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Comprehensive Education Center

David N. Fisher
Clemson University

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COMPREHENSIVE EDUCATION CENTER

David N. Fisher

Spring 1981

A terminal project submitted to the faculty of the College of Architecture, Clemson University, in partial fulfillment of the requirements for the degree of Master of Architecture.

Approved:

[Signatures of faculty members]

Peter R. Lee, Committee Chairman
Frédérick G. Roth, Committee Member
Yuji Hishimoto, Committee Member
John Jacques, Committee Member
Gaylord B. Witherspoon, Head
Department of Architectural Studies

Harlan E. McClure, Dean
College of Architecture
and I did my time in your rodeo
been here so long and I got
nothin' to show
don't you know that I'm plain loco
fool that I am I'd do it all all
over again

This thesis is dedicated to:
my father for his love
my mother for her compassion
my brother for his amazement
Helen for her patience
Mille grazie
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PROBLEM STATEMENT
The purpose of this terminal project is to develop a design proposal for a Comprehensive Education Center to be located on the Clemson University Campus. The Center will provide laboratory, classroom and faculty space for all departments of the College of Education.

With specific study in depth given to the Department of Industrial Education, the design proposal will be responsive to programmatic and site criteria developed in the predesign phase of the project and documented in this manuscript.
Teacher education programs began as early as the 17th Century in France and Germany, two countries whose influence shaped patterns of training in other nations. Wilhelm von Humboldt, Minister of Education in Germany from 1645 to 1660 developed planned educational programs and established standards and examinations for teachers. Development of pedagogical seminaries increased during his term in office and a year of trial teaching was established as a requirement of all candidates prior to graduation. By 1831, comprehensive examinations in pedagogy and higher school curricula were mandatory for secondary school teachers.

Teacher education in America underwent marked change between 1820 and 1865. The Normal School, or teacher training school became the centers for teacher training in the northeast. The establishment of common or public schools generated the need for an increased number of teachers and uniform training methods for teacher education.

With an increase in the demand by public schools, it became necessary to professionalize teacher education to encompass more specific training. No longer could the standard liberal arts background, previously the equipment of a Normal School graduate, suit the need of the public school environment.

When the federal government assumed civil responsibility of founding and maintenance of public schools, standards for the preparation and qualification of teachers were furthered even still.
Normal Schools became teachers colleges to fulfill the government requirement of collegiate education for all practicing teachers during the 1920's, and the levels and standards of education for teachers have improved since.
Mankind has always been faced with the problem of conveying knowledge and skills to succeeding generations. Direct imitation of parents was the initial and most basic method of learning. However, the increasing scope of knowledge generated by societies, more formalized methods of education were needed. One was the apprentice system. Learned craftsmen taught young men in selected fields of specialty such as stonemasonry or metalsmilling. This method was one of the first formalized means to perpetuate trade skills. The structuring of apprenticeship programs is still the basis of trades education today.

In the early 19th century the western world was on the brink of a new technological era which would demand new and different means of training for the industrial technician.

Sweden and Russia were early pioneers in the field of a revised trade education. A Swedish school system called Sloyd was a highly organized work program based on handicraft traditions. Stressing the need to produce esthetically pleasing, useful articles for society, these craft schools established a precedent for future educational concepts. In contrast, the Russian programs concentrated on operational processes, resulting in less concern for useful products but with an emphasis on skills development.

In America a similar situation existed. New vocational fields were developing with a parallel need for trained
personnel. To meet these needs, Manual Training Programs were established in secondary schools as a part of general education. These programs dealt with development of specific skills. Widespread acceptance of these programs aided in the development of vocational schools.

Labor unions organized their own training programs to supply their rising demand for skilled craftsmen.

Concern over the lack of aesthetics in these programs generated the Manual Arts movement, which like its Stoyd predecessor, focused on creative design as an integral part of instruction.

SWEDISH SLOYD
RUSSIAN CRAFTS
MANUAL TRAINING
MANUAL ARTS

As industry expanded, so did its technology, and new programs were needed which trained students in multiple skills. The prevailing attitude behind this approach was to provide a new perspective on man's achievements and career alternatives. The terminology "Industrial Arts" evolved from the manual arts as the scope of course content expanded. The gradual departure from the purely disciplinary nature of preceding programs focused on content that encompassed more and more elements of industry.
On the contemporary scene, industrial education programs are organized which provide experience in modern industry. Exploring the fields of current industry in the classroom/laboratory is handled in terms of its organization, material used, processes and products identified and the related implications on society. This new educational outlook on industry evolved to provide the students with a more comprehensive outlook on the technology and interrelatedness of industry and its support. The idea that no industry operates in a vacuum was an important organizational concept. Course content was grouped under thematically similar characteristics to tie industries into certain base groups. The interrelations were more apparent when the technical aspects of these groups were categorized into these general groups. New understanding of the fundamental processes of organization and production was the goal. This new method, called clustering, has proved to be valuable in allowing concepts and processes of industry to be related.
Cluster content is organized under technically similar aspects. Thematically similar disciplines are grouped to emphasize the fundamental technologies in common. The categories base their names on the nature of their similarities. **Communication** encompasses graphic arts and other visually related disciplines. **Production** signifies the metal and wood related curriculum. **Power** deals with investigation of energy sources and electronics. Nearly all courses of study encountered within a contemporary industrial education program can be classified into one of the cluster categories.

An added advantage is the potential for cross clustering. If, in fact, a comprehensive industrial experience is to be stressed, all realms of industry ideally should be encountered. Projects undertaken by the students could require the support of numerous communication, production, and power courses before the finished product is achieved. This idea is strongly in keeping with the interrelatedness of industrial fields.

Other positive aspects of clustering are elimination of duplication. Support for production in many cases is shared, creating a natural interdependency and thus reinforcing actual relationships that exist.

Clusters have evolved into a traditional spatial classification of "high bay" and "low bay" labs. The general nature of activity within the area usually defines the
Clusters (klus·tər) previously unorganized activities ordered into groups by similarities

- Communication related curricula
- Production related curricula
- Power related curricula

Planning for interrelatedness

Cross clustering

drafting  wood  machine  power

Technical specialties

construction lab  fabricate motor parts

Semi related process

design and build a windmill

Full industrial process
classification. Light technology, clean pursuits fall under the low bay categories. Graphic arts and electronic studies are examples of clean labs. Wood technologies and material processes are on the other hand "dirty" pursuits or high bay labs.

**SPATIAL NOMENCLATURE**

Clustering of related activities falls conveniently into this high bay/low bay spatial treatment. "Light" activities are clustered as a family grouping. Dirty activities are grouped similarly.

Support services to the clusters are grouped accordingly. Common areas to be shared are usually centrally located to the served spaces. Stock and storage areas are frequently accessible to the building exterior for services. In some instances, these areas are at a level above the lab spaces so as not to take up floor area.
Faculty offices are usually not directly related to the labs. This feature differs from vocational schools where faculty offices preside over lab spaces. Provisions are made for faculty of Industrial Education facilities to have separate offices from the lab/shop space.
The Clusters

Power
Power Technology Lab
Electronics Lab

Communication
Graphic Arts Lab
Photography Lab
Drafting and Design Lab
Media Development Lab
Electronics Lab

Production
Metal Machining Lab
Wood Technology Lab
General Metals Lab
Arts and Crafts Lab
Construction Lab
Plastics Lab
Conclusion

The design of Industrial Arts laboratories and buildings has too often been premised on past and present circumstances. Traditional methods as seen perpetuate a segmental content structure, based on the type of technology used in industry. Although the field of Industrial Arts education purpose is to provide a means for students to explore the technologies and occupational areas found in industry, it was becoming increasingly accepted that traditional education techniques are basically skill oriented and project centered rather than conceptual in nature. The field was intended to be exploratory in its approach and educators see a need to prompt this exploration of curricula by interrelating fields of study to a high degree. Current trends of education fall short in carrying over concepts learned from one content to the next. The design of today's facilities should be geared to emerging curricular programs and instructional approaches in industrial education.

A variety of curricular innovations have evolved during the past decade. Most of them have common identifiable elements. The trend is going away from classification of content under such terms as metal working, wood working, and the like to broader classifications such as production, communication, and power systems. The impact of career education has generated broader based content organizers under industrial-technological or occupational clusters.
Industrial Technology Center
University of Northern Iowa
Architect: Stenson Warm Grimes Port Architects, Inc.

Program

To provide a setting to encompass the contemporary industrial technology in an organized format based on educational presentation theories.

The building should respond to innovative techniques of instruction, permit great flexibility among related activities, and provide for a means of comprehensive industrial experience and the building should include in-house media resource center, a large lecture demonstration area, offices and support facilities for faculty.

Concept

It was decided that the curriculum and building design should directly reflect the faculty's plan of instruction techniques. Northern Iowa's program relies heavily on self-paced instruction, exposing the students to a broad brush view of industry and its specialties. The method of organizing the shop and lab spaces as the clustering concept. The building was to have a flexible character, permitting openness for the large experiences and relative closure for more detailed studies.
Building Design/Response

All three laboratories, Power, Production, and Communications were designed for flexibility of operation. The large production laboratory for example, can be utilized as a single teaching center. When necessary, "movable" walls can be moved into place in the Power and Communication areas, dividing these labs into separate areas for teaching in-depth technical courses simultaneously by different instructors.

Program flexibility would not be possible without a considerable degree of freedom in locating equipment within the open space of the production laboratory. This is provided by a floor utility grid system which provides for almost unlimited movement of equipment within the lab. This 10' X 10' grid supplies air, power and exhaust and utility connections are made via a portable "post" system. The post is placed over the trench by removal of a plate in the floor. An entire hook-up takes about five minutes and lines of equipment may be set up in any manner complementary to a particular project. A media center contains resources catalogued on processes and procedures of inhouse activities.

Application

A student will come into the resource center and check out a card file for information on equipment or processes
that can be accomplished in the building. The card will list reading and A.V. references, with examinations that are required for the particular subject. The appropriate material is taken to the Resource Center for viewing on an individual basis. Once the student feels competent with the procedure it is demonstrated before teaching personnel which judges his performance and knowledge. This technique permits the student to proceed through desired courses, or to learn various equipment operations at his own speed.

Analysis
Positive

The Industrial Technology Center is an important industrial education prototype because it allows diverse activities to occur.

The comprehensive industrial experience, which is the basic goal of the program's organization, is available to students working at their own pace. Clustering of labs permits a better opportunity of understanding interrelationships of various industries.

The flexible utility system is a unique feature which may gain widespread acceptance in facilities of this type.

A large display area located at the circulation junction within the building exposes students to various opportunities in Industrial Education.
Problems

Conventional scheduling of activities within the flexible spaces could be difficult. The moving partitions may not in actuality work as conceived. Experience has shown that excessive flexibility within teaching spaces is often not taken advantage of.
UNRELATED COURSES

SEMI RELATED COURSES

FULL CAPACITY

UNIT CLUSTER CONCEPT RESPONSE

UTILITY POST ALLOWS MORE INTERIOR FLEXABILITY OF EQUIPMENT
Kemper Hall
Southwest Missouri State University
Architect: Paul F. Rich, AIA

Program

The building design was derived from an extensive instructional program written by the Industrial Education Department Head based on contemporary concepts of facility organization. The facility includes 22 laboratories and specialized areas with 5 general purpose classrooms and offices and support for faculty.

Concept

Kemper Hall is planned according to the clustering concepts. Power, communication and production are the major areas represented in the program. Related fields of each cluster are grouped in close proximity. The idea of high bay spaces and low bay spaces is incorporated into the building and a degree of flexibility between some of the lab areas is possible.

Building Design/Response

Power and production related activities are grouped on the building's first level in high bay spaces where they have access to the exterior.
The communication related activities are grouped on the second level of the building. They are serviced by elevator from a central supply store on the ground level. Flammable storage is outside the facility in a storage shed adjacent to the building.

Classrooms are flexible in size and are accompanied by storage area for demonstration materials. Circulation within the building is along a double loaded spine. Access between labs is via interconnecting doors.

Utility shafts are located on the building exterior. Soil is bermed up against the walls of the high bay lab spaces to conserve energy.

Analysis
Positive

Kemper Hall uses two characteristics of contemporary facility planning: the clustering of related activities and the use of the high bay/low bay concept. A comprehensive view of industrial process is available and a degree of interrelationship is strewed. Display cabinets are located throughout the building adjacent to the various activity labs. The arrangement of labs isolates noise generating areas from the quieter areas. This sound isolation is enhanced by permanent partitions that separate labs.
Problems

There is no provision for an in-house resource library.

The comprehensive industrial experience and project flexibility may be hampered by the two level arrangement.
COLLEGE OF EDUCATION
A Brief History of Teacher Education at Clemson University

Teacher education at Clemson College was started in 1917 to meet an increasing state-wide demand. Originally an agricultural education program, it expanded from a two-year to a four-year curriculum leading to a B.S. degree in Vocational Education.

Of the departments in the School of Vocational Education, Industrial Education was formed in 1918, generated along with Agricultural Education under the Smith Hughes Act, providing federal funding for the promotion and installation of vocational education programs. Administered until the late 1950's by the School of Vocational Education, these programs were developed into Bachelors degrees in Engineering Industrial Education and Textile Industrial Education.

The Department of Elementary and Secondary Education was started in 1933 as a program to prepare high school math and science teachers. Later the program was broadened to include other teaching areas.

With new degrees offered other than vocational oriented majors, the School of Vocational Education changed its name to School of Education in 1950. In 1955, the School of Education was disbanded with math and science education courses going to the School of Arts and Sciences, Vocational and Agricultural Education to the School of Agriculture, and Industrial Education to the School of Engineering.
In the early 1960's, while administered by the School of Engineering, the Industrial Education program was assigned use of 35,000 square feet in Freeman Hall. Built in 1929 as a machine shop, the building was inadequately designed from the onset, and has since undergone significant renovation and expansion to accommodate the needs of the programs of Industrial Education.

In 1965, Industrial Education, Agricultural Education and Elementary and Secondary Education were incorporated into the newly established College of Education, a situation which holds true today.

The shift gave Godfrey Hall to Elementary and Secondary Education and the College administration. However, Industrial Education and administration were reduced to 16,000 square feet of useable space in Freeman Hall. Ten years later, an additional 3,000 square feet was assigned in Freeman for needed expansion. The space occupied, though extremely inadequate, has served the program until present.

The current part of Industrial Education at Clemson is to prepare teachers of industrial arts, vocational and technical training. Undergraduate programs in these fields are geared toward an awareness of Industrial Education in a technological society. Students develop competency in various training methods and techniques through practice and observation. The department recognizes the value of "hands-on" experience as a key to educating students in these fields. However,
the current spatial situation is hampering the overall effectiveness of the programs taught in Freeman Hall. To further the problem, a report issued in 1979 by the NASDTEC Accreditation Panel on the Industrial Education program stated that the facilities and equipment were not state of the art or equal to that currently in use in South Carolina's modern systems of vocational-technical training.

With an increasing demand for Industrial Education teachers, NASDTEC concluded that better spatial provisions for the department would aid in meeting this need. The current program in Industrial Education can accommodate about 150 majors per year and only 200 students enrolled in service courses. With new additional space, equipment, and faculty, larger numbers of students could be served and eventually fulfill market demand for their skills.
A Chronology of Development

1917: first programs in teacher education at Clemson College established;
Smith Hughes Act for establishing vocational education programs;

1918: Industrial Education programs established, four-year B.S. degree;
Agricultural Education programs established; four-year B.S. degree;

1919: B.S. degree available in Engineering Industrial Education;

1933: Elementary and Secondary Education Programs established;

1950: School of Vocational Education becomes School of Education;

1955: Administrative shake-up: School of Education disbanded with courses reassigned to School of Arts and Sciences and School of Engineering;
Industrial Education moves to Freeman Hall under School of Engineering;

1965: College of Education formed with Agricultural Education, Industrial Education, Elementary and Secondary Education, Dean's Office;
Loss of space in Freeman Hall;

1978: Tillman Hall undergoes renovation for College of Education, Dean and Elementary and Secondary Education Department;
College of Education Structure

The physical organization of the academic activities of Clemson University is characterized by a core of general education facilities surrounded by clustered specialized education activities. The College of Education is the exception to this pattern. Its various activities are somewhat randomly located throughout the campus. The college administration as well as Educational Services, the Elementary and Secondary Education Department are located in Godfrey Hall and Tillman Hall up on the north edge of campus. Agricultural Education and Industrial Education are located on the southern portion of campus in the Nursing Building and Freeman Hall respectively.
teacher training facilities for Clemson University's College of Education

COLLEGE OF EDUCATION FACILITIES
Education majors will be the predominant users of the Center. Among most of the departments of study, all majors will be taught their professional development courses in house. Industrial Education majors, particularly Industrial Arts and Vocational Technology specialties, will have a majority of courses taught in the lab spaces. Elementary and Secondary Education majors will concentrate studies on methods and principles of education also in the Center.

Agricultural Education majors have the majority of their courses in professional development located around McGinty Mall. The exception is based on the established agricultural campus and related fields of study. The transferring of the higher level courses of Agricultural Education to the Education Center is possible. It should be noted though that there is a potential of more involvement across the departments under more comprehensive conditions that do not currently exist.

Service courses for the education major, or the general education, are dispersed across the campus. The nature of a student's pursuits will determine the percentage of outside building uses. An Elementary Education major may wish to specialize in mathematics teaching. Courses relating to this will be located in the Martin Complex. An Industrial Education teacher under the Industrial Arts option may wish to specialize in graphic arts. Supplementary courses may be found in Lee Hall with the Visual Studies
Department. Management, Safety and Health courses are located in Sirrine Hall. The degree of mobility around the campus after the general education years depends on the individual and the particular interest he or she may hold.
The following scenarios are typical user profiles of three Education majors. The information documents the courses taken across four years of study, the buildings in which the course was taken and a final calculation of percentage of building purpose. The study was an attempt to identify the buildings which house the support courses and their relative location to the proposed building sites.
Industrial Education
Education for Industry Option
Subject: Maria Steigler

Calculations of Building Use Percentages:
Freshman Year. Pattern typical of General Education structure. All buildings in Central Spine area.

<table>
<thead>
<tr>
<th>Building</th>
<th>Floors</th>
<th>Percentage</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin</td>
<td>3</td>
<td>30%</td>
<td>Math, Comp. Sci.</td>
</tr>
<tr>
<td>Daniel</td>
<td>3</td>
<td>30%</td>
<td>Eng., Lang.</td>
</tr>
<tr>
<td>Tillman</td>
<td>1</td>
<td>10%</td>
<td>Soc. Sci.</td>
</tr>
<tr>
<td>Hardin</td>
<td>1</td>
<td>10%</td>
<td>Soc. Sci.</td>
</tr>
<tr>
<td>Brackett</td>
<td>1</td>
<td>10%</td>
<td>Phy. Sci.</td>
</tr>
<tr>
<td>Lowery</td>
<td>1</td>
<td>10%</td>
<td>Gen. Graphics</td>
</tr>
</tbody>
</table>

Sophomore Year. Specialty being in Industrial Arts

<table>
<thead>
<tr>
<th>Student</th>
<th>Floors</th>
<th>Percentage</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeman</td>
<td>7</td>
<td>63%</td>
<td>In. Ed.</td>
</tr>
<tr>
<td>Lee</td>
<td>2</td>
<td>18%</td>
<td>Vis. Art</td>
</tr>
<tr>
<td>Daniel</td>
<td>1</td>
<td>9%</td>
<td>Lit.</td>
</tr>
<tr>
<td>Brackett</td>
<td>1</td>
<td>9%</td>
<td>Phy. Sci.</td>
</tr>
</tbody>
</table>

Junior Year. Option specialties being

<table>
<thead>
<tr>
<th>Student</th>
<th>Floors</th>
<th>Percentage</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeman</td>
<td>3</td>
<td>23%</td>
<td>In. Ed. course</td>
</tr>
<tr>
<td>Sirrine</td>
<td>4</td>
<td>30%</td>
<td>Management</td>
</tr>
<tr>
<td>Lee</td>
<td>3</td>
<td>23%</td>
<td>Vis. Art</td>
</tr>
<tr>
<td>Daniel</td>
<td>2</td>
<td>15%</td>
<td>Lit.</td>
</tr>
<tr>
<td>P&amp;A</td>
<td>1</td>
<td>7%</td>
<td>Ag. Econ</td>
</tr>
</tbody>
</table>
Senior Year. Education Rounds out in Industrial Education

<table>
<thead>
<tr>
<th>Name</th>
<th>Courses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeman</td>
<td>4</td>
<td>44% (In. Ed.)</td>
</tr>
<tr>
<td>Lee</td>
<td>2</td>
<td>22% (Vis. Art)</td>
</tr>
<tr>
<td>Kinard</td>
<td>1</td>
<td>11% (Phy. Sci.)</td>
</tr>
<tr>
<td>Sirrine</td>
<td>1</td>
<td>11% (Management)</td>
</tr>
<tr>
<td>Martin</td>
<td>1</td>
<td>11% (Soc. Sci.)</td>
</tr>
</tbody>
</table>

% Building Use

<table>
<thead>
<tr>
<th>Name</th>
<th>Courses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin</td>
<td>4</td>
<td>9%</td>
</tr>
<tr>
<td>Daniel</td>
<td>6</td>
<td>13%</td>
</tr>
<tr>
<td>Tillman</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Hardin</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Brackett</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Lowery</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Freeman</td>
<td>14</td>
<td>32%</td>
</tr>
<tr>
<td>Lee</td>
<td>7</td>
<td>16%</td>
</tr>
<tr>
<td>Sirrine</td>
<td>5</td>
<td>11%</td>
</tr>
<tr>
<td>Poole (P&amp;A)</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Kinard</td>
<td>1</td>
<td>2%</td>
</tr>
</tbody>
</table>
Elementary Education

Minor in Math

Subject: Cindy Rutledge

**Freshman Year.** General Education pattern of core courses

<table>
<thead>
<tr>
<th>Name</th>
<th>Courses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin</td>
<td>4</td>
<td>36%</td>
</tr>
<tr>
<td>Daniel</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td>Hardin</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td>Brackett</td>
<td>2</td>
<td>18%</td>
</tr>
<tr>
<td>Long</td>
<td>1</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Sophomore Year.** General Education courses majority

<table>
<thead>
<tr>
<th>Name</th>
<th>Courses</th>
<th>Course Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sirrine</td>
<td>1</td>
<td>9% (Econ)</td>
</tr>
<tr>
<td>Daniel</td>
<td>6</td>
<td>54% (Eng., Lang.)</td>
</tr>
<tr>
<td>Martin</td>
<td>1</td>
<td>9% (Math.)</td>
</tr>
<tr>
<td>Godfrey</td>
<td>1</td>
<td>9% (Education)</td>
</tr>
<tr>
<td>Long</td>
<td>1</td>
<td>9% (Phy. Sci.)</td>
</tr>
<tr>
<td>Hardin</td>
<td>1</td>
<td>9% (Phy. Sci.)</td>
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**Junior Year.** Profession speciality courses begin.

<table>
<thead>
<tr>
<th>Name</th>
<th>Courses</th>
<th>Category</th>
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<tr>
<td>Godfrey</td>
<td>3</td>
<td>33% (Education)</td>
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<tr>
<td>Hardin</td>
<td>1</td>
<td>11% (History)</td>
</tr>
<tr>
<td>Daniel</td>
<td>3</td>
<td>33% (Music, Lang.)</td>
</tr>
<tr>
<td>Martin</td>
<td>1</td>
<td>11% (Math)</td>
</tr>
<tr>
<td>Lee</td>
<td>1</td>
<td>11% (CAAH)</td>
</tr>
<tr>
<td>Senior Year</td>
<td>Professional courses in speciality</td>
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<td>-------------</td>
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<tr>
<td>Hardin</td>
<td>1 8% (History)</td>
<td></td>
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<tr>
<td>Freeman</td>
<td>1 8% (In. Ed.)</td>
<td></td>
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<tr>
<td>Godfrey</td>
<td>6 50% (Educ.)</td>
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<tr>
<td>Martin</td>
<td>2 16% (Math.)</td>
<td></td>
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<tr>
<td>Daniel</td>
<td>2 16% (Music, Lit.)</td>
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<tr>
<th>% Building Use</th>
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<tbody>
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<td>Martin</td>
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<td>Daniel</td>
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<td>Hardin</td>
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<td>Sirrine</td>
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<tr>
<td>Godfrey</td>
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<tr>
<td>Lee</td>
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<tr>
<td>Freeman</td>
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teacher training facilities for clemson university's college of education
Industrial Education
Graphic Arts Specialty
Subject: Aileen Alley

Freshman Year.
Daniel 4 36% (Gen. Ed.)
Martin 2 18% (Math.)
Brackett 2 18% (Phy. Sci.)
Hardin 2 18% (Soc. Sci.)
Freeman 1 9% (In. Ed.)

Sophomore Year.
Freeman 4 50% (In. Ed.)
Kinard 1 10% (Phy. Sci.)
Hardin 3 37% (Soc. Sci.)

Junior Year. Specialty
Freeman 10 62% (In. Ed.)
Daniel 2 12% (Gen.)
Godfrey 2 12% (Ed.)
Kinard 1 6% (Phy. Sci.)
Lee 1 6% (Gen.)

Senior Year.
Freeman 4 80% (In. Ed.)
Godfrey 1 20% (Ed.)
Practice Teach
<table>
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<th>% Building Use</th>
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<tbody>
<tr>
<td>Daniel</td>
<td>15%</td>
</tr>
<tr>
<td>Brackett</td>
<td>5%</td>
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<tr>
<td>Hardin</td>
<td>12%</td>
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<tr>
<td>Freeman</td>
<td>48%</td>
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<tr>
<td>Martin</td>
<td>5%</td>
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<td>Lee</td>
<td>2%</td>
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<tr>
<td>Kinard</td>
<td>5%</td>
</tr>
<tr>
<td>Godfrey</td>
<td>7%</td>
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</table>
Outside users of courses offered can come from nearly every major on campus. A number of classes generate more demand than others. The Graphic Arts and Photography labs under the Department of Industrial Education receive a high percentage of non-education majors participation. It is expected that this outsider interest trend will increase. Some feel that this trend should be capitalized on by the image the facility could generate as advertisement for available learning.

On the other hand, at present a number of courses service in-house majors only. Those receiving a low demand of outside interest may be incorporated accordingly into the facility as relating, were applicable, to higher interest courses. For Industrial Education, the cluster method of spatial arrangement will provide a means of relating courses to one another that were previously handled as separate specialties. This design concept may spark new interest in some courses overlooked by outsiders as being unrelated to their specific interests. The ideology applies as strongly to in-house majors as well.

The College of Education has a number of professional development courses that are of a continuing education nature. These courses are scheduled primarily at night. This program is unique to the college. Night courses are designed to further teachers currently practicing in the field, and are relatively well received.
In conclusion, the Comprehensive Education Center should be sited within reasonable location to the support courses that will supplement the in-house major's education. The facility need not be critically close to any other part of campus nor overly convenient to one in particular. Any student at Clemson University, regardless of major, will attest to the educational value of changing classes across a limited distance.

The facility should be located within reasonable proximity to the parking facilities currently available to both faculty and commuting students as new demands will be made on available space.

Service to the facility should be readily accessible to current main service patterns on or around the university property.
The setting for Clemson University's Comprehensive Education Center is considered in the following study. Its purpose is directed towards the goal of selecting the most appropriate site for the facility.

To accomplish this, several studies are undertaken which in a broad sense, deal with Clemson University, past, present and future.
By examining the historical development of the Clemson University campus it is possible to determine the factors which influenced the campus growth in the past and through this gain insight into future growth. This analysis has been divided into five major time periods during which significant growth or development took place.

The campus of Clemson University was originally the property of John C. Calhoun. In 1825 he built his home on a hill beside a steep ravine where it still stands today. During the period of 1825-1890, the land was used exclusively for agriculture.

In 1890, the first buildings of Clemson College, founded by Thomas Clemson, were constructed. Tillman Hall, the most important, served as library and academic center. Elements affecting campus growth during this period were basically the Calhoun Mansion, and the natural edge to development formed by the steep slopes of the ravine. The Parade Grounds--now known as Bowman Field--were laid out as a necessary adjunct to a military school.

By 1825, growth to the north had been halted by the development of commercial buildings in downtown Clemson. Moving the library to Sikes Hall in effect shifted the academic center of the campus to that building, providing the impetus for campus growth down the east side of the ravine.
Development continued in much the same direction for the next twenty years, responding to the ravine, the Calhoun Mansion, Bowman Field, the athletic areas, the cemetery, and Williams Road. Growth was therefore directed to the south and southwest. The ravine remained as before a major edge to development, as can be seen in the almost completely bisected campus.

In 1965, an important development took place with regard to campus growth, which was becoming more and more attenuated. This was the construction of the Muldrow Cooper Library. For the third time, the library was moved to form a stronger academic center for the campus. The library was located squarely in the ravine, bridging the two main fingers of campus growth in its east and west banks. Beyond this point, however, development has continued along the sides of the remainder of the ravine and to the southwest.

During this period, the park extending from Sikes Hall to the President's Home developed into yet another boundary.

The site plan depicts the Clemson University campus as it exists today: the result of continuous growth influenced by both man-made and natural constraints.

Conclusions

The preceding historical developing makes it easier to realize dominant edge elements, to understand their effect on present and proposed campus development.
The current Clemson University campus is the result of two major factors. The first is the shape of the land itself, which contributed to an organic growth pattern. The second is the natural grouping of buildings produced by organizational relationships among various disciplines. The academic areas are contained in east and west groupings of specialized disciplines emanating from a central core of basic studies. Housing is tightly attached to the periphery of these groups and athletic areas occur to the west in an area equivalent in size to the total academic campus.

Future building development for Clemson is anticipated to be mainly in the nature of infill. The Comprehensive Education Center must fit into the existing academic framework, both in siting and discipline grouping. The location of the Continuing Education Center and Performing Arts Center have yet to be determined, but their placement will undoubtedly have a critical effect on the campus plan.
Land Use

Current patterns of building development indicate the campus education structure. A radial movement of academic progress is from general studies at campus core to specialty studies on the extremeties. As students move through their general education to specific major, courses dealing with their professional development are found on the perimeter of the core.

Agricultural specialties are located around the McGinty Mall area on east campus. Engineering professional level courses are located in a series of buildings moving from the core to the south on west campus. The Colleges of Architecture, Nursing, and Industrial Management and Textile Science are all similar in location to the general education core. The College of Education, currently located in Godfrey and Tillman Halls, is an exception. This will be addressed in proceeding material.

Circulation on and around the campus for pedestrian and vehicular traffic will figure prominently in the facility location. Although pedestrian patterns of movement seem relatively established, vehicular traffic, particularly on campus, will be subject to change. A move to eliminate non-essential traffic on campus has been proposed. The facility setting will respond accordingly.
Vehicular Movement

Clemson University is bounded by the town of Clemson to the north and east, and by Lake Hartwell to the west. The downtown area is accessible by 3 major highways, U.S. 76, U.S. 123 and S.C. 93. The latter road causes a serious traffic conflict between the town and the university, particularly at its intersection with College Avenue, at the foot of Bowman Field. A proposed by-pass, in the form of an improved Perimeter Road, is expected to relieve Highway 93 of a major portion of current through traffic.

Vehicular and pedestrian circulation on campus is partially separated at the present time. The blocking of Palmetto Drive during class hours prevents through traffic and encourages the use of Perimeter Road where a number of parking areas are located.

Certain areas in the pedestrian movement system are gathering points. These areas are called activity nodes.

Proposed vehicular movement systems for the campus include the relocation of portions of Perimeter Road and the discontinuance of many interior roads for any use except by service and emergency vehicles. The change in Perimeter Road would emphasize its use as both a by-pass of the Clemson area and as an access to major parking areas. Elimination of internal traffic movement would result in a safer, less congested campus which places primary emphasis on the pedestrian.
COMPREHENSIVE EDUCATION CENTER

teacher training facilities for clemson university's college of education

REGIONAL
Pedestrian Movement

Major pedestrian movement occurs on both an east-west and north-south axis. East-west traffic is mainly generated by dormitory locations on the edge of the academic framework. North-south traffic is influenced by the location of commuter parking lots and the downtown Clemson area.

New building developments to the south will increase student movement in this direction. This will call for improved pedestrian ways in this area including the study of a secondary linkage of the east and west campus legs, and the generation of new pedestrian activity nodes.
Conclusions

Clemson University in scale is a pedestrian campus. University growth in the past ten years has necessitated the large commuter lots with heavy vehicular traffic at points during the day. However, the growth and future interest of the campus should respond to the radial plan of ring parking servicing a pedestrian oriented campus.
THE SITE
Criteria for Site Selection

The site should uphold the many existing patterns of campus land use and future development.

The site should be accessible to major campus vehicular traffic routes, preferably an off campus roadway.

Vehicular traffic on and to the site for pick-up/drop-off or service functions should not conflict with current pedestrian paths or increase on-campus vehicular traffic.

The site should be within close proximity to substantial parking areas for facility users.

The site should be located with easy access to major campus pedestrian pathways.

The site should not be an undue travel distance from any supporting activity on campus relative to the daily users.
The following is an overview of positive and negative characteristics held by three possible locations for a Comprehensive Educational Facility.

The options are:

1. Renovation of Godfrey Hall;
2. Construction of new facilities for Industrial Education only;
3. Relocation of entire College of Education into a new complex.
Option 1: Renovation and Addition to Godfrey Hall

Tillman Hall is currently being renovated to accommodate the collective needs of the College of Education, excluding the Industrial Education Department. Upon completion of work, all facilities housed in Godfrey Hall will be relocated to Tillman Hall. Offices for the Department of Agricultural Education will be located there with its associated graduate program.

The office of the Dean, Educational Services Office, and all functions needed to support specialty courses for Education majors will be included.

Proposal Advantages:
1. Godfrey Hall will be available for renovation to fit needs of the Industrial Education Department.
2. A closer relationship potential for all administrative charges of the College of Education.
3. Economics of renovation exceed construction of new by far.
4. Godfrey Hall character is appropriate for the "Industrial" functions of the department.
5. Pattern of specialty campuses is upheld.

Proposal Disadvantages:
1. Overall idea of housing College of Education in Tillman conflicts with interest of University Planning Council. Due to the overwhelming association
of Tillman with Clemson University, the Council recommends that the building be a university-wide information center. The magnetism of the building and the architectural style lend more to this idea than to the College of Education classroom and administration building.

2. Restricted parking and availability to expand for future automotive needs.

3. Servicing the facility housed in Godfrey will increase inter-campus traffic and potential conflict with Harcombe Dining Hall and Post Office Service access.

4. Godfrey will require expansion to a certain degree with limited land available to do so. The history and place of Godfrey Hall in Clemson development will bear significantly in any renovation or change to outward building character.

5. Flexibility of service courses to Industrial Education will be altered.
Option 2: Construction of New Facilities

A relocation study conducted several years ago found a potential building area north of the campus central core. Located with Brackett Hall to the west and Sikes Hall to the east, the site is adjacent to Bowman Field.

Proposal Advantages:
1. Adjacency to Tillman Hall and Godfrey Hall is fair for administrative purposes.
2. A "specialty" grouping of buildings for the College of Education is fair.
3. Location to the campus core is good with little variance in class change distance.
4. Located close to S.C. Highway 93 with service relatively good.

Proposal Disadvantages:
1. Inter-campus vehicular traffic would be increased with service from 93.
2. Minimal parking available for building users.
3. Building will conflict with imagery existing in that area with Tillman, Sikes and the view to the library.
4. Service needs for building are questionable on that site.
5. Only the Industrial Education Complex could be sited on the location.
Option 3: Relocation of College of Education

The site proposed for the relocation of the entire College of Education to a single complex is located west of the Lee/Lowry complex, east of Earle Hall.

Proposal Advantages:
1. Creation of a new specialty campus in line with others existing.
2. All parts of the College of Education will be in close proximity.
3. Availability of existing parking.
4. Serviceability from major off-campus roadway is good.
5. Area is adjacent to other high night-time user facilities, Lee Hall.
6. Service courses for Industrial Education majors out of house are in close proximity.

Proposal Disadvantages:
1. Existing buildings around site are more technically oriented in specialty. Could be justified by traditional associations of Industrial Education to Engineering.
2. Service courses for some specialties are not as convenient as to prior location.
Conclusions

The Option 3 is selected for the Comprehensive Education Center. The positive aspects of the site with regard to program and facility requirements eliminated the other two site options. The potential for a "specialty campus" upholds the university development patterns. The site is able to meet easily the selection criteria as previously stated, and is therefore the only logical choice for a Center of this nature.
Comprehensive Student Services Complex

Tillman Hall and Godfrey Hall should be returned to university student services. The magnetism of Tillman gives first-time visitors naturally to this specific area of campus. The building should be a campus-wide information center for students and visitors alike.

A cluster of buildings which would include Mell Hall, Holtzender YMCA, Godfrey Hall, Tillman Hall, Sikes Hall and the University Student Union can become a comprehensive student services complex, encompassing Graduate School Offices, Student Bank, ROTC Functions, Counselling Center and numerous other student/visitor related organizations.
teacher training facilities for clemson university's college of education

COMPREHENSIVE STUDENT SERVICES
Site Analysis

A comprehensive site analysis is conducted to identify the characteristics of the site and surrounding context. Features important to the development of the site are diagrammed according to their nature and significance. General descriptions and recommendations concerning the site and characteristics are included.
Site Description and Inventory

The site is presently void of any building development. To the east are located Lee Hall, College of Architecture, and Lowry Hall, Department of Civil Engineering. West boundaries are formed by Earle Hall, Department of Chemical Engineering, and Williamson Road, the east entry of campus. On the southern edge of the site are commuter parking lots. A small access road for service to and parking behind Earle Hall runs from South Palmetto Blvd.
Vegetation

Much of the site is open grassy areas. Several large deciduous trees spot the site along the Lee/Lowry entrance drive. A heavy concentration of pine trees cover an embankment south of Earle Hall. Various groups of bushlike ground cover exist at random points around the site. Adjacent to the approach to commuter parking lots on the south side of the site is a large grassy slope that runs the length of the site from east to west.
Terrain

The site terrain is varied from nearly flat to some rises approaching 100%. The eastern edge rising to Lee Hall is the steepest slope. The land fall runs from highest at South Palmetto Blvd, slopes gradually to the south and southwest. Some of the site along the rear is flat. As mentioned before, a steep embankment parallels Earle Hall to the rear and literally bisects the site on an east-west axis.
Site Character

The hard building edges bordering the site lend a sense of containment to the location. It is important to note the possibilities of forming a situation similar to McGinty Mall on East Campus by correct facility siting. Soft edges define open areas such as the grassy slope. The site provides a variety of vistas from both on site and off site. Vehicular approach from Perimeter Road to parking views the site in its entirety from south to north. Pedestrian movement along the major spine, north/south, of west campus parallels the site and allows excellent views. Along South Palmetto views onto the site are good.
Environment

Prevailing breezes from the south move unchecked across farm fields to the site. Solar gain can be utilized due to the southern sloping nature of the site. Western exposure is minimized during critical months by the tree covered cemetery knoll and Earle Hall landscaping. Traffic noise of consequence will originate from the commuter parking access and Perimeter Road to the south.
Hydrology and Utilities

Water drainage from the site as well as higher elevations to the north and east, is channeled to the southwest. Presently several storm drains traverse the site from east to west. Runoffs are predominantly sub-surface due to the grass covering of the site.

Utilities for the site are provided in a service tunnel that parallels South Palmetto Blvd.
Conclusions

As previously mentioned, the hard building edges and roadways bordering the site add significant containment. The possibilities for forming a west campus academic "mall" are very likely.

Pedestrian access to the site will be directly off existing major paths. Vehicular access will be from Perimeter Road. Parking for faculty and students will be on existing lots. Areas to the south of the site for students, and to the north of Earle Hall for faculty parking have adequate space.

No dominant spatial characteristic of the site is warranting preservation. The areas immediately associated with Earle Hall are an exception. The service drive to Earle on the east will be eliminated. Existing service from Williamson on the west of Earle Hall will replace the eliminated access drive covered above.
THE FUNCTIONS
Office of the Dean

The Dean of the College of Education will be located in the center. The offices should serve as the administrative "head" for the college, and be readily accessible to both in-house personnel and visitors.

The following spaces are required as set forth by the College: the dean's office, offices for two administrative assistants, secretarial space, and a conference room. A lobby area aside from the physical office arrangement is desirable.
Office of Educational Services

The Offices of Educational Services are used in conjunction with development and education of student candidates for accreditation. The service includes information on placement, certification, National Teacher Examinations, information on conditions of other state requirements, etc. The Office issues applications, registration material and paperwork pertaining to resumes and references. Interviews with recruiters from various school systems are arranged and a file of applications and placement brochures is kept.

The office services break down into the categories listed. A brief activity analysis and need statement follow. All parts must be grouped as a whole.

Interview and Testing Rooms

These rooms are used primarily for interviews and testing. Totalling four, the small rooms should be private for intimate functions.

Needs: The cubicles should open into the Career Materials Center.

Career Materials Center

Reference materials are filed on salary schedules, certification requirements in states other than South Carolina, South Carolina requirements, and various matters
related to placement and certification. A placement and information board listing up-to-date job opportunities, N.T.E. information, and other pertinent data is kept.

Needs: Facility should be able to accommodate at least ten students, and the following administrative spaces: Director's Office, Administrative Assistant, Receptionist and Typist, and Storage.
Department of Elementary and Secondary Education

This department is the largest of the college and encompasses professional development, strategies and diagnostic courses. Spaces are required to house the Department Head, staff, and forty faculty members with supporting areas for faculty and administration alike.

All classes to be taught in the building will be held in the following categories: Professional Development, Curriculum and Instruction, and Educational Leadership. Spatial requirements and descriptions are as follow:

Personal Development Laboratories:

These labs will be sued for professional development courses covering the topics of: Educational Psychology, Adult Education, Early Childhood Education, Child Growth and Development, Reading labs, guidance related courses, and special education for career counseling.

The labs break down into the categories listed. A brief activity and need statement is included with each.

Health Education Lab

A study of the information needed for the effective cooperation with parents, doctors and public health agencies in promotion and improvement of community health.

Needs: Health Education Lab is a classroom space with forty student seating capacity. A demonstration
platform, 8 feet long on one side of the room, is required. Storage and shelving is needed along one wall.

Measurement Laboratory

Used primarily for courses dealing with principles of testing, test administration and test evaluation.

Measurement Lab is conducted in classroom type space. Capacity for fifty students is desired.

Developmental Reading Laboratory

Professional courses concentrating on the study of students with special reading problems are taught in these labs. Problems related to diagnosis and corrective measures of reading problems at any level are covered. Students work directly with "problem" readers, as well as observe techniques applied by others.

Two adjacent rooms with one-way glass between for observation purposes. Each room should accommodate thirty students.

Observation Lab

Used for control testing of subject pupils. Evaluation tests for I.Q., aptitude and comprehension are administered and observation of test subject response is included.

Two adjacent rooms with one-way glass between for observation purposes. Each room should accommodate forty students.
Counselling and Reading Cubicles

These are a series of small rooms used for test administration, counselling, and observation purposes. They are primarily for individual testing and consultation in a one on one basis.

Twenty-four rooms at two each being connected by one-way glass for observational purposes. Rooms should be private in nature.

Special Education Lab

A multi-purpose classroom space with forty-student capacity.

Classroom (Seminar Type)

A multi-purpose classroom with forty-student capacity.

Needs: Must be able to control room light levels for any audio-visual presentation.

Early Childhood Laboratory

Students in the field of Early Childhood Education observe and practice the methods used to handle children at the primary schooling levels.

Needs: The Early Childhood Labs should be adjacent to one another so that the college students will be able to observe the children in the adjoining room via one-way glass. Toilet facilities for the youngsters should
be adjacent to their room. The observation room should accommodate forty students.

Curriculum and Instructional Labs

These labs will be used for professional development courses covering the topics of planning curricula for the classroom. Formal classes in methods and implementation of planning are taught.

The labs break down into the categories listed. A brief activity summary and needs statement follow.

Materials Center Lab

This area houses current resources available to aid education majors in lesson planning. The space functions as a library with limited access for control of incoming and outgoing resource material. A materials processing room adjacent to the resource center and control cubicle is necessary.

Adjacent receptionist-type checkout station. Staff should be able to observe activities within the center. Two stations are required. The exit, not including emergency, must be by the check-out window.

Curriculum Planning Laboratory

This space functions as a classroom equipped to instruct graduate and undergraduate students on methods, curricula planning and classroom instruction techniques.
Two each with a forty-student seating capacity, five adjoining cubicles for more intimate instructional purposes should adjoin the lab spaces.

Audio-Visual Laboratory

This lab contains audio-visual resources available to aid curricula planning and development.

The space should accommodate forty students. Adjacent to the lab are two preview booths for film viewing. These booths must be completely soundproof but connected to the lab.

Experimental Strategies Lab

These spaces are used in conjunction with teaching methodology.

Two each with a twenty-student capacity. Each lab should have an enclosed projection booth at the rear. A raised platform for demonstration purposes is needed. Room should have "dark-out" capabilities.

Test Storage and Preview Laboratory

This space is a test resource center. It is adjacent to the Materials Resource Center for the laboratories.

Must be planned to open into the Materials Center Lab so that exit is by the receptionist check-out window.
Educational Leadership Laboratory

These labs will be used for professional development courses dealing with students desiring a career in Education Administration or supervision.

The following spaces are required: materials laboratory, developmental laboratory, and seminar/conference room.

The labs break down into the categories listed:

Materials Lab

This is a central location for instruction materials with adjoining cubicles for projects and programming. This space is not mentioned in conjunction with materials centers of the other departmental groupings.

Developmental Lab

These are ten cubicles opening onto the Materials Center. They are used for the project and program development.

Seminar/Conference Room

Two classroom spaces with twenty-student capacity. These rooms are used for group instruction on Educational Leadership.
Department of Agricultural Education

The Agricultural Education major is designed for students who wish to pursue a career in vocational agriculture, agricultural occupations and other teaching positions in the secondary school. Curricula is planned to cover many facets of agricultural education such as public relations, conservation, agricultural missionaries and extension services.

All courses concerning choice of profession and development are primarily agriculture oriented. The administration and faculty involved with the areas of actual teacher training of Agricultural Education majors will be located at the Center.

The department will require the following facilities listed:

- Offices for faculty and staff
- Support services for secretary and receptionist
- Offices for clerk and secretary
- Seminar room with a twenty person capacity
- One teaching lab space for instructional purposes. This classroom should have a thirty student capacity.
Department of Industrial Education

Curricula, faculty and staff associated with Industrial Education at the College will be located in the Center. Department Head and staff offices, with sixteen faculty offices and supporting spaces are required.

As previously discussed, the curricula is categorized into the three clusters. For clarity, the list below and following information describes the activities and spatial needs of the laboratories.

The Clusters

Production
Metals Technology Lab
Metal Machining Lab
Wood Technology Lab
Construction Lab
Plastics Lab
Arts and Crafts Lab
Materials Testing Lab

Communication
Graphic Arts Lab
Photography Lab
Drafting/Design Lab
Media Development Lab
Power

Electricity/Electronics Lab

Power Technology Lab
Production Cluster--Wood Technology

Students learn the material wood, its properties, and the requisite skills necessary for understanding the use of wood.

Tool and machine identification used in woodworking is covered. Students are made aware of correct methods for accomplishing a variety of experiences in each lab session. Cutting, shaping, joining and planning exercises aid in establishing principal equipment operation procedures. Students are provided with a supervised opportunity to develop beginning skills in working with wood materials, tools and machinery.

Activities include parts production, jointery, preparation and assembly of selected projects.

Issues:

Approximately ten percent of area in lab should be devoted to assembly, preferably in the area near the exterior access in the event of large projects.

A substantial area should be clear around the stock room. This allows large sections of lumber to be maneuvered to the first cut machinery.

Larger machinery should be close to stock room to avoid portage of big lumber through the lab space.

Exhaust equipment should tap into each machine.
Distinct traffic patterns should be established between areas of heavy use, such as machine groups, finishing room and tool panels.

Machinery associated with certain activity areas should be grouped accordingly. Bench work areas should be accompanied by equipment frequently used in conjunction.

A smooth flow from storage to finished product should be emphasized.

Bench working stations should be organized so as to not conflict with adjacent work stations and laboratory traffic.

Finishing room requires ventilation.

Project storage and finishing rooms should be adjacent. Adequate project storage room is necessary.

A gluing bench is located near benchwork area, storage and finishing room. A generous amount of free assembly area should accompany gluing.
Production Cluster--Metal Machining Lab

Students work in the area of machining metal. The laboratory is equipped exclusively for these purposes. Participants develop skills in safety performing common operations using basic machine tools and equipment. Students acquire a technical knowledge of materials, tools and processes commonly used in the machine tooling industry.

Exercises are graduated in complexity, but almost all require the use of three machining instruments, the lathe, the milling machine, and the shaper. Demonstrations are given on the principles and capabilities of the shop equipment, and students conduct similar exercises in round-working and flatworking to learn the techniques by their own hand.

Knowledge of the tools, as well as maintenance, is stressed. Machinery is used by the participants to maintain other parts and tools used in labs.

In higher level courses, precision is emphasized in machining. Students develop an understanding of the theoretical and technical knowledge associated with precision metal removal, shaping processes and equipment. Exercises geared at increasing the proficiency of the student are conducted through the tooling of a project using the basic areas of the lab spinning, milling and shaping.
Issues:

The unit shop idea is stressed for control purposes. The sophistication of machines in the lab lend to a relatively "clean" environment to insure machine accuracy.

Lighting in the lab is critical. Shadows are undesirable on machinery and work surfaces.

Ground floor orientation is a prerequisite. The machine weight and vibrations require a solid mount to the floor.

A lecture area is desirable with provisions for audio-visual equipment.

Adequate stock storage and student project storage is required.

Project processes within the shop are based on selecting stock and making an initial cut. From there the work moves from station to station depending on the machine group required to tool the work. No assembly line process is required, but machines of similar capacities are grouped for instructional purposes.
Production Cluster--Metal Technology Lab:

The many facets of product assembly with fabricated metal parts are explored. Methods and procedures for material separating, forming and combining used in industry ae studied. Basic casting, welding and shaping techniques are used in project work with emphasis on measurement in­spection and quality control.

Three basic areas make up metals lab: the foundry area, where metals casting and molding are done, the welding area will be for investiation and application of prin­ciples used in welding, and the third area involves the shaping of sheetmetal stock in general.

Some affiliated areas with metals lab exist, but not so much on the scale of importance as the main three. An acids area deals with treatment of metals in electroplating and coloration. Tooling zones for some grinding and shaping are closely associated with welding. Heat treatment equipment is used to investigate tempering of metals.

Stock for this lab is centrally stored to all parts. Linear bars and sheetmetal panels are the basis of all project work, with the exception of the foundry area. Machin­ery associated with initial cutting of stock is located close at hand to eliminate unnecessary portage of large material pieces through the lab.
Needs

Foundry, acids, and welding areas need forced ventilation to carry off fumes.

A general area for work layout and project storage is needed. The size of a given project may vary considerably.

Special light screening drapes are needed to shield harmful light rays generated by welding torches.

Stock is replaced periodically. Access to the exterior, though not necessarily immediate, is needed.

Lighting used should preferably not cast shadows in work areas.

Gas cylinder storage should be located outside the building but adjacent to lab.
Production Cluster--Construction Lab

This lab specializes in principles of building materials and the methods of combining them in current applications. Activities are directed at developing a working knowledge of construction technology.

Production of useful projects aligned with materials and assembly methods practiced in the field are promoted. Students learn the essentials in planning through product covering, framing, and basic wiring.

Needs

The nature of work done in this lab aligns it strongly with wood technology. Stock storage and machinery common to the needs of the construction lab could be shared.

Adjacency to the exterior is desirable in the event of large project construction.

Forced ventilation systems for machinery are needed.
Production Cluster--Arts and Crafts Lab

Exploratory experiences in the performance of a variety of arts and crafts activities are conducted. Major areas of consideration are ceramics and wood working. Other activities covered are leather work, jewelry crafting, and graphic arts. This particular lab has considerable use targeted at the purpose of developing an understanding toward integrating the study of industry and technology into the classroom. Emphasis is seen on learning the importance of the need for well-designed and functionally oriented products.

Zoning of activities is seen as important. Dissimilar and incompatible studies are conducted simultaneously. A given amount of separation, though not necessarily physical, should be given clean and dirty activities.

Forced dust removal of any wood working machinery in the lab is needed so that chips and dust do not settle in other areas. A clear area for instructional material, planning and evaluation is desirable.

Needs

Stock room should be relatively accessible to exterior services.

A finishing room is desirable along with a spray booth. Project storage for each area is needed. Forced ventilation for fumes is needed.
Drying areas for work produced in graphic arts and ceramics areas.

Conclusions

The comprehensive nature of experiences across industry offered by this lab are somewhat unique. Whereas most other labs are specific to an area of industry, Arts and Crafts covers a little of it all.

This client has requested a model comprehensive lab, which is in effect a simulator for a secondary school shop. The set-up in this space duplicates a majority of that needed in Arts and Crafts. It is seen that these two labs could easily become one with all experiences encompassed within.

The nature of the users, as well as the purpose of the two labs, in the long run call for this combination.
Production Cluster--Plastics Lab

The industrial, commercial, and personal uses of plastics are discussed and demonstrated. The various kinds of plastics and their physical properties are covered. Students investigate the numerous applications of plastics as well as the molding, shaping and joining techniques required to produce plastic based products. Exercises include injection and vacuum form shaping, laminating with plastics, heat sealing with plastic, polishing plastic products, and joining plastics together.

A fundamental background in the physical properties of plastic is given to acquaint students with the product potentials and limitations. Special exercises investigating the families of plastics are conducted in lecture. Structure and production of plastics are studied by use of audio-visual instruction. Instructor demonstrated exercises in joining with adhesives are covered in lecture as well.

The exercises in shaping, forming and molding of plastic based products are conducted in lab.

Issues.

Exhaust of harmful fumes is required.
Communications Cluster--Graphic Arts Lab

Major emphasis is placed on the basic principles underlying the graphic arts. Areas of study are photography, graphic layout and design. Printing activities include process photography, offset lithography and silk screening. Students are expected to develop an understanding of modern industrial application in the graphic arts field. Work involves a planning to product approach with heavy reliance on self-paced instruction. Advanced students will gain experience in packaging products which involve the full gambit of graphic arts. Production will include copy preparation, type composition, photographic techniques of line, halftone, duotone and special effects. Color reproduction, plate making, and offset work are covered.

Emphasis on consideration of decision making in areas of equipment selection and process is stressed.

The lab is divided into three basic zones, all of which flow in an orderly progression. The layout/paste up area is used for initial planning and design. From here work advances to the darkroom where the large process cameras and stat cameras are used for image making, work then moves back to the paste up area for review. Preparations are made in accordance to the printing techniques to be used. Plates are made or screens are prepared and work moves into the printing area. It is here that the product reaches its final stages.
Issues

Graphic arts lab has a tradition of high use in Industrial Education. The processes involved are very methodical and graduate in complexity. Provisions for the interrelationship and area use hierarchy are necessary to stress the technology involved. Space should be designed accordingly.

Humidity has an important effect on the lab space. Prints drying may be adversely affected by moisture. Isolation of wet areas is needed. These areas are plate cleaning and wet processing of film and paper.

Plate cleaning involves chemicals which must be properly ventilated. A separate room with exhaust hood is required. This room should be visually open to the adjacent lab.

Plate making requires a separate room which should also be visually open to lab.

Press area should be an "island" type layout with major circulation away from machinery.

An audiovisual area with instructional materials storage should adjoin lab space.

Storage should be relatively accessible to major loading dock. Paper goods in large quantities are periodically restocked.

Student work storage space is needed to accommodate the projects.

Print drying racks with hooded exhaust are to be included.
Communication Cluster--Media Development Lab

The many areas of media selection for instructional usage are covered. Students choose a topic, specify learning outcomes, and plan the methods of production. The fundamentals of storyboards, art direction and appropriate media selection are covered. Experience in still and motion picture productions with audio accompaniment is required.

The lab is equipped with facilities to produce these programs. Students concentrate on the elements involved in packaging multi-media productions. The role of curricula materials development is seen as increasingly important in education.

Needs

A close association with graphic arts is desirable, but separate darkroom facilities are needed. Duplication of some specialty equipment can be avoided by sharing some facilities with graphic arts. A bank of darkrooms could separate the two spaces.

Sufficient planning and layout area is needed.

Cubicles for long-term projects are needed to isolate from the projects of shorter duration and possible material mix-up.

Project storage area is needed. An equipment room for valuable material is desirable.
Communications Cluster--Photography Lab

Emphasis is placed on application of black and white photography as activities for vocation and avocation. Basic fundamentals of camera working and principles of operation are covered. Sufficient laboratory experiences are provided to expost students to all facets of photography. From film loading to print making various photographic techniques are explored. Problems encountered in the application of photography in industry are considered.

Students learn how photography is important in the technology of industry and communication. Studio work includes action, portrait, still life and character study aspects of the field.

Needs

Photography as a communication medium in industry is aligned closely with graphic arts. Often one is a direct foundation for another. This alliance should be enhanced. The studio/lab space for photography should be adjacent to graphic arts lab. To prevent overload on equipment, photo lab would have machinery sufficient to support its own needs. However, in the event of a possible spill-over, the facilities in this lab could be used in association with graphic arts lab needs.
Loading closets for film are needed. These are light-tight, short-term use, walk-in closets with safe light for film to camera loading.

A wet area is needed for film processing. Sinks and countertops are sufficient.

A darkroom for printing processes is needed. This should be large with upwards of space for fifteen enlarger stations. A central island for print processing is needed. However, equipment is available for self-contained print processing and is frequently used.

A studio space with a high ceiling and lighting controls is needed. This will be used in investigation of composing and photographing a variety of subject matter. Studio adjacent to work area.

The central work area for instruction and review is needed. Print drying and mounting is done in this space. Storage for materials is included.

The space should be visible from the graphic arts lab, but must be able to be darkened off if needed. Pull down black-out shades could be used.
Communications Cluster--Drafting Lab

A fundamental approach to the importance of drafting in industry begins with instruction of basic principles. Work is primarily board oriented with each student at a work station. Views, projections and drawing types are covered to provide the students with an understanding of how the media is used to communicate information. Students are acquainted with the uses of drafting and can specialize in a particular application.

Architectural and technical illustration are covered. Model building, a key to understanding two dimensions in three dimensional form, is a key device the students investigate.

Needs

Alignment with other clusters is strong because of the fundamental planning for projects. A drawing is essential to record information needed throughout the industrial experience. The implications of visual media place drafting with communications. However its use is basic to all clusters.

A separate, but not necessarily physically, area is needed to confine airbrush activities associated with illustration.

A print machine area is needed along with paper storage.
The lab should be able to be blacked out for A-V presentations.

Room orientation should focus on an instructional station for teacher use in demonstration.

A self-instructional area of viewing cubicles is needed.
Power Cluster--Electricity/Electronics Laboratory

Activities are designed to give the student a basic understanding of electrical phenomena, circuits and components as well as practical experiences with electrical circuits and machines. Students will gain knowledge of the applications and uses of electrical power and devices in industry as a basis for instructional activities both in the electrical field and related fields.

Higher level investigation includes a further study of electronic principles and devices with emphasis on design construction and troubleshooting of electrical and electronic equipment.

Heavy reliance is placed on instructional "trainers," pre-packaged material, graduated in complexity, designed to acquaint students with the principles of electronic and electricity application in industry.

General activities are divided among various areas of study within the lab. The lab will include the following activity areas:

A development area where planning tables, reference materials, and instructors' area is needed. This area will function as a discussion or chalk lab space as well as circuit planning and design.

An adjacent computers area with CRT's will be located next to the development area. Students will be acquainted
with the basics of computer operation and application in industry.

A central work area is seen as the heart of the electricity/electronics lab. Consisting of four to five "island" stations with capacity for four students per island, the central area is the heart of the "trainer" application. The trainer, as previously mentioned, is an exercise or series of exercises programmed in complexity as a student's skill graduates. The trainer consists of all things necessary to complete an exercise. Within each island station is the instrumentation and power supplies for the trainer.

A fabrication area is needed for the construction of printed circuit boards.

A diagnostic/servicing area is needed to acquaint students with instrumentation for analyzing circuits. This area is seen as being specifically for investigational conditions that may arise.

A communication area with HAM radio and other receiving transmitting equipment is desired.

Needs

Activities involving commercial and domestic wiring application could align the lab close to the construction lab in the Production Cluster. It is possible that an off-shoot area of the E/E lab could be used for wiring a 3-D hookup portion of a framed house or construction lab project.
Sinks and benches for sodering and pounding are required in the fabrication area.

A separate but visually open space is needed for the computer area and diagnostic area due to the sophisticated equipment. The latter area should be a lockable room.

Storage for circuit surplus and tools should be open into the central area, adjacent where it is needed most.
Power Cluster--Power Technology Lab

Oriented around the impact of power sources on industry. A study of the advancements and progress of our culture as being dependent on the invention and development of power sources is the activity theme. Power technology involves the investigation of various sources of mechanical power.

Students cover the historical development of power sources, their uses, control, transmission, measurement, advantages, disadvantages, future, social and economic problems involved.

Students develop an inventory of energy sources for power generation. An understanding of principles involved with each source is achieved by background information on development. Activities are conducted to familiarize students with the workings of sources. Information packages that step-by-step disassemble a model are used as in lab sources are studied. A variety of 2-cycle, 4-cycle, and diesel engines are dismantled, serviced, or simply investigated in lab. Studies in solar and other alternative energy sources are conducted.

Students design and construct energy producing systems. Levels of investigation deal with fundamental steam generation to jet or rocket engines.
Needs

Ventilation of exhaust fumes produced by engines is a necessity. This can be accomplished by a hose hook-up which channels fumes to outside the building. Lab needs relative proximity to building exterior. Automotive diagnostic work need not be directly with the lab since equipment can be portable. However, an exterior area for work is desirable.

Noise generated by the engines in use must be well insulated.

A quiet area is needed for review of self-pace materials. Study carrels and a discussion area should be included.

Natural lighting is preferred.

Storage for tools should be located with respect to principal use. Specialized tool areas are assigned to the various power sources.
Cluster Support--Lecture/Demonstration Room

This space will be used for group instruction. Demonstration of methods and procedures involved with aspects of Industrial Education will be prepared.

The room should be fully set up for audio-visual equipment. Material prepared to explain working principles of equipment will be used. That which cannot be taught in the lab for any reason will be taught in this space.

Were an instructor explaining the operation of a welding torch, he may use cut-a-way views to explain concepts not readily understood in the field. Provisions will be made to include a preparation and material storage area adjacent to the instruction station. This may be used to house mock ups of actual equipment the students will encounter. At times the subject being covered may require large group observation, something that the labs ordinarily don't provide the space for. The lecture/demonstration room is designed to accommodate these needs. Space should have permanent seating to provide for 50 or more students. The environment should be somewhat intimate to maximize learning.

Graduate Student Carrells

An area is required for students enrolled in the various graduate programs offered in Industrial Education.
This area will be used as non-laboratory work space for the students' research.

Space for twenty carrells is required.

Trade and Industrial Education In-Service Resource Room

A library for storing and display of current resource material is needed. The area will be used by faculty and students both for keeping abreast of the current state of the art in Industrial Education.

The area should be easily accessible to outsider use by field teachers.

This area will be combined with the central material center of the building.

Model Comprehensive Lab

Essentially a simulator secondary school shop, ideally it should contain some of all parts of the entire Industrial Education curricula. The basis of such an area is to acquaint Industrial Education teachers with the possibilities of what may be encountered in the field. From this experience they can plan instructional material on the comprehensive scope ultimately adjusted to meet or improve provisions at their field assignment.

The lab is designed to develop an understanding of the multiple activity program as carried out in the state's industrial arts and pre-vocational institutions. Opportunities
are provided to develop a management plan for multi-activity programs, which may be used during field experience.
DESIGN CONSTRAINTS
General Laboratory Design Considerations

Proportions

The shapes and proportions of the laboratory spaces are vitally important to the function of the areas. Some predetermined standards based on conditions observed in the field are listed.

Laboratory spaces should not be less than thirty-five feet wide. The general proportions should be rectilinear in shape. The interior of the individual laboratory should be unobstructed by partitions. Any support space within the lab should be visually open to the main area. These spaces include spray booths, storage rooms, etc. Laboratory lengths should not be excessive (100 feet maximum).

The above criteria are based on safety in the learning environment. Instructors must visually control the activities in the labs to insure the well-being of students in potentially dangerous situations.

Circulation

A need for clear paths of circulation is important to successful use of laboratory functions. Conflicting patterns of movement can result in inefficient and often dangerous conditions within the lab.

A main pattern or circulation spine should lead the length of any laboratory. From this spine secondary paths
to equipment zones should be established. Movement should not be across zones of machinery which will conflict with any activity.

Power machinery should be zoned into a specific area with adequate operating space, regardless of function, as required by machine. Similar functions should be grouped to minimize cross circulation possibilities, for instance bench areas should be central to other areas, machines, and supporting functions.

Services

Utility benches on a 10' X 10' grid will be installed to provide vacuuming, compressed air and power hook-ups when needed by the machinery. Utility posts will be installed to connect machinery to the Trenches. These posts shall be portable to maximize flexibility of laboratory arrangement. All labs will be serviced with running water.

Environment

Noise isolation is critical to the laboratory environment. Acoustical treatment shall be installed in each lab to reduce the noise levels and isolate the sound. Noise producing labs can be located away from sensitive areas. Lighting should not cast shadows onto machinery and working surfaces. North light is preferable in the high bay laboratories. Supplemental lighting shall be integrated into the aesthetic of the high bay environment.
Codes

The following requirements set forth in the Standard Building Code by the Southern Building Code Congress International apply to the proposed building:

Occupancy classification: mixed occupancy. Principal intended use is education.

Construction type: Type I or Type II.

Maximum allowable height: Type I--no limit; Type II--80 feet.

Maximum allowable floor area: Type I--no limit; Type II--no limit.

Exit requirements: maximum distance to have to a protected exit is 150 feet unsprinkled or 200 feet sprinkled.

Occupancy per floor: Classroom--20 sq. ft. per occupant; laboratory--50 sq. ft. per occupant.

Capacity of means of egress: 100 persons per 22" level travel; 60 persons per 22" stairs; 44" minimum exitway.

Special uses: areas in which flammables are used or stored must be enclosed by construction of no less than 1 hour fire rating.

Accessibility for the physically disabled and/or handicapped: corridors, 44" minimum; doors, 32" minimum; ramps, 1' 12" maximum rise, 4' minimum width, with 3' level area every thirty feet.
SPACE REQUIREMENTS
<table>
<thead>
<tr>
<th>Office of the Dean</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean's Office</td>
<td>225</td>
</tr>
<tr>
<td>Administrative Assistant</td>
<td>100</td>
</tr>
<tr>
<td>Staff Assistant</td>
<td>100</td>
</tr>
<tr>
<td>Receptionist and Typist</td>
<td>150</td>
</tr>
<tr>
<td>Conference Room</td>
<td>400</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>975 sq. ft.</strong></td>
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Office of Educational Services

<table>
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<tr>
<th>Role</th>
<th>Space (sq. ft.)</th>
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<tr>
<td>Director</td>
<td>150</td>
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<tr>
<td>Administrative Assistant</td>
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<tr>
<td>Receptionist and Typist</td>
<td>300</td>
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<tr>
<td>(2 @ 150 sq. ft. ea.)</td>
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<tr>
<td>Storage</td>
<td>150</td>
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<tr>
<td>Interview and Testing Rooms</td>
<td>320</td>
</tr>
<tr>
<td>(4 @ 80 sq. ft. ea.)</td>
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<tr>
<td>Career Materials Center</td>
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<tr>
<td>Conference Room</td>
<td>400</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>1,570 sq. ft.</strong></td>
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Department of Elementary and Secondary Education

Administration and Faculty

Department Head 150
Administrative Assistant 100
Staff Assistant 100
Receptionist & Typist 400
(4 @ 100 sq. ft. ea.)
Conference Room 800
(2 @ 400 sq. ft. ea.)
Storage & Reproduction 300
Faculty lounge and workroom 625
Faculty Offices 4,000
(40 @ 100 sq. ft. ea.)

Subtotal 6,275 sq. ft.

Classroom Space

Educational leadership laboratory

Materials Center 600
Development Laboratory 1,000
Seminar Room 800
(2 @ 400 sq. ft.)

Subtotal 2,400 sq. ft.
<table>
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<tr>
<th>Curriculum and Instructional Laboratories</th>
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<tbody>
<tr>
<td><strong>Materials Center</strong></td>
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<tr>
<td>Stacks</td>
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<tr>
<td>Receptionist &amp; Check-out</td>
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<tr>
<td>Materials Processing</td>
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<td>Test Storage and Preview</td>
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<tr>
<td><strong>Audio-Visual Laboratory</strong></td>
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<tr>
<td>Preview Booths</td>
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<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Curriculum Planning Laboratories</strong></td>
</tr>
<tr>
<td>(2 @ 800 sq. ft. ea.)</td>
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<tr>
<td><strong>Experimental Strategies Laboratories</strong></td>
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<tr>
<td>(2 @ 1,200 sq. ft. ea.)</td>
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<tr>
<td>Personal Development Laboratories</td>
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<tr>
<td>---------------------------------------------------</td>
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<tr>
<td>Counselling and Reading Cubicles (20 @ 100 sq. ft. ea.)</td>
</tr>
<tr>
<td>Observation Laboratory (2 @ 800 sq. ft. ea.)</td>
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<tr>
<td>Measurement Laboratory</td>
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<tr>
<td>Developmental Reading (2 @ 625 sq. ft. ea.)</td>
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<tr>
<td>Health Education Laboratory</td>
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<tr>
<td>Early Childhood Laboratory (2 @ 800 sq. ft. ea.)</td>
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<td>Special Education Laboratory</td>
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<tr>
<td><strong>Subtotal</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
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</table>
Department of Agricultural Education

Department Head 150
Receptionist & Departmental Secretary 150
Secretary & Clerk 300
(2 @ 150 sq. ft. ea.)
Faculty Offices 800
(8 @ 100 sq. ft. ea.)
Seminar Room 400

Total 1,800 sq. ft.
Department of Industrial Education

Administration and Faculty

Department Head 150  
Staff Assistant 100  
Receptionist & Typist 300  
(2 @ 150 sq. ft. ea.)  
Conference Room 400  
Storage and Reproduction 300  
Faculty Offices 1,600  
(16 @ 100 sq. ft. ea.)  
Conference cubicles 400  
(4 @ 100 sq. ft. ea.)  
Graduate student carrells 1,000  
(10 @ 100 sq. ft. ea.)  
Subtotal 4,240 sq. ft.

Classroom and Laboratory Spaces

Production Cluster
Metal Machining Lab 4,000  
Metal Technology Lab 4,500  
Wood Technology Lab 4,000  
Arts & Crafts Lab 4,000  
Construction Lab 3,000  
Materials Testing Lab 3,000  
Plastics Lab 3,000  
Model Comprehensive Lab 4,000  
Subtotal 29,500 sq. ft.
<table>
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<tr>
<th>Cluster</th>
<th>Facility</th>
<th>Sq. ft.</th>
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<tbody>
<tr>
<td>Communication Cluster</td>
<td>Graphic Arts</td>
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<tr>
<td></td>
<td>Photographic Lab</td>
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<td>Drafting Lab</td>
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<td></td>
<td>Media Development</td>
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<tr>
<td>Power Cluster</td>
<td>Electronics Laboratory</td>
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<tr>
<td></td>
<td>Power Technology Laboratory</td>
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<tr>
<td></td>
<td></td>
<td>8,000</td>
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<tr>
<td></td>
<td>Lecture Hall</td>
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<td></td>
<td>Materials Center</td>
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<tr>
<td>Subtotal</td>
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<td><strong>1,800 sq. ft.</strong></td>
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<tr>
<td>TOTAL</td>
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<td><strong>56,500 sq. ft.</strong></td>
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College Area Requirements

Office of the Dean 975
Office of Educational Services 1,570
Department of Agricultural Education 1,800
Department of Elementary and Secondary Education 35,075
Department of Industrial Education 56,500

Net Area 95,920 sq. ft.

TARE (mechanical, circulation, structure @ 20%) 19,184 sq. ft.

Gross Area 115,104 sq. ft.
GRAPHIC SOLUTION
Diagnostic Level

South Elevation

S Palmetto St Elevation

Faculty Office Level

Bullpens and support

Classroom

Courtyard

Educational Services

Elementary & Secondary Education Dept
RESOURCES

Dr. A. Newton
The Faculty of the College of Education
Dr. Crouch
Dr. Lovedahl
Dr. Smith
Dr. Caley
Dr. Maurer
Dr. Purkett
Martin Kuldike

Peter R. Lee
Fritz G. Roth
Yugi Kishimoto
John Jacques

Randy Kidd
Betsy Gourlay
David P. Dubinsky
Resources

Bibliography

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Course Syllabi Industrial Education, Clemson University, College of Education, Department of Industrial Arts.

Designing Educational Facilities for the Future, Dr. Ronald Bro, Department of Industrial Technology, University of Northern Iowa, 1974.