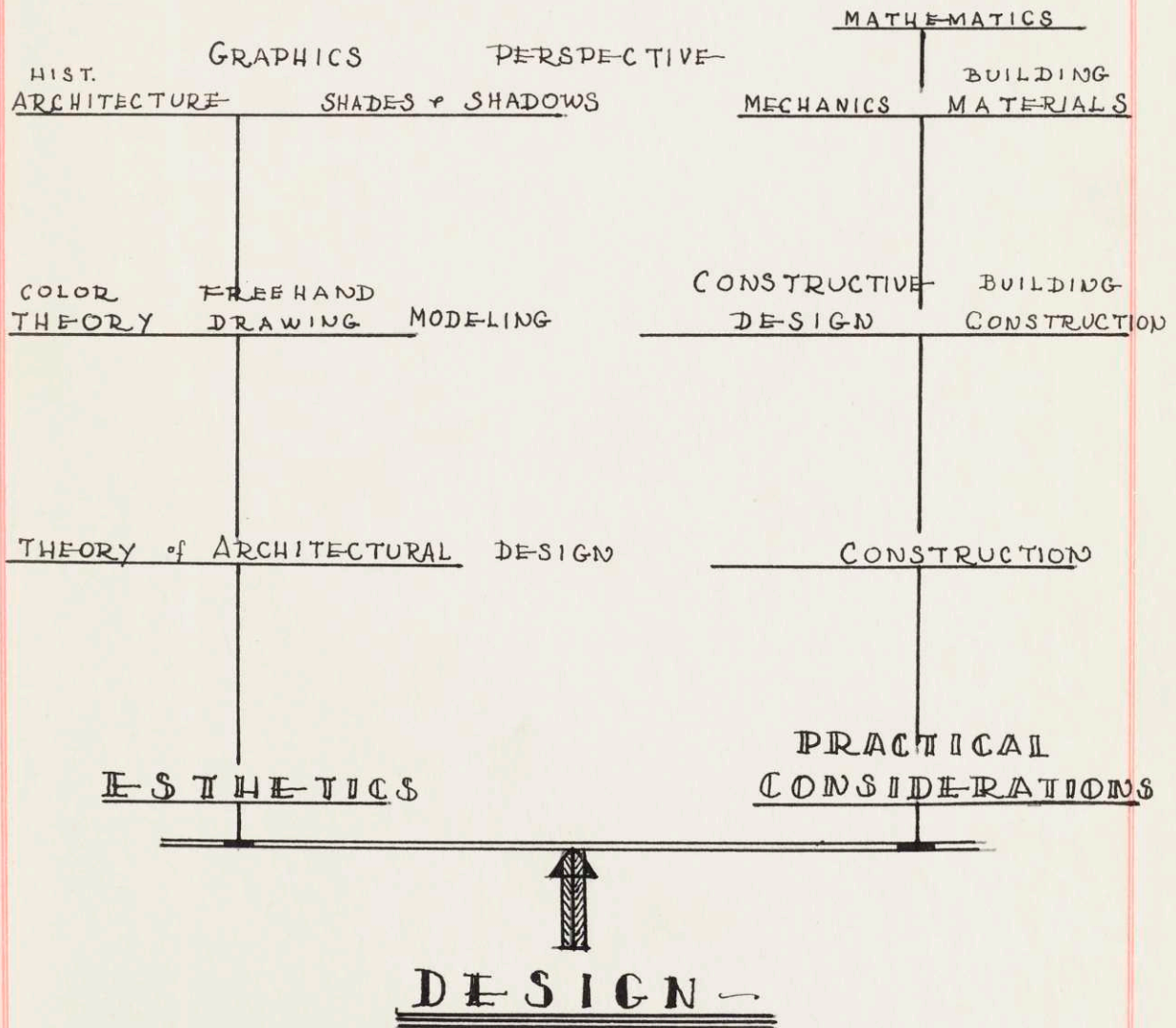
DRAWING, in which is grouped free hand drawing, color theory, and modeling.

CONSTRUCTION, which includes mathematics, mechanics, constructive design, building construction, mechanical equipment of buildings and office practice.

DESIGN, including courses in theory of architecture and architectural composition.

These divisions are more or less standard thruout the architectural schools. It is, however, the relative importance of these subjects which is constantly under-

going change. Since 1872, the last mentioned subject has been increasing in importance, until today, Design holds the key position in the curriculum of nearly all architectural schools. If we should set up Design as the fulcrum about which to balance a general division of subjects into two groups that might be termed aesthetics and practical considerations we would find the result to be as diagrammed below.



It is obvious from this representation, that to produce a system of study that is well balanced, necessitates a complete knowledge of the relative value of the individual subjects, not only within their group but also in their relation to the second group, thru Design. There is no course in an architectural curriculum which can be a self-centered unit. The importance of an individual subject cannot be measured in credit hours or by any other mechanical means, but must be approached from the more or less intangible viewpoint of the mental training which it affords and the exact results which it produces. In order to obtain what might be termed a "balanced diet" no subject can be stressed beyond its importance within the scheme, without having the balance tend toward one side or the other. The direction and ultimate end of the curriculum should be aimed toward a unity in the mind of the graduating student of the many complex phases of Architecture. It is then with this aim in view that I am now attempting to organize a course of study as a second year subject, for the relating of construction and creative design.

THE IMPORTANCE OF CONSTRUCTION

It would be a fair assumption to maintain that in

giving a student an architectural training, a sense of construction and an aesthetic sense are of equal importance. One cannot exist successfully without the aid of the other, and only when the two are correlated is there a real foundation for a true understanding of the principle of architectural design. Yet to what extent is this attitude propagated thruout our school? To quote from "A Study of Architectural Schools" by Bosworth and Jones compiled in 1931 we find the following: "--It is interesting to observe that schools in the United States have shown a tendency in general to minimize construction in the so-called straight architectural courses. This is in striking contrast to the very school in Europe which has been held up as an ideal of the high plane to which architectural training should aspire. Only a few American schools approach anywhere near the extent and thoroughness with which mathematics and construction are taught in the Ecole des Beaux Arts in Paris. Many people are beginning to ask if there may not be some connection between the tendency and the oft-cited failure of American architecture to make full use of the new materials and new construction methods which American engineers have so prolifically developed." This then is what con-

fronts us from the start. Although the various schools accept the importance of a knowledge of construction to the student, yet knowingly or unknowingly they neglect this most important phase of architectural training and refuse to give it its proper place in the curriculum. Therefore, the reasons underlying this tendency must be studied in order to remedy the obvious defect.

ATTITUDE OF CRITICS TOWARDS CONSTRUCTION

To say that, in general, professors of architectural design encourage the student to neglect a consideration of construction when approaching an architectural problem, would be obviously stretching the truth of the matter a good way. However, to say that critics neglect to impress on the student the fact that considerations of construction are as vitally important and necessary to a good project as are the relation of rooms, composition of elements, and a pleasing facade, would not be far from the truth. But the blame for this cannot be placed in any great measure on the critics themselves. To correct this, means hours specified in the curriculum devoted to construction, combined with a mechanical method of expression, to stimulate the interest of the student and guide his thought. But these have been lacking to the critics, and as a result, he

has consoled himself and his students with the words, "You'll get that when you go into an office." And so the student goes blithely on his way thru design with only a casual regard for construction.

ATTITUDE OF STUDENTS TOWARD CONSTRUCTION

Because from the start of his training the student finds that the general attitude in Architectural Schools is to neglect considerations of construction, there is immediately fostered in him a dislike for anything which smacks of the practical. Due to his individual make-up, the ordinary architectural student has no great leaning toward mathematics or to the application of them toward practical problems in construction. Too often his aesthetic sense is pampered and fostered by an over-indulgent critic until he rebels at any thoughts of practical limitations. And as a result when he finds himself in a course dealing with construction and its theories he immediately dislikes it *and considers it as something to complete,* and then forgets. The theories and practices which he acquires thru exposure to the constructive course, have no application in fact, and as a result he feels that they are unnecessary to him. However, after his education has advanced and he finds himself confronted with the more complex architectural problems, he soon

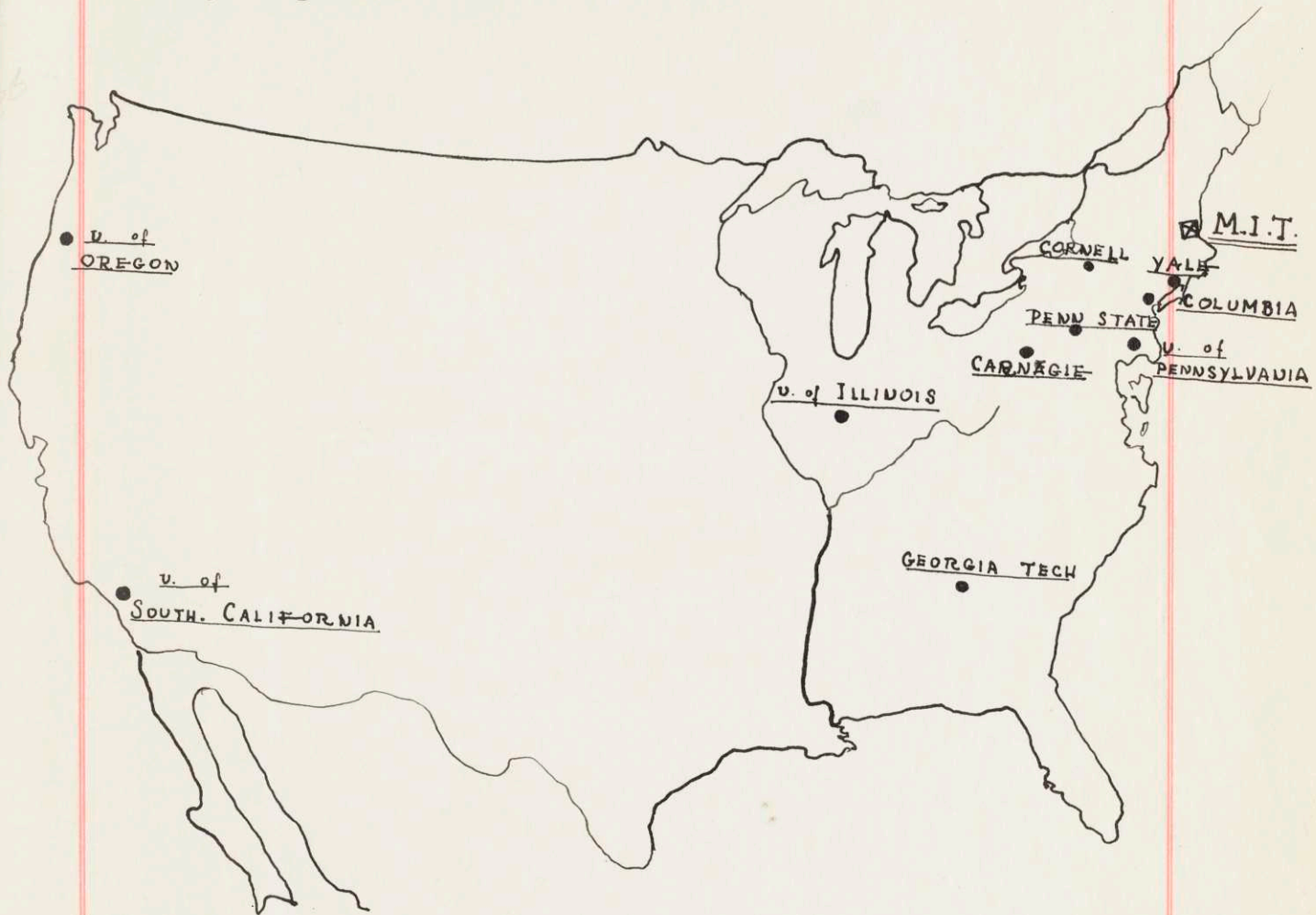
realizes the tremendous handicap under which he labors. And yet he proceeds thru the final years of his school training, copying construction from current books and periodicals and revamping them to suit his needs, understanding little of the logic and none of the theory which he imitates. Upon completing his training he finds himself then ready to enter an architectural office and work at a nominal wage, while making the mistakes and gaining the experience which his relatively expensive education might have furnished him.

CORRELATION OF CONSTRUCTIVE AND CREATIVE DESIGN THRU LECTURES

There have been attempts made to correlate constructive and creative design thru lecture courses dealing with construction methods, use of materials, manufacture of materials and numerous other subjects treating of construction. Generally, these lecture courses become merely a futile gesture in attempting to arouse the student's interest and prevail on him to acquire a knowledge of construction thru individual research. What the student actually assimilates from such a course is merely a superficial vernacular of the construction engineer. ^{Jacking} ~~Without~~ a concrete method of applying this knowledge and so stimulate ^{it} thinking, means nothing more than turning this lecture

system into a process in which the contents of the professor's notebook are transferred by means of a fountain pen to the student's notebook, without having passed thru the brain of either. To expect the student to take an interest in a course by feeding him detailed knowledge in the form of pre-digested pap, to be assimilated by him, and accepted at its face value, is asking a good deal. Thus it would appear that to attempt to bridge the gap between constructive design and creative design requires something more tangible than a lecture course, per se. The alternative, is to combine a lecture course with a method of expressing the knowledge derived thereof by means of drawings and models. These thoughts have been current in the minds of educators in architectural schools for some time. It is therefore necessary at this time to study what measures have been taken to remedy this defect in architectural schools up to the present time, as well as plans for future steps.

Map showing distribution of schools chosen for a survey of present conditions.



GROUPING OF SCHOOLS ACCORDING TO TYPES OF ORGANIZATION

Type I Units of Fine Arts or Applied Arts Group

1. University of Pennsylvania
2. University of Illinois
3. Yale University

Type I 4. Carnegie Institute of Technology

Type II Independent Schools

1. Columbia University
2. Cornell University
3. University of Southern California
4. University of Oregon

Type III Units of an Engineering Group

1. Pennsylvania State College
2. Massachusetts Institute of Technology
3. Georgia Institute of Technology

The method of selection of these ten architectural schools was as follows: The architectural schools in America were first divided into the three major groups as indicated above, in order to have a basis of comparison. Then, within these three divisions a finer selection was made based on the size of school, number of years it has been functioning, and its location. It is now necessary to investigate each of these schools and gain a knowledge of what has been done to correlate constructive and architectural design, as well as their plans for the future. From this limited survey we may gain a more exact knowledge of the advance both in thought and actuality that has been made up to the present moment.

Type I Units of Fine Arts or Applied Arts Group
University of Pennsylvania

The University of Pennsylvania, established in 1890 is at present organized on a five year system leading to a degree of Bachelor in Architecture. In this school the following attitude is adopted: It is recognized that Architectural Construction and Architectural Design are inseparable, and as a result, construction is taught in their elementary courses showing the architectural forms which result from structural necessities. In the second year, Mechanics and Graphic Statics are begun simultaneously with Grade I Design. In the third year there are 20 hours a week given over to Design, and 10 hours a week are devoted to Architectural Construction. In the fourth year we find 32 hours a week spent on Design work while the hours for the teaching of Construction are diminished to 8. In the fifth year there is no Construction taught.

There are two courses offered which teach a good deal of the theory of construction, namely Materials and Methods of Construction. ~~While~~ In the course in Architectural Construction a number of plates typifying timber, mill construction and fire-proof construction, and concrete design are drawn with the idea of

introducing the student to the best office practice. In giving these courses the materials are exhibited, scale-models of timber and steel construction are studied, and models of various forms of patented and non-patented materials are exhibited and studied. There is however no course in which the student is required to construct models. In this way the attempt is made to acquaint the student with the relative value of the different methods of construction before approaching the factual study in constructive design.

University of Illinois

The University of Illinois, established in 1868, is organized on the four year plan leading to a B. S. degree in Architecture. In this school, a number of years ago the department tried to have the construction work co-ordinated with a Design problem. The student after having completed the Architectural Design was supposed to design and detail the construction. It was found that this was not working satisfactorily, and now prints are being used which are traced from actual detail sheets of constructed buildings. These tracings show the outlines of sections of various parts of buildings, cornices, heads of doorways, lintels, girder

clearances, floor clearances, etc. This material is then given to the student to design the construction for the conditions as imposed by the sketches. After the student has solved the problem the actual blue print showing the construction used by the architect is taken to the drafting room and a lecture given showing what has been done and how it differed from the student's idea of the problem. Toward the end of the year, each student is given a complete set of prints of a building, and the exercise calls for the complete framing for the entire structure. The students react very favorably to this presentation, in that the problem upon which they are working is an actual building which has been built, and by use of the working drawings which are in the Department they can see exactly the construction used. This Department is fortunate in having a number of complete sets of working drawings of large and small buildings in various parts of the country, which have been presented to the Department for class instruction. In this manner the department at Illinois tries to interest the student in the necessities of construction and their ^{La}relation to architectural design.

Yale University

Yale University department of architecture was established in 1913 and is of the five year system. The method used in this school of correlating construction and Architectural Design is as follows: In most of the construction courses the students are taken to actual buildings illustrating the topics covered. Their experience with making models is that they take a great deal of time, often out of proportion to the result. There is a growing tendency to prepare scale models during projects, but they are of so small a scale that they do not bear on construction. Under Professor Crane there is a course devoted to what is termed "Comparative Construction". Following a course in Building Materials which covers their physical properties, manufacture and uses, there are described various assemblies such as the different systems of floor construction, wall construction, etc. It is the intention by this system to enable the student to choose, for example, the most suitable type of floor construction for the fire-resisting building as governed by the type of frame and other considerations. Also a course in the standards of good practice in conjunction with the building codes is offered. There

seems to be no effort in this department to correlate this work with the actual architectural design as taught.

Type II Independent Schools

Columbia University

Columbia University School of Architecture was established in 1881 and is organized on a six year system leading to a degree of B. S. in Architecture. In this school we find a good deal of thought has been devoted toward correlating construction and Architectural Design. There is being carried on at the present time in Columbia, the organization of a course intended to anticipate the problems in design by providing the student in advance of his design course, with that experience with structure which he will need for a proper understanding of Architectural Design. It is planned that this course will be introduced in the year preceding second year design, and will be in effect in the school year 1933-1934. It is expected at this school, that the student must design, not paper patterns, but structures made of brick and steel and therefore it is thought important that he should know something about brick and steel before he begins to design.

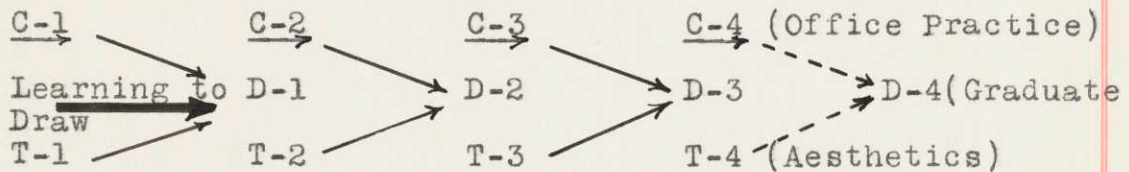
The relationship of the courses will be:



The new course (C-1) will be continued in the second and third years as a part of the courses in construction and will be related in a similar manner to the later design courses in the manner indicated below.



In conjunction with this a new three year course in the theory of architecture is planned, related in the same manner to the course in design. The resulting diagram explains the relation.



This then, is a skeleton idea of the trend of thought at Columbia toward relating Construction and Creative Design.

Cornell University

Cornell University was established in 1871, and the architectural school is based on the five year plan leading to a degree of Bachelor in Architecture. Professor Bosworth, in charge of the Architectural School at Cornell was one of the authors of "A Study of Architectural Schools" and therefore, is probably better acquainted with this subject than anyone else.

The work carried on at Cornell under his supervision is based on the following theory: There is carried on in the course a close collaboration of the two phases of design, architectural and construction, with each year's work growing progressively more complex in the nature of the design or constructive problem as the case may be, and really culminating in the final test for graduation, the Thesis. The feeling at Columbia *7 Cornell* is, that there is no one year when this collaboration should be brought about, but that it should be a continuous process. An outline of their plan is as follows:

First Year

This consists of a series of problems, some four or five, each divided into two parts; the first part being only the plan with outline section of some form of a one-story building of four or five rooms. With this goes a certain number of lectures on simple construction, and, of course individual research on the part of the student. The second part,-- entirely distinct from the first part,--is an elevation to fit the plan and sections already determined, and with this of course goes the continuation of individual research and lectures on those constructional questions involved in the particular problem.

Second Year

The architectural problems are slightly more complex going into two or more story buildings, each problem being a complete unity itself. The integration on construction and design being left this year to the individual critic. Meanwhile the courses in Mechanics and Structural Design have been started.

Third Year

The third year follows closely the second year plan with more complexity, and with problems written with the idea of bringing out the relation of architectural design to structural design, not so much from the point of view of materials of construction as to forms which are being developed meanwhile in the course in structural design itself.

Fourth Year

In this year is taught a course known as Applied Design consisting of some three or four problems which are quite similar in nature to the course as given at the Ecole des Beaux Arts with such adaptations as would seem wise for an American institution. In these problems the necessary calculations involving necessities of structure, heating and plumbing, are carried on. This course is administered by a committee on which the

members of the faculty who teach Structural Design, Materials of Construction, and Design all collaborate.

As far as results are concerned, Professor Bosworth is of the opinion, based upon experience in his own school as well as many others, that wherever this coordination of the two phases of architecture has been attempted in a small degree, it has almost universally been succeeded by an extension to a greater degree. This would indicate that in the mind of the faculty at least, the basic idea# was satisfactory. In Cornell this general scheme was first started some fourteen years ago and has been continually extended and amplified.

University of Southern California

This school was established in 1919 and is organized on the five year system leading to a degree of Bachelor in Architecture. Under this system there has been an attempt at some correlation between fourth year design and the construction problems which parallel it during that year. There is also an interesting experiment being carried on in an endeavor to combine the course in Professional Practice, which during the third and fourth years is largely an expanded working

drawings course, with a corresponding course in design. It has been hoped to try at this school a method of developing simple models of construction in order to visualize actual problems, but as yet the opportunity to begin this study has not presented itself.

University of Oregon

The University of Oregon was established in 1914 and the normal length of the Architectural course is five years. In this school we find an entirely different method of approach to the teaching of architectural design. Under the influence of Dr. Eugene Steinhof of the National School of Decorative Art in Vienna, the school at Oregon University has undergone radical changes in its method of teaching. There has been a definite step taken toward the abolishment of the competitive system because of the fear that it tends to develop a wrong sense of values. In the Carnegie Art Center at the University of Oregon a new approach to Architectural Design was carried on under Dr. Steinhof. This new approach reverses the academic idea of teaching which developed principles from a technique to an idea. The new method develops (1) from the object to its organization (2) from the idea

of the object, to its representation in the material. The building of the object to design, in model form, is an inherent part of this scheme. To use his words "Everything that has been acquired by this method has become a personal experience, and therefore, it remains deeply rooted in the student's mind". Construction is offered in the first step in the form of empirical and practical consultation. The student starts at once with the whole architectural problem."

And so here again is still another method wherein an attempt has been made to inter-relate creative and constructive. It is obviously a case of swinging the pendulum a good way in one direction but is however worthy of a deal of consideration and study. Now it is necessary to turn to the third group which contains the school at ^{the} Massachusetts Institute of Technology.

Type III Units of an Engineering Group

Pennsylvania State College

Pennsylvania State College was established 1890 and is of the four year system leading to a degree of B. S. in Architecture. This institution is of course fortunate in having curricula in both Architectural Engineering and Architecture. The correlation between architectural design and constructive design is made chiefly by the contacts of the staff members of both

branches to the extent of individual cooperation of these two representatives with the student over the drafting board. It is however admitted that this method is haphazard and that a more concrete procedure would be advisable. There have been attempts made in this school to prevail upon the instructors in structural design to present their elementary courses in such a way that the student would have a working knowledge of construction before any attempt would be made to proceed with the factual instruction. It has been the experience however, that this point of view is not popular with those teaching structural design. And so we have the two factions, both intent on the same goal but neither willing to concede any dependance upon the other with the result that the student becomes rather a victim of circumstances.

Georgia Institute of Technology

The Department of Architecture at the Georgia Institute of Technology was established in 1908 and is organized on the four year plan leading to a degree of B. S. in Architecture. Again this department is fortunate in having the assistance of an engineering unit in carrying out its curriculum. Here the work is carried on in much the same manner as that at Pennsylvania State. But here again we find the same difficulty in trying to combine the two factions for the common good of the student. Each department realizes its dependence upon the other but when it comes to a question of working together there seems to be a certain lack of cooperation. This is partly due to the difficulty encountered in the mechanics of combining these two departments in any one course rather than the lack of sympathy in point of view of one with the other.

Now then, it seems urgent at this time to compile a brief comparative summary of the advance made by these schools in the direction of correlating architectural and constructive design. Upon concluding this part we will then be ready to definitely approach a discussion of a new method of solving this defect of the present system of teaching.

Summary and Conclusion

Without exception every school selected in this survey agrees with and confirms the opinion that to give a student a really thorough training for the practice of architecture necessitates a correlation of creative and constructive design in his study of Architectural Design. Furthermore each school offers some preliminary courses in construction and building methods and makes some gesture toward relating them to Architectural Design either thru lectures, drawings or inspection tours. There appear to be four methods by which this correlation is being attempted in the various schools. These are as follows:

1. Those in which correlation is effected by a study of blue-prints of actual buildings in relation to current problems in Design, combined with lectures on this material. Within this category are the University of Pennsylvania and the University of Illinois.
2. Those in which correlation is effected by lectures only, which deal with construction methods and materials, with no direct relation to current design. The schools which use this approach are Yale, University of Southern California and Georgia Tech.

3. Those in which correlation is effected by combining the efforts of both the architectural and engineering departments in criticism over the drafting table. Those adopting this scheme are Cornell, Pennsylvania State.
4. Those in which an entirely new approach to this correlation is in the process of formulation. The two schools which seem to have advanced a bit in this direction are the University of Oregon and Columbia University.

Let us now analyze these four methods as to their real value to the student in his design work. The first method, namely that in which blue-prints of construction are copied and analyzed, is of value to the student in the sense that it does give him a certain knowledge of construction in practice. However he is able to apply this knowledge to his current problems in Design. And it does seem a bit illogical to continually decrease the hours allotted to construction as the student delves deeper into the more complex problems of Design until in the fifth year no construction whatsoever is taught. On the surface, this would appear to defeat the whole purpose of the method of correlation in practice at the University of Pennsylvania and the Uni-

versity of Illinois.

The second method, by which this work is carried on in lecture courses only, has the advantage that more ground can be covered in group instruction as compared with individual criticism. In this way the theory of construction can be rather thoroughly covered. But again there are the obvious questions raised:-- "How much of this theory is actually retained by the student?" "Can this theory be applied to his design work directly?" "Can a genuine interest in this work be aroused by lecture courses per se?" To answer these questions we must turn to the results obtained by this method. The schools of Architecture using this method admit that they feel there is something lacking in the results obtained from it. They realize that it is not the best approach, but lacking facilities and a more concrete basis upon which to work they have no other alternative.

And now we turn to those schools in which this correlation is effected by combining both the architectural and engineering facilities of the school to this one task. Under this method there have been good results obtained. At Cornell, under Professor Bosworth, this method is continued from the first years of training through five years of school and culminates in the

thesis. This course has continually been enlarged thru its fourteen years of existence at Cornell and is still in the process of extension. Although this course is thorough there is however a feeling on the part of those in charge, that if an actual expression could be found for this knowledge of construction in some form of model building there would be a good deal gained by the student.

The last two types seem to be the most interesting from the fact that in their methods they accept construction and theory of design as equals when they endeavor to give the student a solid foundation for the study of architectural design. The method of teaching architecture at Oregon is to approach the design of a building "from the inside out" so to speak. This is basically nothing new in architecture. On the contrary it was probably the approach used since early times and from which school architecture has so radically departed until now. I am not sufficiently acquainted with Dr. Steinhof's method to criticize it intelligently at this time, yet from the results which it has evidently produced, its logic cannot be questioned. However one of Dr. Steinhof's chief arguments is that having the student construct models he can achieve greater success

and more rapid results than could possibly be hoped for in lecture methods or class instruction.

And finally, at Columbia we find a course now being formulated which again accepts these principles. By this method it is planned to teach construction and Theory of Architecture simultaneously a year in advance of any actual Design. Moreover it is intended to continue this principle all thru the five years of study up to the graduate work. Because there are no results from which to draw conclusions it is not possible at this time to judge this method. Nevertheless it is a step in the right direction.

With the conclusions drawn from this survey it is now possible to approach the organization of a new method of correlating Constructive and Architectural Design on a firmer footing. By a selection of the proper constituents based on past experience in this same field, and a revamping of obsolete ideas in teaching it should be possible to construct this new approach sanely. It must be of necessity slightly revolutionary, and an ear must be continually kept to the ground to anticipate reactions and correct them. It must be understood that whatever is accomplished in this discussion is only a beginning. To achieve its purpose the idea must be ex-

tended to include all four years of the student's training in Architecture, otherwise it becomes merely an empty gesture.

Part II

The organization of a course of study to be taught as a second year subject in the curriculum at the Massachusetts Institute of Technology, for the purpose of correlating Constructive and Architectural Design.

Introductory

The relative importance of any one course of study even within a definite curriculum is a most intangible thing to select and understand. To superimpose a course of study upon a group of courses within the same curriculum, requires a great deal of investigation in order to bring out its proper relation to the other courses as well as its bearing on the direction of the thought of the student. For this reason a proper beginning for such an investigation can only be based on a few general assumptions. The importance to a student of any one course in a curriculum may be based upon the following four general considerations, with respect to:

1. Its bearing upon the student's present courses of study.
2. The degree to which the student may be expected to develop an interest in the course.
3. Its bearing upon the student's future course of study.
4. The number of hours which may be allotted to the course within the restrictions of the curriculum.

It is a necessity at this time to discuss these individual considerations at greater length.

I

It is agreed that all courses of study within a curriculum should have a definite relation to one another. This should be at once apparent to the student so that he may bend his efforts toward a goal which will unify the extremely complex phases of his training. Any course which tends to segregate itself from the other courses loses at once its importance in the eyes of the student. There must be a relation between courses of study, or at least an interrelation by means of other courses. It is upon this cohesion, that depends the degree to which a student may be expected to develop an interest in a course of study.

II

Human beings are individuals of characteristics as different as their physiognomies. To expect an equal interest on the part of all students in an individual study is a mistake. The degree of interest will vary with the separate types of students but if there is a proper relation between courses it will have a direct bearing upon the interest of the student. It is this apparent lack of relationship which causes the neglect of certain courses on the part of the students.

There must be an obvious direction to the trend of study, and each course should point to a future course, slightly more complex as well as interesting.

III

It is this interest which governs to a great degree the connection between courses of study in constructive years. If the direction of his education and training is apparent to the student and he realizes the steps he must ascend in order to unify this training, then there need be no worry concerning his interest in a single course. Neglect on the part of the student comes only when a course seems extraneous or unnecessary. When a student realizes that a knowledge of this or that subject is essential to him before he can be expected to approach successfully a future course, he immediately bends his efforts in that direction. To expect a thinking student to accept as fact the word of the instructor, concerning the importance of any one subject and its relation to future subjects without a very definite and concrete understanding of this on the part of the student, is indeed a mistake. All this requires experimentation with the

curriculum, to keep it in a form, elastic enough to suit all purposes. And as a result this discussion resolves itself to a consideration of that very important element of Time.

IV

Because the organization of courses of study is such an intangible thing, it becomes extremely difficult to subdivide the curriculum into a grouping of hours in any "hard and fast" manner. It may be that this division into hours is false and leads to incorrect assumptions. However in order to accomplish anything in this direction there must be a definite beginning. Because my problem is involved with the curriculum in architecture at the Massachusetts Institute of Technology it becomes important therefore, that I accept this as a starting point. A discussion of curricula seems of prime importance at this time.

A Discussion of Curricula

Any discussion of curricula becomes perennial, and there is difficulty in finding a logical answer with respect to it. Any formulation of

curricula has a tendency to begin with false premises, -- on the assumption that a course of study can be made to fit, by the clock, the infinite variety of minds and temperaments of human beings; also, that the order of interest and necessity for certain knowledge and skill is the same among them at the same time. It tends constantly to fit square pegs into round holes.

Imposition of curricula is readily explainable I suppose because of its so-called economy of mass-production, regarding its making of really educated men as comparable to the making of inanimate things. It has been said that "perhaps the worst indictment of the present-day educational system is that it fails to reveal to men trained under it, its superficial results -- as if an outward similarity of equipment is of any importance." However it must be accepted in this case that curricula is unavoidable. Sequence of studies can be improved by varying relationship of subjects, but the results can hardly be better than makeshifts as far as the individual student is concerned. Moreover it seems that only by a slow accumulation of experience can these complications of curricula be analyzed and corrected. So

often this "system of study" develops such an importance that it becomes the goal itself. All of which suggests that probably an inquiry into the more "real problems" confronting such a discussion in this would be advisable at the present time. In other words, to get down to the particular problem which confronts ^{me} ~~one~~, namely the correlation of Constructive and Architectural Design, the following observations might be made. Does this problem which I am trying to solve require a "course"? Would a "course" lead the student to conceive of construction as distinct from design, or design from construction? Can the two be disassociated? It is felt that the two are so interwoven that severance of them into distinct courses would tend toward interfering with a developing sense of their constant and necessary inter-relation. Curricula seems to encourage the separation of divisions of a subject in an artificial and unrealistic manner. As a result they come to impress upon the mind the notion that they are distinct, and uninvolved with each other. This leads to a segregation of ideas, ^{their} ~~then~~ teaching by different men, each having a special field, and tends to destroy the unity of the course.

At this time it will be necessary to disre-

gard any ideas of radical departures from curricula or conventions of teaching. The purpose of this thesis is to attempt to solve this problem first from an analytical approach and then from a constructive basis. Extreme changes of curricula involve too many departmental complications. Therefore for a firm basis upon which to build I am assuming that the starting place will be the present curriculum of second year. And so a study of this curriculum is now advisable with a view toward incorporating in it a method of correlating Architectural and Constructive Design.

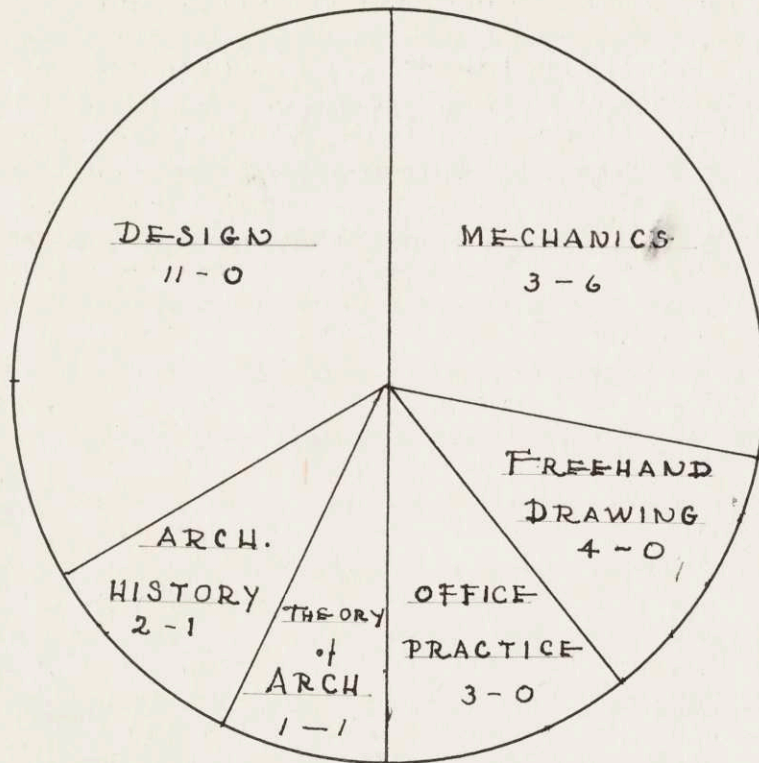
The Present Curriculum (1932-1933)

Under the present curriculum the first and second term outlines are identical as to the number of hours devoted to each subject. They are as follows:

		CLASS	HOURS	PREPARATION.
1.	Mechanics		3 - 6	
2.	Freehand Drawing		4 - 0	
3.	Office Practice		3 - 0	
4.	Theory of Architecture		1 - 1	
5.	Architectural History		2 - 1	
6.	Design II		11 - 0	
7.	English and History		3 - 5	
8.	French		2 - 3	
9.	Military Science		3 - 0	

Units of exercise and preparation 32 - 16

For the purposes of this discussion we may disregard the last three subjects as having little direct bearing upon the development of the purely Architectural phase. We therefore have thirty-two hours remaining for the purpose of directed study, each week. In order to obtain a more exact relation, let us plot these hours on a diagrammatic circle showing the number of hours devoted to each course of study.



From this circle diagram the time relationship of these six subjects taught in the present curriculum may be readily understood. It is now essential that further investigation be undergone at this point with regard to the inter-relation of these allied subjects. With this in view an individual discussion of these courses should be the next step.

Design II

From the above diagram we find eleven scheduled hours of class work per week are devoted to Design. This time is spent in a study of the problems in architectural composition as applied to buildings of simple requirements and varied character. This work is carried on by means of eight hour preliminary sketch exercises in the form of sketch problems. Some of these are further developed to a final result in a period of from four to five weeks. Although there are eleven hours allowed for this work in the curriculum, it is safe to say that actually slightly more than twice these many hours are devoted to Design by the student. What are the reasons behind this action? The obvious answer is that the student feels the importance of this course and knows that in order to approach Design III he must make a creditable showing in Design II. Not only that, but also the course is interesting to him from the standpoint of subject matter itself, as well as the method of presenting the course. His interest moreover results from the fact that whatever he accomplishes is more or less a product of his own imagination based on his own judgment. The course itself, as well as the method of presenting it,

is elastic enough to allow the student a certain amount of freedom in thought which he immediately appreciates and capitalizes upon. Generally he feels, or should feel that he is authority of himself in matters pertaining to his individual problems in Design, and should rely upon the critic only when he is in doubt. With this brief review in mind we may now turn to the next most important subject of the second year curriculum.

Mechanics

There are nine hours allotted to the study of Mechanics each week. This subject treats of a study of the fundamental principles of statics, with applications in analytical and graphical solutions for stresses for simple frames and trusses. Also the determination of centers of gravity and moments of inertia of plane areas is taken up in the first term. The second term of this course deals with the definitions and relations of the physical properties of materials, simple problems in tension, compression and shear, the common theory of beams, with applications, the analysis of stresses and columns and simple problems in combined bending and axial loading.

Now let us examine the results produced by

this study. Fundamentally this course is purely theoretical. And yet, there is a genuine interest on the part of the average student in this work. The course itself is well organized and thorough in its application. The student completes this course with a good working knowledge of the analysis of stresses and beam theory, and is well founded for a future study of constructive design. Yet while he is exposed to this course he finds no direct application for this acquired knowledge. Granted that it leads to a continuation in constructive design, yet it has very little bearing on the creative design which the student is carrying on at the same time. It becomes what might be called a "segregated course", the knowledge of which must be pigeon-holed and retained in an inert form until the following year. As a result we may analyze the situation in the following manner. The student finds himself carrying on two fairly distinct courses of study simultaneously. On the one hand he has the theory of architectural design taught in "Theory of Architecture" and "Design". On the other hand he has the theory of Construction taught in "Mechanics" and "Constructive Design". In other words we have two theoretical courses running side by side, yet nowhere is there an

actual convergence of these two parallel studies. Granted that there is an outlet for the student's acquired knowledge of the theory of architecture in his design work on paper -- and that he has a similar outlet for his theory of structure in his constructive design. Yet there is offered to him no real tangible method of correlating the two parallel courses. This should be possible.

Freehand Drawing

There are four hours a week devoted to the study of Freehand Drawing. It is continually stressed in this course that a knowledge of the structure and proportions of the human figure is the finest training that a student can undergo in studying architectural design. This course is so closely allied to Design that there is hardly needed any effort on the part of the instructor to convince the student of its importance to him. The correlation of these two courses is apparent, therefore further consideration or criticism is unnecessary.

Office Practice

There are three hours a week devoted to an analysis of the methods followed in Architects' offices in the preparation of plans and specifications as well

as details for a good building. Again we find the same danger in the method of teaching this course which was referred to previously. That is, that mere copying of details does not train the student to think in the proper manner. Yet it is important that the student understand the present day methods of office practice, so that when a chance to utilize his training presents itself he will have a basis for comparison. The mechanics of operation taught in this course are infinitely more important to him than any details he may absorb. It would hardly be rational to attempt to relate a course such as this is, directly to Design since its training pertains to fields apart from school work.

Architectural History may be assumed, for practical purposes, to be in a way irrelevant to this discussion. And now we will turn to the final subject of this group.

Theory of Architecture

In this course, one hour a week is spent on lectures dealing with the fundamental theory of architecture with a general consideration of materials, construction, and elements of buildings. It has been said that this is a vast field to cover in one hour a

week by means of a lecture. Of course the elements taught in this course can be given more consideration by combined class instruction than would be allowed by individual instruction over the drafting table. However it is difficult to train students to apply this general knowledge directly to their current problems in the drafting room. So much must be covered so rapidly in this short lecture course that the application of the knowledge becomes haphazard in a sense. This is a most important subject, and until now it has been felt that too little time has been allotted to this study.

In brief this is the situation with which I am confronted at the present time and under the present method of teaching. The curriculum, as it stands, lacks to some degree, the correlation between individual courses which should give direction to the student's training and simplify the complex phases of an architectural education. To attempt to remedy this defect with respect to one course will naturally affect the other courses to some extent. The ultimate aim of this study, is of course, to try to improve by slight revision the present method of teaching architectural design. The more specific goal of this study is to try to improve only one phase of this fundamental training.

namely the "construction phase". However, before any attempt at improving this specific phase can be approached there must first come a general explanation of the changes in curriculum and methods of teaching which would have to be carried out before any new course could be inserted into the second year course of study. Furthermore it must be determined whether a new "course" so-called would be the best answer to the problem in question, or whether a "segregated course" would only complicate matters to an even greater degree.

A Suggested Change in the Method of Teaching

Architectural Design

During the past year, more than at any other time, it has been felt that the standard academic method of teaching architectural Design has been losing favor thruout this country. Each year more schools have withdrawn from the "Beaux-Arts" group. Even among those who direct the interests of the Beaux-Arts there is a feeling that a change is needed. In a sense educators now are groping for a solution to this problem. If there must come a revision in the present academic methods of teaching there must first come a certain amount of experimentation. Extreme changes are neither advisable nor are they actually required at the present

time. There must be an effort made however, to check the tendencies which academic training has followed during the past years and hark back to a conception of early teaching methods which will suit modern needs. The evil of "paper architecture" is well known, and students now realize the importance of correcting this evil. Less attention must be paid to rendering and more to honest designing. But the key to the situation has in the obvious attempt which has been made by most architectural schools, to "pad" their curriculums with a great number of minor courses having little relation to one another. Upon this fact rests the logic behind the remainder of this study. Upon the correction of this defect in curriculum may be based a sound, logical method of teaching design to suit the needs of the present day. I am convinced that courses such as Theory of Architecture, Building Construction, and other minor studies cannot be segregated into "courses" but must be included in Design and taught directly in conjunction with Design. Furthermore the student must be taught to design "from the inside out" instead of creating shell facades to fit academic parti in plan. He must be led away from the long-standing tendency of approaching a problem from a standpoint of parti as a

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primary consideration. With a course in Design enlarged to include within it the various allied minor studies the following method of approach could be developed.

II The student could be taught to approach a problem in design by first qualifying the individual elements according to the following characteristics:

- a. Use of the element or room.
- b. Shape of room - governed by
 1. Construction
 2. Proper lighting
 3. Acoustics
 4. General appearance or treatment.
- c. After qualifying the individual rooms he is then ready to approach the question of composition of circulation and elements. There will result, of necessity, a method of "cut and fill" in trying to reconcile b and c.
- d. The student in the meanwhile is ready for the consideration of exterior treatment which could be studied from a standpoint of
 1. Materials

2. Construction

3. General appearance

There will then follow a revision of a, b and c until a satisfactory solution can be produced. The resulting architecture would not necessarily be Classic, Modern, International, or any style. It would merely be the best answer to the problem according to the judgment of the student, without the hindrance of academic precedent. There is nothing new or radical in this method of teaching design except in the mechanics of placing it in operation.

Upon these conclusions rests the basis for an organization of a course of study to correlate constructive and architectural design. To formulate this study as a segregated course would be merely defeating its purpose. It must be a study within a study to hold its proper relationship with Design. To advise an enlargement of Design would seem to refute my former statement criticising the over-stressing of separate courses out of proportion to their value. Such is not my intention. By broadening the course in Design to include minor subjects the instructor would be allowed the opportunity to make this course elastic enough to suit his needs. With such a course he could take what

might be termed the "design temperature" of his class. With such a wide range he could vary the course from week to week to bring out the best qualities of the latent ability of his students. We are now ready for an explanation of how a specific course correlating constructive and architectural design might be incorporated into this general method of teaching design.

A Plan for Revision of the Present Curriculum

In revising the present curriculum I plan to make no radical changes as far as the hourly schedule is concerned. The general change to be studied will be the enlargement of Design II to include four minor studies. These minor studies will be as follows:

Theory of Architecture

This course will consist of a study of abstract design including considerations of form, color and materials as applied to current problems in Design II.

* Applied Construction

This course will consist of a study of methods and theories of construction as applied to current problems in Design, and will be carried out by means of drawings, and models made by the individual students.

Theory and Application of Lighting Methods

This course will consist of a study of methods of lighting as applied to the current problems in Design II.

Theory of Acoustics

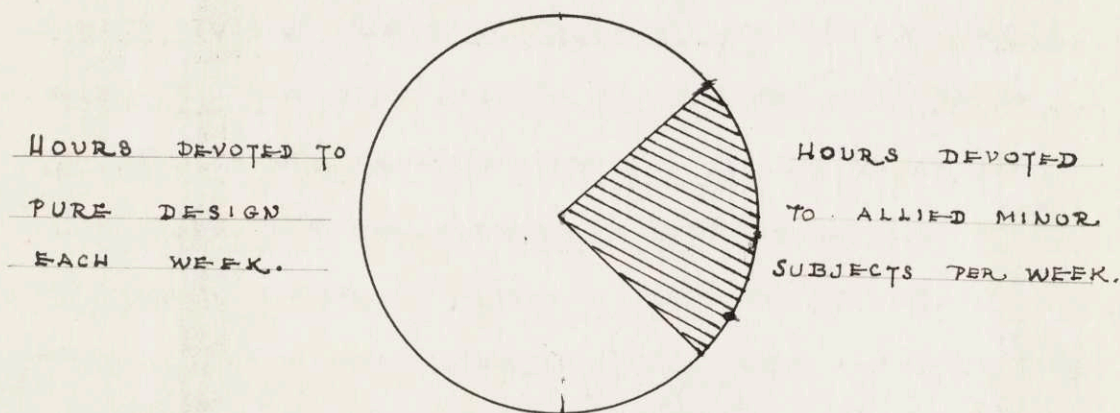
This course, being of lesser importance in second year work will however find application in problems of design of this year.

We may now examine the maximum number of hours which could be allowed to this enlarged course in Design each week.

Day	Maximum No. of Hours
Monday	8
Tuesday	4
Wednesday	0
Thursday	3
Friday	3
Saturday	2

From this diagram we find that there would be a maximum of twenty hours a week which could be given over to Design. Of these twenty hours a week, four hours could be devoted to the allied minor subjects. Since Monday must be devoted exclusively to sketch

problem work the number of hours on this day will remain fixed. However, one hour could be allowed to these minor subjects on each of the four remaining days in which some design is taught. The following diagram shows this relationship more obviously.



There will be required in conjunction with the time spent in class on these four subjects, an equal amount of time (four hours) devoted to these subjects outside of class. This time could either be spent in directed research, drawing, or model-building. There is a very obvious advantage to an arrangement such as this. In the first place it makes for a direct correlation between these subjects and the study of Design. These subjects would be taught in the drafting room by the instructor in Design, not as lectures but in the guise of formal seminars, in which the students carry on the greater percentage of the discussion. In the second place, the percentage of the time allowed to each

individual minor subject could be varied each week by the instructor to suit the needs of the situation. For instance if the current problem happened to be one of pure composition of elements in abstract form, two or three hours could be utilized in a discussion of "pure design" called Theory of Architecture, during that week. On the other hand if the current problem required a knowledge of a type of lighting or construction, then more hours could be devoted to a discussion of these problems and less to pure design during that week. With an arrangement of this sort the instructor would be provided with a course, so elastic that he would be able to give his students a well-rounded, well-balanced training in Architectural Design, correlated in the proper manner for an understanding of the many complex phases of this study.

Organization of the Hours Devoted to Applied Construction

For practical purposes let us assume that during the school year there would be a maximum of thirty weeks for study. The minimum number of hours which would be allowed for the study of applied construction would be two hours per week, or sixty hours during the school term. With sixty hours as a minimum

we may now proceed with the organization of the course proper. It would be safe to say that a minimum of twenty seminars could be held during the school year. These seminars would be conducted in the drafting room, combining the discussion with illustrations by means of a blackboard, drawings, and models on the part of both the instructor and the student. There must be no waste of time. Part of this time must be reserved for detail drawing and model-building.

The following is a tentative weekly schedule as revised:

HRS.	MON.	TUES.	WED.	THUR.	FRI.	SAT.
9-10	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.
10-11	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.
11-12	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.
12-1	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	DESIGN.
1-2	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	DESIGN.
2-3	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.
3-4	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.
4-5	SKETCH PROBLEM UNTIL 10 - P.M.	SPARE PERIODS	SEPARATE COURSES	OFFICE PRACTICE	DESIGN.	DESIGN.

Advantages of Construction by Models

There has always been one element in a course such as this which has hampered its use for instruction purposes, and as a result, made such a study impractical. This element has been the lack of a material for model work, which was pliable, easy to work and assemble, and relatively inexpensive.

Modeling clay has its limitations. I believe I have overcome this part of the difficulty in the use of a material which I have obtained for model work. This material is a transparent form of celluloid which is light and pliable and may be obtained in varying thicknesses and widths. It is easily cut and can be assembled quickly, by a method with which I have experimented and found satisfactory. Transparent, opaque, or colored joints can be made to suit the needs of the model. Joints may be made permanent or semi-permanent. With facilities such as these the scope of this course is fairly broad. I need hardly ~~to~~ speak of the advantages of individual construction of models, as compared with detail drawing or lectures per se. A thing constructed by the hands is retained in the mind indefinitely. I need not mention the many other advantages which work of this sort offers to the student. The models should be self-explanatory. An organization of the work to be covered in the seminars now follows:

Organization of Seminars

In organizing these seminars there should be an attempt to relate the general discussion as closely as possible to the current problems in Design. For purposes of this study I am relating these seminars to

problems in Design II of the years 1931-1932 and 1932-1933.

Seminar I

The first seminar would consist of an explanation of the purpose of the course, and exactly what was to be expected of the student. The inter-relation between this course and Design as well as the other minor courses should be brought to their attention. Following this there would be given to the students a list of reference books which are to be used by the students thruout the course. For purposes of my own study the books used were as follows:

1. Wood Construction D.F.Holtman
(Prepared under National Committee on Wood Utilization)
2. Architectural Construction Vol 1 Voss & Henry
3. Architectural Construction Vol. 1 - Books 1 & 2 Voss & Henry
4. Good Practice in Construction 1 & 2 P.G.Knoblock
5. Kidder's Architects' Handbook Thos.Nolan

The material to be used for models should be explained to the student at this time as well as the method of assembling the material. A preliminary exercise would then be given out, the purpose of which would be to introduce the material of the models to the students and afford them a chance to experiment with a

very simple exercise in model work.

Exercise I

This preliminary exercise would consist of making isometric drawings of a corner of an 8" wall showing four types of brick bonding (Flemish, English, Dutch, and Common. The drawings, completed on yellow detail paper would be at the same scale as the accompanying model. Upon completion of the four drawings, two would be selected to ^{be} reproduced in model form. The time allowed for this work would be one week.

Seminar II

The first part of the second seminar would be devoted to a general criticism of the drawings and models presented at that time. New methods of construction or bonding of brick would be discussed, including the effects which different brick surface treatments have on bonding, etc. Specific reference could be made to a problem such as Problem I (Design II 32-33) which had to do with the treatment of a swimming pool on a country estate." Any difficulties which could not be ironed out by reference to models would be explained by rough sketches at the blackboard. There should be

reserved at the end of the seminar, ample time for the introduction to Exercise III. Reference, material to be covered, method of approach, and any other important factors which suggest themselves, would then be explained to the students.

Exercise II

This problem would consist of a study of post and lintel construction. There would be required two drawings in connection with this exercise. The first drawing would be a method of joint floor construction in wood with bearing walls. The second would be the same problem illustrating fire-proof construction, with curtain walls and steel and concrete supports. This problem might have direct reference to Problem I (31-32) (An Arcade Street) and the same dimensions could be used. After the drawings had been completed a model of Drawing No. 1 would then be assembled.

Seminar III

For the completion of Exercise II there would be allowed four weeks. Within this time the following material would be covered by the student and brought up for discussion in the 8 seminars.

1. Strength of Wood

From this discussion the student would gain a general knowledge of the important factors governing the selection of wood for structural purposes. Beams sizes, both nominal and actual would be considered. With this knowledge the student would be expected to select the proper structural wood for the exercise in question.

2. Structural Requirements at Beam Connections.

Under this phase would come the general conditions concerning bearing surfaces and the use of bearing plates. Wall hangers and boxes, their requirements and advantages would also enter into this discussion.

3. Built-up Beams

In considering compound beams the general interest should be centered around their construction. The economic and structural value would be the main consideration.

Seminar IV

There would now be time devoted to the following considerations:

Floor Construction

To begin this discussion there would be a propose very general conception of the effect which loading has on floor construction. The method of selection of a floor panel would be taken up as well as fire-proofing and fire-stopping.

Joist Sizes

The selection of joist sizes would be vital to this discussion in relation to the current exercise. In all this work, specifications would be constantly referred to. Details of joist construction of all classes would be discussed and explained graphically. With this would follow methods of joist connections of various types.

Mill Construction

This type of construction should be covered fairly thoroughly both as to the objective as well as its advantages in structural quality. There should also be some discussion concerning the use of laminated flooring and its advantages.

Seminar V

The greater portion of this period should be spent in general criticism of drawings for exercise two

as far as they had progressed. The relation between this work and the problems in design with which it has reference, should be stressed constantly. Original ideas and methods of construction could be introduced and criticised with respect to their practical application and effect upon current architectural design. At this time also there would be started the assembling of the models to accompany Exercise Two.

Seminar VI

Exercise II would be required to be completed and ready for presentation during this period. There would follow a specific criticism of these models, and at this time the relation between this type of construction and fire-proof construction as illustrated in the drawings would be exemplified. Again reference would be made to the effect which these construction changes would have upon the current problem in design, in order to keep the inter-relation of the two constantly before the mind of the student. At the end of this period reference material would be given out for preparation for Exercise III and an explanation of this would follow.

Exercise III

This exercise would take up the matter of roofing. The problems in design to which this could have specific reference are Problem 4 - 1932-33 (AA Post Office) or Problem 8 - 1932-33 (A Library). In both these problems large open areas must be spanned and the knowledge of how this could be done should be of vital importance to the students. The exercise itself would consist of designing in a very simple manner, a truss to span the dimension required of the specific design problem. The drawing would consist of an expression of this in both wood and steel. A different form of truss would be used in each case. After the drawing had been completed, a model would be assembled of the wood truss as drawn for the completion of this exercise.

Between Seminar VI and VII there would be spent a certain amount of time in inspection trips for the purpose of stressing more forcefully the principles taught in connection with Exercise II

Seminar VII

In this discussion the following principles would be considered:

Requirements for a Roof

Under this topic would come the consideration of types of roof construction as defined by the use of the building. The selection of materials for roof structures would also enter into this phase as well as fire protection and other qualifications. Reference would be made of course to specifications and building codes.

Roof Pitches

A very important element in the design of the roof truss would be of course an exact knowledge of the pitch required. The factors which influence this would be discussed and explained. Within this scope would also come a consideration of the economical depth of the truss.

Selection of Types of Truss

Having considered the factors governing the pitch of the roof the next element to discuss would be the type of truss necessary. An explanation of the desirability of trusses would of course be included in this seminar. Comparison between types of wood and steel trusses covering the same span would also be a necessity. From this discussion a student would then be qualified to approach the actual type of construction necessary for Exercise III.

Seminar VIII

As a beginning for Seminar VIII a very general discussion of loading would be taken up. This would cover very briefly the effects of snow-loads, wind loads and dead loads upon the design of a truss. The various methods of roofing would be considered at this time including saw-tooth as well as flat roofed types and mill construction.

Use of Timber Trusses

The limitations of timber trusses would be the next consideration. Under this would come classification as to span limits and economy of construction. Comparison with similar steel trusses would always be an important element in the discussion.

Design of Truss Members

With a specific type of truss in mind the next step would be a consideration of the individual members. The necessity of simplicity of joints would be explained. Type of joint as affected by method of erection would also be considered. The end connection of truss and bearing wall would be the most vital element to discuss at this moment. This work would be explained at the blackboard with rough sketches.

Seminar IX

This seminar would continue the discussion of the preceding seminar and take up the designing of the intermediate joints of the truss. Methods of cutting and securing joints would be considered at the same time. The use of laminated members would be discussed both as to their desirability and advantage. In the latter part of this period there would be general criticism of drawings as far as they had proceeded.

Seminar X and XI

Final criticism of drawings and models would take place during these periods with the major portion of the time spent in assembling the models.

Seminar XII

At this time the students would be expected to present the completed drawings and models. There would follow a general criticism and a comparison of the method of designing a truss in wood and steel. Reference would be made to the effect which the design of the truss would have on the architectural problem

involved. The latter part of the period would be spent in clearing up any questions resulting from this work or its relation to problems in design.

Between this period and the next seminar time would be spent in inspection trips to structures in the process of being built.

Conclusion of the Course

The remaining seminars of this course would be spent on an original piece of work of this type. Students would be encouraged to take a problem which would be of interest to them and which could be applied to their design work. They would have to do their own research with suggestions from the instructor. The work would still be carried on in open seminars. Upon finishing this project the students would be required to prepare a brief paper treating of his specific problems, to be delivered before the class in seminar. The final three seminars would be reserved for these orals.

Conduct of the Course

It will be noticed that thruout this course as planned, wood construction has been stressed, and other

types subordinated. This will undoubtedly be criticised. However, my reasons for not stressing both masonry and steel and concrete construction are as follows: To treat the subject of masonry construction properly would require a special course in that very exact study known as stereotomy. It would not be reasonable to spend the amount of time necessary to a course of this sort when its future value to the student does not seem to warrant it. My reasons for not stressing steel and concrete construction will be ~~in-~~^{considered.}cluded in the conclusion since a continuation of the course is involved in this matter.

In any course such as this, in which models are used extensively there are pitfalls to be avoided. The great danger to be averted is to prevent technique in execution from overshadowing the objective in the exercise. There is always the tendency on the part of the students to spend too large a percentage of time in perfecting a method of presentation and as a result they are not able to "see the woods for the trees". The objective must be kept in mind at all times.

The substitution of seminars for lectures will be criticised from the point of view that it is difficult ^{there-in} to guide the discussion in the proper manner. This danger can be avoided by exact limitation of time,

so that all points can be covered within the specified period. A good deal will depend upon the guidance given the seminar period by the instructor in charge. The students must carry on the greater part of the discussion, aided from time to time by suggestion and criticism from the instructor.

I firmly believe that the "case system" is most adaptable to a course of this sort. That again is a matter of opinion. However, this statement is ratified by men in both the department of Architecture and Engineering. Their experience is that the bulk of the students do not have the faculty to apply the theoretical knowledge of structures to the various practical problems, without first having a fundamental education in methods of construction. Courses in theory of construction usually result in merely an exposure to that side of an Architectural education, which ^{is} ~~was~~ soon forgotten because of a definite lack of opportunity for applying this knowledge.

Conclusion

This is by no means a completed study in correlating Architectural and Constructive Design. Rather it is merely a beginning, and serves only to open up possibilities for a future development which would form a real training for a student. To have a definite purpose, this course must be extended into the third and fourth year curricula. My reasons for stressing wood construction in this course were based in part upon this fact. Since the course in Mechanics (2:231-2:232) deals largely with theory as related to wood construction, then it would be reasonable to stress the application of this theory in the course in Applied Construction in second year. If Applied Construction could be continued in third year, the matter of steel and reinforced concrete could be stressed at that time in conjunction with, or preceding Constructive Design. In this way the student would be always working toward a definite goal, and would realize the great degree to which each subject depends upon the other for complete understanding.

I am convinced that a course such as I have organized would give the student an eagerness for that knowledge of construction which would affect his study

of Architectural Design. To carry the idea thru successfully would result in changes, in curriculum and methods of teaching. There should also result a change in the attitude of both instructor and student concerning the approach to architectural problems. Moreover these changes must come, and the undercurrent is being sensed already. There are properties of strength in the present system which must be kept; properties of weakness that must be corrected. Certain schools are awake to these essential needs and are planning for the future. Other schools are groping and trying to revert to a past which has ceased to exist. The one encouraging fact seems to be that the thinking students are awake to the problems confronting them, under present conditions. Because they realize their weaknesses they will make progress. Within the school these changes will not take place rapidly. The reaction has only started, yet it is certainly in the right direction. Correct research and logical refinement applied at this time will simplify matters in the future. As Mr. C. Howard Walker has so often quoted to us,-- "The mills of the gods grind slowly, but they grind exceeding fine."

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