TECHNOLOGIST EDUCATION IN ARCHITECTURE: A STUDY OF CURRENT AND FUTURE OCCUPATIONAL RESPONSIBILITIES

By

JIMMIE L. KING

Bachelor of Science
Central State University
Edmond, Oklahoma
1978

Master of Arts
Central State University
Edmond, Oklahoma
1984

Master of Education
Central State University
Edmond, Oklahoma
1985

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
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RESPONSIBILITIES

Thesis Approved:

Thesis Adviser

Clyde B. Knight

R. W. Pelts

Emmet Osgood

Norman N. Durham

Dean of the Graduate College

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CHAPTER I

INTRODUCTION

In 1984 the Encyclopedia of Careers and Vocational Guidance identified architectural technology as a "new and emerging" career field in which practitioners have found themselves increasingly responsible for a wider range of duties within the environmental design profession (architecture, construction, engineering, landscape architecture, and planning). The Bureau of Labor Statistics has predicted that this trend will continue and when combined with the affects of attrition, will result in the need for a 58 percent manpower increase in architectural technologists by the mid 1990's (Brooking, 1980).

The evolution and expansion of the occupational responsibilities performed by the architectural technologist are a direct result of various social, economic, and technological changes which have occurred. Those changes include:

1. Growth Within the Construction Industry. The building construction industry has consistently proven to be one of the largest capital concerns within the American economy. In 1984, over $311 million was spent on "new construction" in the United States and some 19 percent of the total work force was employed in a construction related field. This represents a $71 million increase in total "new construction" since 1980 (Construction Review, 1985, Figure 1).

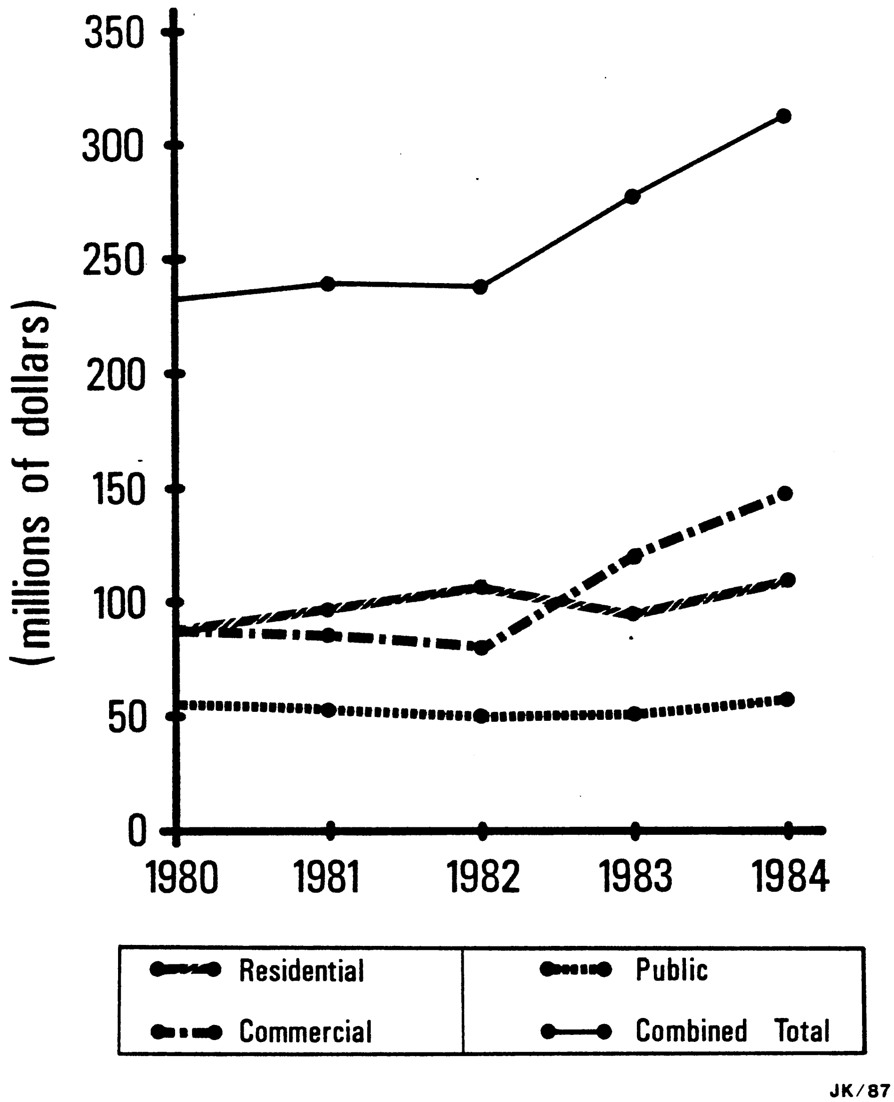

Figure 1. New Construction in the U.S.

2. <u>Demographic Trends</u>. Economic and industrial changes will result in greater numbers of people moving from rural areas to metropolitan centers across the country. In fact, the urban population of the 1970's is expected to double to 280 million by the year 2000 (<u>Construction and Building Trades</u>, 1984). The impact upon residential, commercial and industrial construction is obvious.

3. <u>Urban Renewal Efforts</u>. Federal and state efforts aimed at revitalizing the inner city will continue to create a significant market for the energy efficient and aesthetic reconstruction of existing residential and commercial sites.

4. <u>Environmental Awareness</u>. As our efforts continue to focus upon the management of our natural environment and the conservation of natural resources, the architectural technologist will play an increasingly important role in the areas of materials development, research and energy efficient building design (passive solar, earth sheltered, et cetera).

5. <u>Advances in Process Engineering</u>. Many building design duties which were once quasi-experimental in nature and exclusively performed by the registered architect or engineer have become sufficiently routine as to permit the technician or technologist to successfully and competently perform the duty (U.S. Department of Education, 1984). Processes and systems that have facilitated these changes include Computer Aided Drafting and Design (CAD[D]) and the utilization of prefabricated structural systems such as beams, rafters and wall units.

Occupational Definition

A precise and clearly defined occupational definition for the architectural technologist has yet to be formalized by the Dictionary of Occupational Titles. However, by looking at certain occupational parameters--general job description, performance responsibilities, and educational requirements--it is possible to establish an operational definition for the position.

General Job Description

The architectural technologist is a para-professional who specializes in the practical application of applied science to the broadly defined field of environmental design which includes architecture, construction, interior design, engineering, landscape architecture, and urban planning (Yohannan, Lucas, 1978).

Performance Responsibilities

Specific performance responsibilities will be outlined in greater detail in Chapter II, but for immediate purposes, Ringel (1983) described the architectural technologist as being responsible for the following general duties:

1. Plans and designs residential structures; note that residential construction represents between 40 and 50 percent of total construction expenditures (Figure 1).

2. In conjunction with registered architects and engineers, articulates and plans the structural features of commercial, multi-family, and industrial structures.

3. Makes sketches, technical drawings, models, and illustrations

of plans and details.

4. Makes routine engineering computations of the strength of materials, beams and trusses.

5. Calculates material quantity and cost estimates.

6. Calculates excavation cuts and fills.

7. Inspects job sites to insure that the details and specifications called for in the working drawings are carried out.

Educational Requirements

At present there are no established educational standards or professional licenses required for employment as an architectural technologist. However, in response to the expansion of occupational duties performed by practitioners, various professional organizations have expressed the need for architectural technologists and designers to meet uniform standards of competency. Those same organizations have suggested that the most feasible method of demonstrating the required level of competency is through the administration of a standardized regional examination, similar to that required of other engineering technicians and technologists.

Statement of the Problem

Due to the "new and emerging" nature of architectural technology, certain areas of concern have arisen regarding present and future job performance expectations. Those areas of concern are: (1) a concise delineation of the duties performed by practitioners has yet to be established, (2) there is a lack of consensus among educators and practitioners in the field as to the relative degree of importance associated with specific duties performed; and (3) due to a lack of data regarding questions one and two, projections concerning trends and changes in future occupational responsibilities have not been possible.

Purpose of the Study

Based upon the perceptions of selected educators, practitioners and administrators the purpose of this study was to determine: (1) what occupational duties are performed and will be performed in the near future by the architectural technologist, (2) the relative degree of importance of these duties, and (3) what changes will occur during the next five years regarding the importance of those duties identified.

Research Questions

In order to accomplish the purpose of this study, the following research questions were formulated:

1. Within the occupational field of environmental design, what duties are presently performed by architectural technologists and what duties will be required in five years?

2. What is the mean level of importance of those duties identified as perceived by architectural technology educators, established practitioners, and administrators of comprehensive environmental design firms?

3. What statistically significant changes will occur within the next five years regarding the degree of perceived importance of those duties performed by the architectural technologist?

Assumptions

The research made the following assumptions:

1. The subjects who participated in the study were knowledgeable about their respective professional fields of expertise and responded to the instrument questions honestly and to the best of their ability.

2. That sources from which the sample population was drawn was representative of environmental design educators, practitioners and administrators at large within the "Four-State" region.

Scope and Limitations of the Study

The scope and limitations of the study were as follows:

1. Architectural technology educators from the Four-State Industrial Technology Conference Region (Arkansas, Kansas, Missouri, and Oklahoma) who currently teach at four-year colleges and universities.

2. Administrative heads of comprehensive environmental design firms (those offering services in architecture, construction, engineering, and planning) who (a) have corporate offices in one or more of the States of Arkansas, Kansas, Missouri, and Oklahoma and (b) were members of the American Institute of Architects.

3. Practicing architectural technologists who (a) owned their own architectural design firms, (b) were located in the State of Arkansas, Kansas, Missouri, or Oklahoma and (c) maintained a current listing in the business directory of the telephone book.

4. The scope of the study was also limited to a concept analysis of architectural technology (see page 21 for a detailed description of concept analysis).

Definitions

Architectural Designer*: An architectural technologist working primarily in the area of residential and light commercial building design and who possesses the equivalent of a baccalaureate degree.

Duty: A major division of work with unique and distinctive characteristics (Kenneke, Nystrom, Stadt, 1973).

Competency: A specific job skill that an employer expects an employee to possess in order to obtain and maintain continued employment (Perry, 1982).

Comprehensive Environmental Design Firm*: Those business organizations offering a wide range of environmental design services--architecture, construction, engineering, planning, et cetera.

Perception*: A general state of awareness concerning needs, values, properties, et cetera within one's particular field of expertise.

Practitioner: One that practices a profession (Webster's Dictionary, 1974).

Registered Architect: A building design professional who has achieved a combination of eight years or more of university training and supervised internship and who has successfully completed a national competency examination (State of Oklahoma, 1987).

Task: A logical and necessary step in the performance of a duty (Butler, 1972).

Technician*: A person who has acquired a specialized skill normally through the completion of a two-year post secondary program at a technical institute, community college or vo-tech.

<u>Technologist</u>*: A person who has acquired a specialized skill through the completion of a four-year bachelor degree program at a college or university.

*Definitions not otherwise notated are those of the researcher.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The purpose of the review of literature is to examine pertinent articles and research that relate to the problem statement and objectives of the study. Accordingly, the review is divided into four separate areas of concentration: (1) Developmental Foundations, (2) Contemporary Trends in Technology Education, (3) The Process of Work Systems Analysis, and (4) Applied Analysis in Architectural Technology.

Developmental Foundations

In Chapter I, it was stated that architectural technology was a new and emerging field in which the occupational role of the practitioner was expanding in response to certain driving forces which included technological advancements and socio-economic needs. Before the significance of this statement can be fully understood and placed in proper perspective, it is important to examine the historical developments which have formed the basis for architectural technology's contemporary status which has foundational roots in two congruent educational and occupational disciplines: technology education and architecture.

Historical Developments in Technology Education

The technological demands imposed by the Industrial Revolution in the United States resulted in the establishment of a series of "mechanics institutes" during the 1820's which were located in the larger cities of the Northeastern United States. The fundamental purpose of these early institutes was to teach the trade skills which were needed by the newly emerging class of craftsmen and artesians (Henninger, 1959).

In response to the need to employ persons with developmental and research skills, the University of Vermont, in 1829, became the first school to offer courses in civil engineering and in 1835 the Rensselaer Polytechnic Institute was founded, offering curricula in science and engineering.

The establishment of both the mechanics institutes and programs in engineering was significant in that they were the first educational programs in the United States which were not oriented solely toward traditional liberal arts education (Henninger, 1959).

As various industries expanded and resulted in the birth of other industries, technology became a way of life and the need for tradesmen and engineers increased proportionally. As a result, the Land-Grant Act of 1862 was passed and provisions were made for the establishment of at least one publicly financed college in each state. These Land-Grant colleges were aimed at providing not only programs of study in liberal arts, but agriculture and the mechanical arts as well.

These educational programs, however, failed to provide the number of professional engineers and architects needed to adequately supervise the wide range of duties which were required within the continuum of product conception, development, and actual manufacture or construction. What was needed was the development of an occupational classification composed of mid-level, applied science specialists who could assume many of the more routine duties and tasks which were performed by the engineer or architect. The engineer would then be free to concentrate on more theoretical duties which were more theoretical in nature.

The vehicle through which these specialists were to receive their formal training was envisioned by Frederick Pratt who introduced the concept of the Technical Institute in 1895. Pratt's brainchild was patterned after the "Technikum" in Germany which emphasized an integrated and sequential curriculum of courses in mathematics, technology, and related shop and laboratory work. The elements that distinguished the technical institute from the vocational trade schools was the depth, scope and general nature of the training (Henninger, 1959). The basic concept of the technical institute has changed little in the last 90 years.

Movements in Architectural Education

Much has been written and otherwise documented about the history of architecture, but relatively little is known about the development of the profession itself. In order to gain an insight into this facet of the occupation, it is necessary to examine educational movements which, it is assumed, would have closely paralleled the metamorphic changes which were taking place in the profession of architecture.

By way of comparison to educational movements which were taking place in technology education, the late 1800's was also a period of change for architectural education. Many design professionals were questionning the more traditional school's curricular methodology and general ability to adequately prepare architectural students for the future needs of a growing construction industry.

One of the chief advocates of educational change was the architect-educator, Walter Gropious, who created the Beaux-Arts Society in 1894. Prior to the inception of the Beaux-Arts Society, architectural students were taught building design through the graphic reproduction of castings of ancient architectural structures with little thought or emphasis being placed on self-directed problem solving skills (Bowser, 1983).

Gropius and other contemporaries in architecture felt that this methodology failed to emphasize the importance of functional design and, through the Beaux-Arts Society, chose to actively involve the student in the creative exploration of the design process from the beginning stages of the educational program. The curriculum was designed so as to progress the student in short well-defined stages; first introducing the student to basic design concepts and then progressing to problems requiring the complex synthesis of multiple design variables (Bowser 1983).

Gropius felt that students truly understood only what they were able to discover for themselves. Using the Socratic method, Gropius would pose a series of purposeful questions which were intended to nurture the student's ability to engage in self-directed inquiry (Bowser, 1983).

Contemporary Trends in Technology Education

According to Hull and Pedrotti (1986), technology education in the United States has gone through two major revolutionary periods in the last thirty years. The first period occurred from 1958 to 1963, following the U.S.S.R.'s launch of Sputnik and resulted in major shifts in budgetary appropriations, research, and manpower training to the aerospace and related industries.

Then, around 1978 the second technological revolution started with the energy crisis and gained considerable momentum when our heavy manufacturing industries began losing export trade to the Japanese. Our response was to retool our industries and concentrate in areas in which we held a technological edge--computers, telecommunications and lasers.

This second period also marked our entrance into the "information age" (Toffle, 1980) in which computer power began to replace manpower and was predicted to lessen our dependence on natural resources.

Both periods of technological revolution resulted in immense pressure being placed on U.S. engineering schools to upgrade analytical techniques and theory. The counter effect was a de-emphasis on the practical application of technical principles (Hull, Pedrotti, 1986).

The occupational transition that professional architects and engineers have undergone during the past 20 years and the resulting impact upon technology education was best described in a quote from Harold A. Foecke of the Engineers Council for Professional Development (ECPD, 1976):

> From the point of view of 'educational dynamics', if it is fair to say that the center of gravity of programs of formal education for entrance into the engineering profession is

> shifting to the post-baccalaureate level--to graduate level professional schools of engineering--then this would seem to leave at the undergraduate level a sort of educational vacuum into which something is very likely to move. If undergraduate programs in engineering become largely professional and preparatory for more advanced study, then there would seem to be a real need for an undergraduate program in technology which would be much more terminal in nature (p. 34).

The ECPD further documented this trend when reporting that during the decade of the 1970's the number of master's degrees in engineering more than doubled over the previous ten-year period and that the number of doctor's degrees in engineering tripled.

The challenge for technical education has been to create programs that will produce technicians and technologists who will be able to competently fill the void created within the fields of architecture and engineering AND who are technologically flexible in order to remain viable within a constantly changing work environment.

Two-Year Programs in Technology Education

The majority of technical class workers have been graduates of either military tech schools or two-year associate degree programs at technical institutes and community colleges. This trend is expected to continue at least through the next two decades (Hull, Pedrotte, 1986).

These "technician" level programs have sharply increased in number since 1958, which is due largely to federal funds provided through Title VIII of the National Defense Education Act (Foecke, 1976). However, it is difficult to estimate the exact number of these programs since the majority of them are not accredited by the ECPD, or otherwise affiliated with a similar professional organization.

In 1976, the ECPD conducted a curriculum study of the degree requirements for associate and bachelor degree programs in Engineering Technology. Table I summarizes the areas of study for both degree levels and itemizes the average number of hours required in each area. This data provides a direct comparison between the two degree levels in terms of curricular scope and depth.

Four-Year Programs in Technology Education

In 1976, 87 institutions were identified as offering baccalaureate programs in Engineering Technology with a total of 189 different major options (Defore, 1976). These major options can generally be categorized into one of ten major concentrations: (1) aeronautical, (2) automotive, (3) architectural, (4) civil, (5) drafting, (6) electrical/electronic, (7) graphic arts, (8) mechanical, (9) production, and (10) industrial technology.

According to Foecke (1976), these ten technology programs fall roughly into two groups in terms of origination: (1) those which evolved from industrial technology programs and (2) a much smaller group which was more closely related to schools of architecture and engineering and were often called Engineering Technology or Environmental Design programs.

In either case the four-year programs are largely terminal in nature and are designed to prepare the graduate for immediate employment in one of the fields of technology. Table II provides a summary of mean credit hour requirements and a subsequent comparison base between baccalaureate engineering technology curricula and four-year curricula in engineering.

TABLE I

MEAN DEGREE REQUIREMENTS FOR PROGRAMS IN ENGINEERING TECHNOLOGY

	Mean Degree Requirements*			
	Baccalaureate Programs		Associate Degree Programs	
Curricular Area	Sem. Hrs.	Percentage	Sem. Hrs.	Percentage
Technical Specialty Subjects	34	26	22	32
Related Technical Study	20	15	12	18
Engineering Science	3	2	4	6
Mathematics	9	7	8	12
Physical Science	13	10	8	12
Communications	9	7	6	9
Humanities-Social Studies	21	16	5	7
Other	18	14	4	6
Total Technical Study	57	44	38	56
TOTAL	130		68	

*Percentage entries are rounded to the nearest integer; sums, therefore, may not total 100 percent.

Source: Engineering Council for Professional Development, 1976.

TABLE II

MEAN SEMESTER CREDIT HOUR REQUIREMENTS FOR PROGRAMS IN ENGINEERING AND ENGINEERING TECHNOLOGY

Curricular Area	Mean Semester Hours Credit Requirements	
	Four-Year Engineering	Engineering Technology
Technical Specialty Subjects	32	34
Related Technical Study	14	20
Engineering Science	23	3
Mathematics	17	9
Physical Science	18	13
Communications	7	9
Humanities-Social Studies	18	21
Other	10	18
Total Technical Study	69	57
TOTAL	141	130

Source: Engineering Council for Professional Development, 1976.

The Process of Work Systems Analysis

With the preceeding foundational elements in mind, it is important that we next consider the process of work systems analysis and its relationship to the occupational field of architectural technology. According to Kenneke, Nystrom and Stadt (1973), the process of work systems analysis can be divided into five levels of assessment, each of which delimits and organizes information, systematically moving from general to specific concepts and data. The five levels, in order of their progression are depicted in Figure 2.

Occupational Analysis

Occupational analysis is the first step in the work systems analysis process and is intended to gather, synthesize and classify information on occupations and related employment situations. Occupational analysis first identifies a broad occupational category and then subdivides the category into subcomponents or clusters according to a number of alternate schemes: occupational families, technological foundations, applied disciplines, et cetera. Occupational analysis then sets the stage for subsequent levels of analysis (Kenneke, Nystrom and Stadt, 1973).

Content Analysis

Content analysis and concept analysis are both secondary levels of analysis that are performed after the occupational analysis is executed.

Content analysis examines, in some detail, the occupational clusters developed during occupational analysis and further seeks to

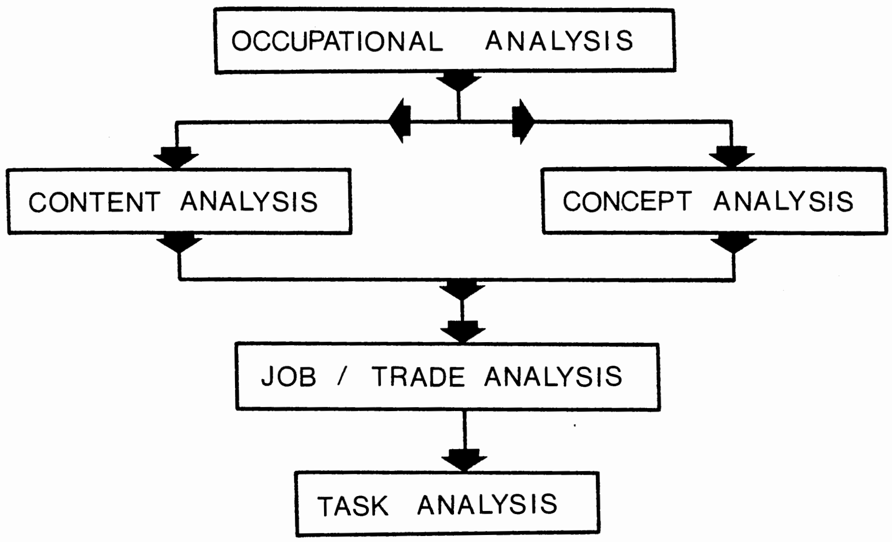

Figure 2. Work Systems Analysis Model

identify the unique blocks of duties within each work cluster. The underlying purpose of content analysis is to develop a rational structure for a particular career program as based upon the human and technological aspects of work (Butler, 1972).

Concept Analysis

Concept analysis is an alternate method of categorizing work, with primary application in the areas of awareness, feelings and attitudes (Kenneke, Nystrom and Stadt, 1973). Concept analysis is based on the idea that certain affective aspects of man's being are significant when integrated with career development and may serve to describe the many facets of a productive society (Kenneke, Nystrom and Stadt, 1973).

Job/Trade Analysis

Job/trade analysis requires an in-depth review of a specific job or trade with the intent to (1) identify exact on-the-job performance conditions and (2) provide the framework for the preparation of job descriptions (Kenneke, Nystrom and Stadt, 1973). The center for Vocational Education (1978) states that job/trade analysis enables planners to look at the critical components of a given job in terms of significant operations, processes and the equipment and tools used. These critical components provide the answer to three questions which are fundamental to job/trade analysis: (1) What gets done? (2) How does it get done? and (3) Why does it get done?

Task Analysis

Task analysis is the lowest level of work systems analysis and is the process whereby the tasks required to accomplish the duties are specified and subsequent performance steps which are required within each task are delineated (Kenneke, Nystrom and Stadt, 1973).

Applied Analysis in Architectural Technology

Considering the stated purposes and objectives of this study and in conjunction with the work analysis concepts presented by Kenneke, Nystrom and Stadt, it is essential that (1) the scope of the analysis performed within this study be stated and clearly understood, and (2) the review of literature provide a data base from which further study can be accomplished.

Scope of the Analysis

As indicated in Chapter I "Limitations of the Study", this research was restricted to occupational and content levels of analysis. The rationale and presentation of related data is as follows:

Applied Occupational Analysis. As suggested by various experts in the field of occupational education, occupational analysis is the first step in the delineation of work and serves as the logical foundation for subsequent analysis. With regards to architectural technology, the *Dictionary of Occupational Titles* and the *Encyclopedia of Careers and Vocational Guidance* state that architectural technology falls under the occupational category of Engineering Technology.

The Engineers Council for Professional Development provide the second layer of classification in their research which depicts ten sub-categories or clusters of occupational families that comprise the field of Engineering Technology: aeronautical, automotive, architectural, civil, drafting, electrical/electronic, graphic arts, mechanical, production, and industrial.

The third and final layer of occupational analysis is concerned with the general occupations in which architectural technologists are commonly employed. Research relevant to this issue was again found in the Dictionary of Occupational Titles, the Encyclopedia of Careers and Vocational Guidance and additional research by Ringel (1983), Van Derslice (1986), and Yohannan (1978). The general consensus of these sources was that architectural technologists are typically employed in the following classifications within the environmental design industry: (1) architects assistant, (2) architectural designer, (3) architectural draftsman, (4) architectural illustrator, (5) building code inspector, (6) building materials sales representative, (7) chief design draftsman, (8) estimator, (9) field inspector, and (10) structural draftsman, designer, and draftsman and checker (See Figure 3).

Applied Content Analysis. Upon completion of level three of the occupational analysis model, it was possible to perform a content analysis of the occupational clusters identified. During the process of content analysis, the general blocks of duties required by each of the clusters were systematically delineated.

A synthesis of the research data provided by the various source documents and research articles previously listed in this report have also provided a description of the general responsibilities which are required in each of the ten architectural technology occupational areas. The responsibilities are as follows:

1. Architects Assistant - Assists the architect, engineer, or planner in assembling specifications, performing routine calculations,

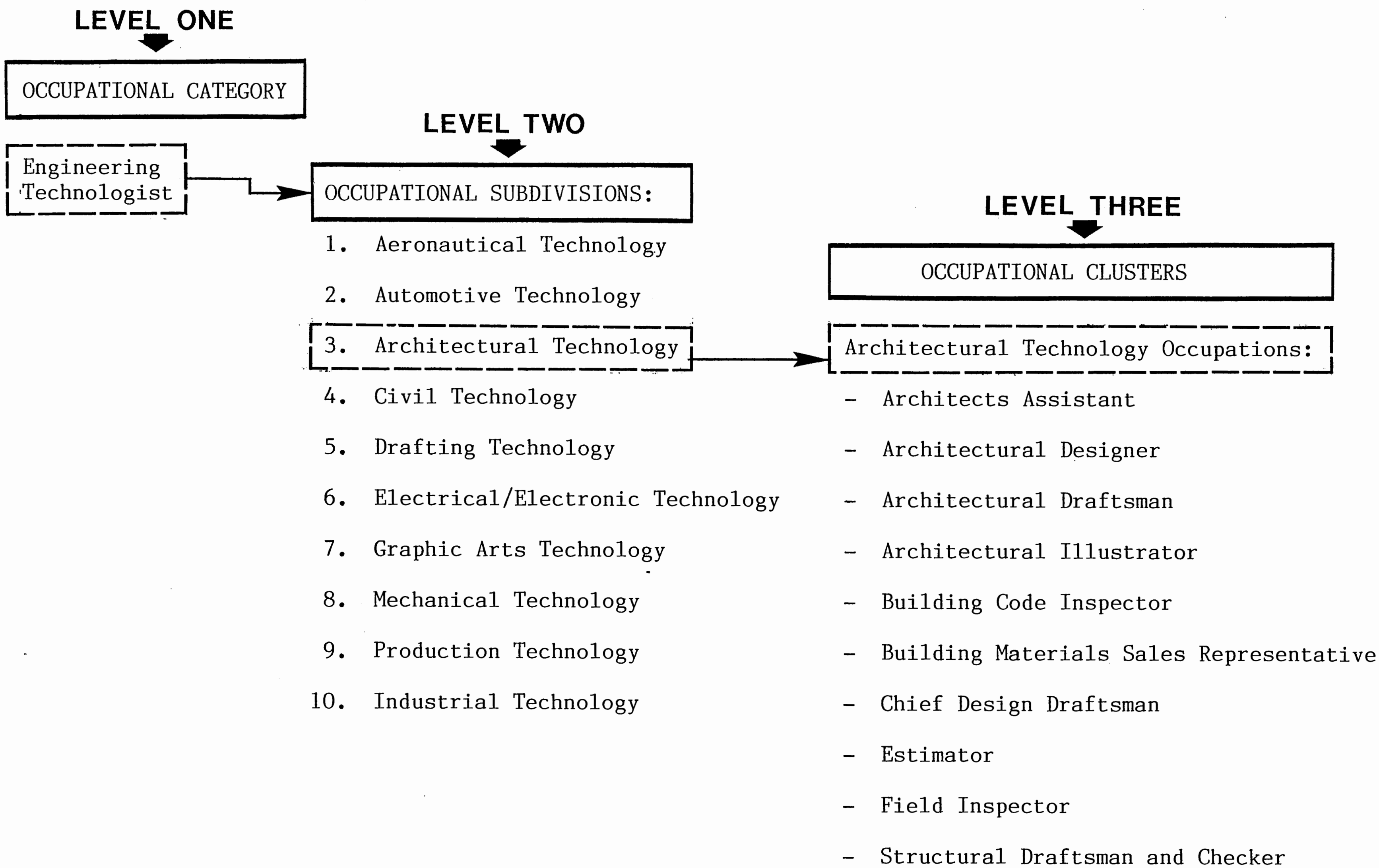

Figure 3. Occupational Analysis Model

and completing working drawings.

2. Architectural Designer - Plans and designs residential and light commercial buildings, planning of space arrangements in offices and factories and completes working and presentation drawings of same.

3. Architectural Illustrator - Renders perspective drawings of building interiors and exteriors using pencil, pen, watercolor, or airbrush.

4. Architectural Draftsman - Makes freehand and mechanical drawings of all classes of buildings; makes routine engineering computations of the strength of material.

5. Building Code Inspector - Inspects buildings, proposed sites, property line placements and construction progress to ensure compliance with county or municipal building and safety codes.

6. Building Materials Sales Representative - Calls on architects and engineers, explaining the use of new building materials and products.

7. Chief Design Draftsman - Supervises the work of architectural or structural draftsmen; continues to perform some drafting and design work on more important projects.

8. Estimator - Makes materials take-offs and subsequent quantity and cost estimates.

9. Field Inspector - Checks construction work at various stages to ensure compliance with specifications called for in the plans, approved practices, and general quality control.

10. Structural Draftsman and Checker - Same duties as an architectural draftsman, but specializes in concrete and steel construction; checks plans for required dimensioning, section views,

construction; checks plans for required dimensioning, section views, equipment lines, et cetera.

Summary

According to The Center for Vocational Education (1978), work systems analysis offers the following distinctive opportunities:

1. Workers know the specific duties and tasks for which they are held accountable.

2. It serves as the basis for organizing a job in the most efficient and effective manner possible.

3. It provides a logical basis for the evaluation of individual workers and the possible effectiveness of training programs.

4. Once specific worker skills are identified, a sound foundation exists for developing or updating educational programs that will produce competent and viable employees.

Work systems analysis thus provides the vehicle through which planners are able to clearly define the worker's role and related responsibilities. However, regarding the occupational field of architectural technology, this has been a difficult task due to expansions in work performance expectations and rapid rates of technological change.

The review of literature has provided both a historical perspective and a contemporary information source sufficient to complete an occupational analysis of the field of architectural technology and to initiate a content analysis of duties performed.

The items listed on the research questionnaire represent a refinement of these duties as outlined earlier in this study. The data generated by this study will conclude the content analysis process and will serve as the basis for subsequent studies concerning job/trade analysis and task analysis in the field of architectural technology.

CHAPTER III

METHODOLOGY

Introduction

In review, the purpose of this study was to determine: (1) the relative ranked importance of the duties performed by architectural technologists both at the present time and in five years and (2) changes in the degree of perceived importance for each of these duties during the next five years.

Considering the nature and scope of these research objectives, it was deemed that descriptive research methods would provide the most feasible means of accomplishing the purposes of the study. Borg (1963) stated that descriptive research techniques are useful where the existing body of knowledge is relatively small and the researcher needs to establish the current state of conditions within a new field of study.

Key (1985) also indicated that occupational analysis inventories are classified as descriptive research and are particularly appropriate when determining occupational needs, trends, and curriculum dictates. The Center for Vocational Education (1978) carries this idea a step further by stating that occupational analysis has long been used by vocational-technical educators to identify the current skills and knowledge which are required by a particular occupational field.

Based upon these foundations it was decided to collect the required data through the administration of a closed occupational analysis questionnaire which was mailed to an equal number of architectural technology educators, practitioners, and environmental design administrators. The instrument contained a listing of the occupational duties which were identified as being performed by architectural technologists. The list of duties was developed from the review of literature and subsequently refined and regionalized by a a four-member advisory committee.

Respondents were asked to rate the degree of importance of each of these duties as performed today and as expected to be performed in five years.

Description of the Sample

Sample selection criteria and methodology is important because, according to Borg (1963), if the sample is representative of the population at large, then conclusions drawn from the sample data can be generalized to the population. When defining the parameters of the population, an important step is to define the specific geographic region from which to draw the sample.

Geographic Distribution

The sample was drawn from individuals who either taught or had professional practices located within the "Four State Industrial Technology Conference" region. The region includes the States of Arkansas, Kansas, Missouri, and Oklahoma. The rationale for selecting the four-state area was that (1) it provided the opportunity to collect data from a regionalized body of educators which would have knowledge relevant to the study and (2) results of the study could be generalized to a relatively large geographic area.

Sample Selection and Description

Considering the diverse and multi-geographical nature of architectural technology, it was decided that a stratified random sample composed of (a) architectural technology educators, (b) established practitioners, and (c) administrators of comprehensive environmental design firms would be the most appropriate means of obtaining data representative of the industry as a whole.

Sample Size - Regarding stratified random samples, Isaac and Michael (1975) stated that, ". . . and it is important to insure that each category is proportionally represented in the sample, the population is subdivided into the appropriate strata and a predetermined quota of cases is drawn at random from each substream" (p. 61). Accordingly, the sample was divided equally in number among the three strata of the population--educators, practitioners and administrators.

The smallest of the three strata was found to be the group of educators which totaled 44 in number. Since this group was the smallest, it served as the numerical base for the other two groups. Consequently, the sample was composed of 44 subjects from each of the three strata, resulting in a total sample of 132 subjects.

Description of Educators Sampled - This strata of the sample was drawn from the membership roles of the Four-State Industrial Technology Conference and included those four-year college/university educators who currently teach courses in architectural technology. All 44 of

TABLE III

POPULATION, SAMPLE AND QUESTIONNAIRE RESPONSE DATA

	Sample Distribution			
Type of Data	Architectural Technology Educators	Practitioners	Administrators of Environmental Design Firms	Total
Population Size	44	435	228	707
Sample Size	44	44	44	132
Sample as a % of the Population	100	10.11	19.29	18.67
Number Responding	26	25	31	82
Response as a % of the Sample	59.09	56.81	70.45	62.12

those educators so identified were included in the sample.

Description of Practitioners Sampled - The practitioners included those architectural technologists who currently own their own business and were randomly selected from the business section of the telephone directory of those cities within the four-state region with a population of 20,000 or more.

Description of Administrators Sampled - The strata included the administrative heads of comprehensive environmental design firms (engineering, architecture, construction) and were randomly selected from the membership roles of the American Institute of Architects.

Description of the Instrument

Instrumentation was achieved through the use of a 28 item closed questionnaire. The 28 items represented the range of duties which are presently performed by architectural technologists as well as those duties which are expected to be important in the near future. Two additional spaces were provided at the end of the questionnaire to enable respondents to write in additional duties which were deemed to be important.

Subjects responded to the items by circling the appropriate number on a zero to 10 bipolar semantic differential scale. Zero indicated a "not important" response and 10 indicated that the item was considered to be "essential".

Two scales were used in conjunction with each item. The first scale reflected the item's perceived degree of performance as performed today and the second scale was a reflection of the item's anticipated degree of importance in five years.

The nature of the semantic differential readily lends itself to quantitative evaluation (Rankin, 1983) and regarding the validity and reliability of the scale. Ary, Jacobs and Razavieh (1972, p. 190) stated that:

> Reports on the validity and reliability of the semantic differential scales are generally satisfactory. The validity studies show correlation coefficients of approximately .80 between the semantic differential ratings and Thurston, Likert, and Guttman scales. The test-retest reliability of the semantic differential is reported to be about .90, a result which is satisfactory.

It was recognized that certain limitations are inherent with the mailed questionnaire, however, after considering the advantages in relation to the specific nature and scope of this study, this method of data collection was deemed to be the most appropriate. In order to minimize the limitations imposed by the mailed questionnaire, the following measures were taken:

1. The instrument was extensively pretested with the advisory committee in order to insure that the language of the questionnaire would be concise and easily understood by all subjects responding.

2. Special effort was made to simplify the directions, method of response and the overall design of the instrument.

3. The questionnaire was professionally typeset in order to improve the graphic quality and readability of the instrument (key words were set in bold face type, et cetera).

Composition of the Advisory Committee

The advisory committee which assisted in the development and refinement of the duties listed on the instrument and the subsequent pretesting of the questionnaire was composed of four established members of the environmental design profession (See Appendix E).

Data Collection

The data used in this study were collected by mailing identical questionnaires and cover letters to selected participants (See Appendix D). The instruments were mailed on the same day (July 15, 1987) and included a self-addressed stamped return envelope. A total of 54 subjects (65 percent) responded to the first mailing.

On July 26, 1987 a follow-up letter was mailed with another questionnaire and return envelope. Twenty-eight subjects (35 percent responded to the second mailing which totaled 82 subjects (62 percent of the total sample of 132 subjects).

According to Ary, Jacobs and Razavieh (1979, p. 175), "the goal in a mailed questionnaire is to achieve a 70-80 percent return rate, however, typically one can expect a return rate of less than 50 percent." The 62 percent return rate accomplished in this study was considered to be adequate, though a higher rate of return would have been desirable.

Statistical Procedures

The review of literature, frequencies, percentages and group means were utilized to determine the following research questions:

1. Within the occupational field of environmental design, what duties are presently performed by architectural technologists and what duties will be required in five years?

2. What is the mean level of importance of those duties identified as perceived by architectural technology educators,

established practitioners, and administrators of comprehensive environmental design firms?

3. What statistically significant changes will occur within the next five years regarding the degree of perceived importance of those duties performed by the architectural technologist.

The specific duties enumerated by the research questions are:

1. communicating with clients
2. communicating with various professionals and tradesmen
3. calculating material and quantity cost estimates
4. calculating foundation requirements
5. calculating earth volume cuts/fills
6. calculating the size of required framing members
7. reproducing Diazo prints
8. reproducing plans electronically
9. inspecting the construction site
10. making microfilm copies
11. preparing material/equipment schedules
12. interpreting building codes
13. supervising drafting personnel
14. making preliminary sketches
15. making presentation drawings
16. constructing working drawings using traditional drafting skills
17. constructing working drawngs using computer aided drafting (CAD)
18. constructing architectural models
19. designing residential structures

20. designing light commercial buildings

21. space planning of commercial interiors

22. designing earth sheltered dwellings

23. designing solar building systems

24. designing plumbing layouts

25. designing electrical layouts

26. designing air distribution systems (HVAC)

27. Conducting site plan analysis

28. planning for remodeling projects

Popham (1967) stated that the t-Test is used to determine how large a difference between the means of two samples is necessary in order to be considered significant. The t-Test for nonindependent samples is a form of the t-Test which specifically allows the research to compare the means obtained by the same group when comparing differences between paired scores.

The instruments were all hand-scored, but the test statistics for the t-Test for nonindependent samples were calculated by computer. The t-Test statistics were tested for significance at the .05 level which is one of the most commonly used levels of significance used in educational research (Ary, Jacobs and Razavieh, 1979).

The raw data obtained from the returned questionnaires were recorded in tabular form for ease of handling and are included in Appendix A for informational purposes.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

The purpose of this chapter is to present and analyze data collected for this study. Sampling was achieved through the utilization of a mailed questionnaire which was administered to 132 subjects from the field of architectural technology which included 44 educators, 44 practitioners and 44 administrators. The instrument was designed to specifically address three related research questions, each of which related to the degree of perceived importance associated with the occupational duties which are (a) performed today and (b) are expected to be required in five years by the architectural technologist.

Research Question One

Within the occupational field of environmental design, what duties are presently performed by architectural technologists and what duties will be required in five years?

The implications of this question are vital to the process of work systems analysis and curriculum development and further provides the foundational data base necessary to investigate research questions two and three.

Question one is subdivided into two related components: (1) what duties are presently performed and (2) what duties will be required in five years. The specific duties are listed on pages 35 and 36 were established from the review of literature and subsequent refinement by the advisory committee.

Research Question Two

> What is the mean level of importance of those duties identified perceived by architectural technology educators, established practitioners, and administrators of comprehensive environmental design firms?

The statistical methodology used to answer question two involved the utilization of rating values for each duty, both as performed today and as expected to be performed in five years. The rating values were quantitatively achieved by calculating the grand mean (combined mean from educators, practitioners, and administrators) of the rated degree of perceived importance.

Table IV summarizes the ranking segment of the data input by listing each of the 28 duties in their order of perceived importance ("most important" to "least important") and also indicates individual grand mean values (See Appendix A, Tables X through XV for response frequency and percentage distributions.

In keeping with the objectives of the study, the presentation and analysis of the data focused upon the calculation of grand mean values from the three combined segments of the sample strata - educators, practitioners, and administrators. For the sake of comparison and possible future study, however, it is important to consider deviations

TABLE IV

MEAN RANKING OF DUTIES AS PERFORMED TODAY

RANKING	ITEM	As Performed Today N	SD	M
1.	2. Communicating With Various Professionals and Tradesmen	82	1.87	8.95
2.	16. Constructing Working Drawings Using Traditional Drafting Techniques	82	1.92	8.87
3.	1. Communicating With Clients	82	2.61	8.35
4.	12. Interpreting Building Codes	82	2.46	7.88
5.	15. Making Presentation Drawings	82	2.21	7.37
6.	14. Making Preliminary Sketches	82	2.23	7.35
7.	19. Designing Residential Structures	82	2.95	6.73
8.	3. Calculating Material Quantity & Cost Estimates	82	2.40	6.59
9.	9. Inspecting the Construction Site	82	2.83	6.54
10.	28. Planning for Remodeling Projects	82	2.31	6.50
11.	20. Designing Light Commercial Buildings	82	2.82	6.34
12.	21. Space Planning of Commercial Interiors	82	2.63	6.28
13.	17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	82	2.23	6.27
14.	27. Conducting Site Plan Analysis	82	2.80	6.04
15.	13. Supervising Drafting Personnel	82	2.55	5.99
16.	6. Calculating the Size of Required Framing Members	82	2.71	5.71
17.	11. Preparing Material/Equipment Schedules	82	2.65	5.41
18.	18. Constructing Architectural Models	82	2.33	5.12
19.	25. Designing Electrical Layouts	82	2.74	5.11
20.	26. Designing Air Distribution Systems (HVAC)	82	2.61	4.95
21.	24. Designing Plumbing Layouts	82	2.72	4.82
22.	4. Calculating Foundation Requirements	82	2.84	4.82
23.	8. Reproducing Plans Electronically	82	2.76	4.59
24.	7. Reproducing Diazo Prints	82	2.95	4.49
25.	5. Calculating Earth Volume Cuts/Fills	82	2.74	4.06
26.	23. Designing Solar Building Systems	82	2.17	3.84
27.	22. Designing Earth Sheltered Dwellings	82	2.30	3.78
28.	10. Making Microfilm Copies	82	2.47	2.26

N = Number of subjects responding
SD = Standard Deviation
M = Grand mean of all three groups of the sample (Educators, Practitioners and Administrators)

from the grand mean by each of the three strata. Accordingly, Table V lists the mean rating values for each duty as reported by educators, practitioners and administrators. For ease of translation, Figure 4 graphically translates this data into a profile comparison of mean responses.

Table VI presents a summary of the findings which relate to the mean level of importance of the duties identified as expected to be performed in five years. These data were also based upon the calculation of the grand mean of the responses from all three strata of the population. Table VII provides a breakdown of responses according to sample distribution and Figure 5 depicts a graphical analysis of the same data.

Research question two is a logical extension of question one and adds appreciable to the statistical dimensions of the study by providing:

1. A logical and quantifiable basis from which to determine both the mean importance of individual duties and subsequent ranking of each duty within the overall range occupational duties which are performed today as well as in five years.

2. A rational foundation for educators, curriculum specialists, and industry trainers to base curriculum planning efforts.

3. The statistical data required for further analysis would determine if changes in the importance of duties performed during the next five years are statistically significant.

4. A graphical comparison of response data among the three segments of the sample strata.

TABLE V

MEAN DEGREE OF IMPORTANCE OF DUTIES AS PERFORMED TODAY ACCORDING TO SAMPLE STRATA

ITEM	Mean Importance Today		
	Educators	Practitioners	Administrators
1. Communicating With Clients	7.84	8.80	8.54
2. Communicating With Various Professionals and Tradesmen	8.84	8.64	9.38
3. Calculating Material Quantity & Cost Estimates	5.90	6.12	7.85
4. Calculating Foundation Requirements	3.65	4.28	6.73
5. Calculating Earth Volume Cuts/Fills	3.55	2.92	5.77
6. Calculating the Size of Required Framing Members	4.00	6.20	7.27
7. Reproducing Diazo Prints	3.68	3.60	6.31
8. Reproducing Plans Electronically	3.65	3.92	6.35
9. Inspecting the Construction Site	6.16	6.48	7.04
10. Making Microfilm Copies	1.29	1.64	4.00
11. Preparing Material/Equipment Schedules	4.87	4.80	6.65
12. Interpreting Building Codes	7.06	8.36	8.38
13. Supervising Drafting Personnel	5.65	5.84	6.54
14. Making Preliminary Sketches	6.90	8.20	7.08
15. Making Presentation Drawings	6.90	7.80	7.50
16. Constructing Working Drawings Using Traditional Drafting Techniques	8.61	9.56	8.50
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	6.45	5.32	6.96
18. Constructing Architectural Models	5.55	3.52	6.15
19. Designing Residential Structures	5.55	7.20	7.69
20. Designing Light Commercial Buildings	5.61	6.00	7.54
21. Space Planning of Commercial Interiors	5.68	5.92	7.35
22. Designing Earth Sheltered Dwellings	2.81	3.76	4.96
23. Designing Solar Building Systems	2.81	3.88	5.04
24. Designing Plumbing Layouts	3.13	4.36	7.27
25. Designing Electrical Layouts	3.48	4.96	7.19
26. Designing Air Distribution Systems (HVAC)	3.35	4.88	6.92
27. Conducting Site Plan Analysis	5.77	5.32	7.04
28. Planning for Remodeling Projects	6.23	5.92	7.38

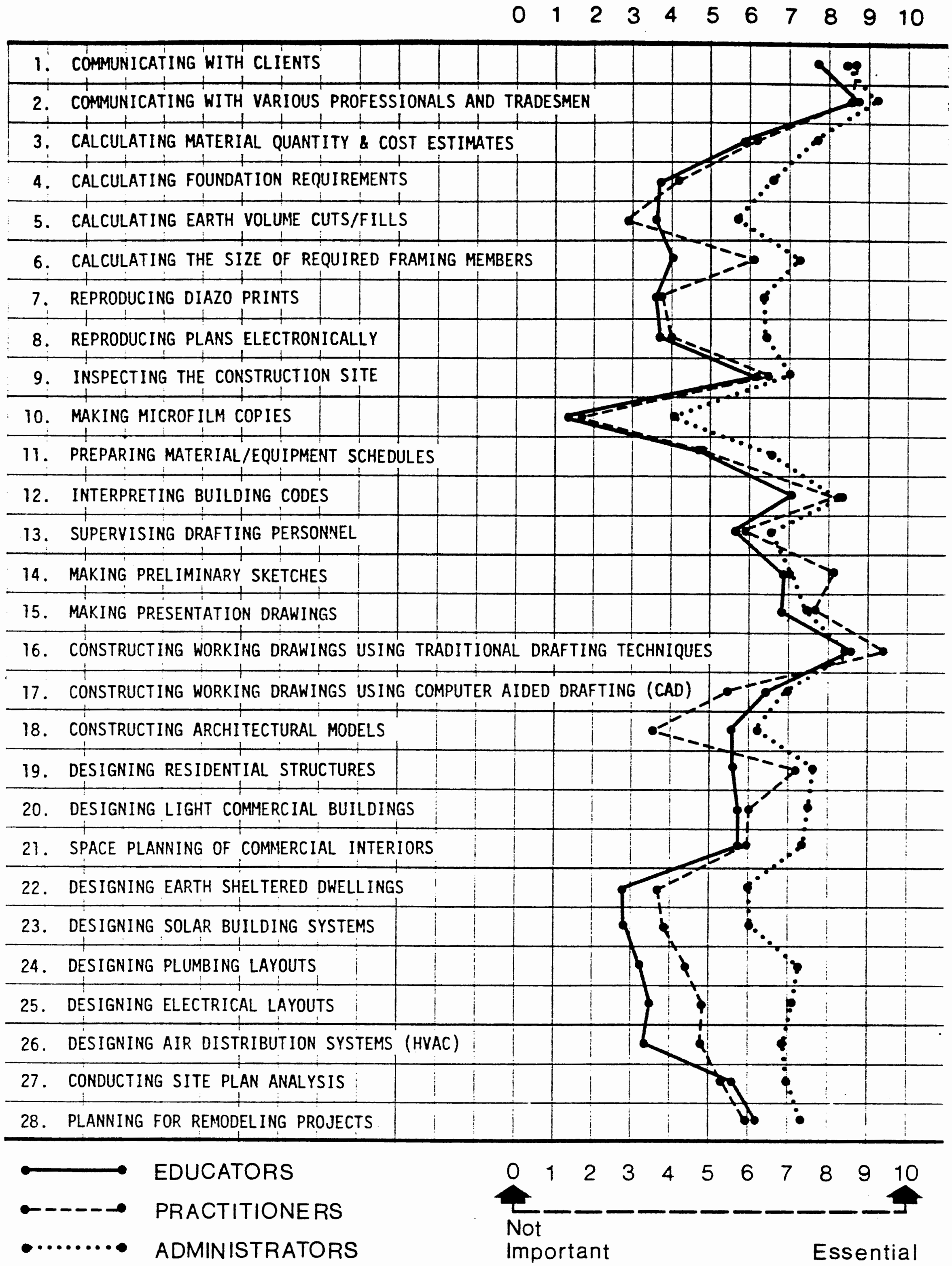

Figure 4. Graph of Response Deviations According to Sample Strata Concerning Those Duties Performed Today

TABLE VI

MEAN RANKING OF DUTIES AS EXPECTED TO BE PERFORMED IN FIVE YEARS

RANKING	ITEM	As Expected to be Performed in Five Years		
		N	SD	M
1.	2. Communicating With Various Professionals and Tradesmen	82	1.44	9.33
2.	17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	82	1.89	9.00
3.	1. Communicating With Clients	82	2.00	8.99
4.	12. Interpreting Building Codes	82	2.25	8.70
5.	16. Constructing Working Drawings Using Traditional Drafting Techniques	82	2.24	8.10
6.	15. Making Presentation Drawings	82	1.66	8.05
7.	14. Making Preliminary Sketches	82	2.04	7.74
8.	19. Designing Residential Structures	82	2.86	7.45
9.	28. Planning for Remodeling Projects	82	2.14	7.38
10.	9. Inspecting the Construction Site	82	2.55	7.28
11.	20. Designing Light Commercial Buildings	82	2.79	7.10
12.	3. Calculating Material Quantity & Cost Estimates	82	2.28	7.09
13.	21. Space Planning of Commercial Interiors	82	2.54	7.06
14.	13. Supervising Drafting Personnel	82	2.28	7.04
15.	27. Conducting Site Plan Analysis	82	2.74	7.01
16.	6. Calculating the Size of Required Framing Members	82	2.67	6.18
17.	11. Preparing Material/Equipment Schedules	82	2.75	6.18
18.	8. Reproducing Plans Electronically	82	3.21	6.04
19.	25. Designing Electrical Layouts	82	2.72	5.65
20.	26. Designing Air Distribution Systems (HVAC)	82	2.63	5.54
21.	24. Designing Plumbing Layouts	82	2.75	5.28
22.	4. Calculating Foundation Requirements	82	2.88	5.23
23.	23. Designing Solar Building Systems	82	2.71	4.95
24.	18. Constructing Architectural Models	82	2.37	4.93
25.	5. Calculating Earth Volume Cuts/Fills	82	2.75	4.28
26.	22. Designing Earth Sheltered Dwellings	82	2.60	4.24
27.	7. Reproducing Diazo Prints	82	2.69	4.05
28.	10. Making Microfilm Copies	82	2.85	2.50

N = Number of subjects responding
SD = Standard deviation
M = Grand mean of all three groups of the sample (Educators, Practitioners and Administrators)

TABLE VII

MEAN DEGREE OF IMPORTANCE OF DUTIES AS EXPECTED TO BE PERFORMED IN FIVE YEARS ACCORDING TO SAMPLE STRATA

ITEM	Mean Importance In Five Years		
	Educators	Practitioners	Administrators
1. Communicating With Clients	8.68	9.64	8.73
2. Communicating With Various Professionals and Tradesmen	9.19	9.44	9.38
3. Calculating Material Quantity & Cost Estimates	6.87	7.00	7.42
4. Calculating Foundation Requirements	4.06	5.20	6.65
5. Calculating Earth Volume Cuts/Fills	3.94	3.16	5.77
6. Calculating the Size of Required Framing Members	4.58	6.84	7.46
7. Reproducing Diazo Prints	3.68	3.56	4.96
8. Reproducing Plans Electronically	5.74	4.88	7.50
9. Inspecting the Construction Site	7.29	7.20	7.35
10. Making Microfilm Copies	1.55	2.60	3.54
11. Preparing Material/Equipment Schedules	5.87	5.80	6.92
12. Interpreting Building Codes	8.52	8.92	8.69
13. Supervising Drafting Personnel	7.00	7.64	6.50
14. Making Preliminary Sketches	7.74	8.60	6.92
15. Making Presentation Drawings	7.65	9.00	7.62
16. Constructing Working Drawings Using Traditional Drafting Techniques	8.42	9.20	6.65
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	9.39	8.44	9.08
18. Constructing Architectural Models	5.26	3.72	5.69
19. Designing Residential Structures	6.61	8.08	7.85
20. Designing Light Commercial Buildings	6.55	6.84	8.00
21. Space Planning of Commercial Interiors			

TABLE VII (Continued)

ITEM	Mean Importance In Five Years		
	Educators	Practitioners	Administrators
	6.61	7.12	7.54
22. Designing Earth Sheltered Dwellings	3.03	4.60	5.35
23. Designing Solar Building Systems	4.03	5.24	5.77
24. Designing Plumbing Layouts	3.74	4.60	7.77
25. Designing Electrical Layouts	4.00	5.44	7.81
26. Designing Air Distribution Systems (HVAC)	3.94	5.20	7.77
27. Conducting Site Plan Analysis	7.13	6.24	7.62
28. Planning for Remodeling Projects	7.42	7.36	7.35

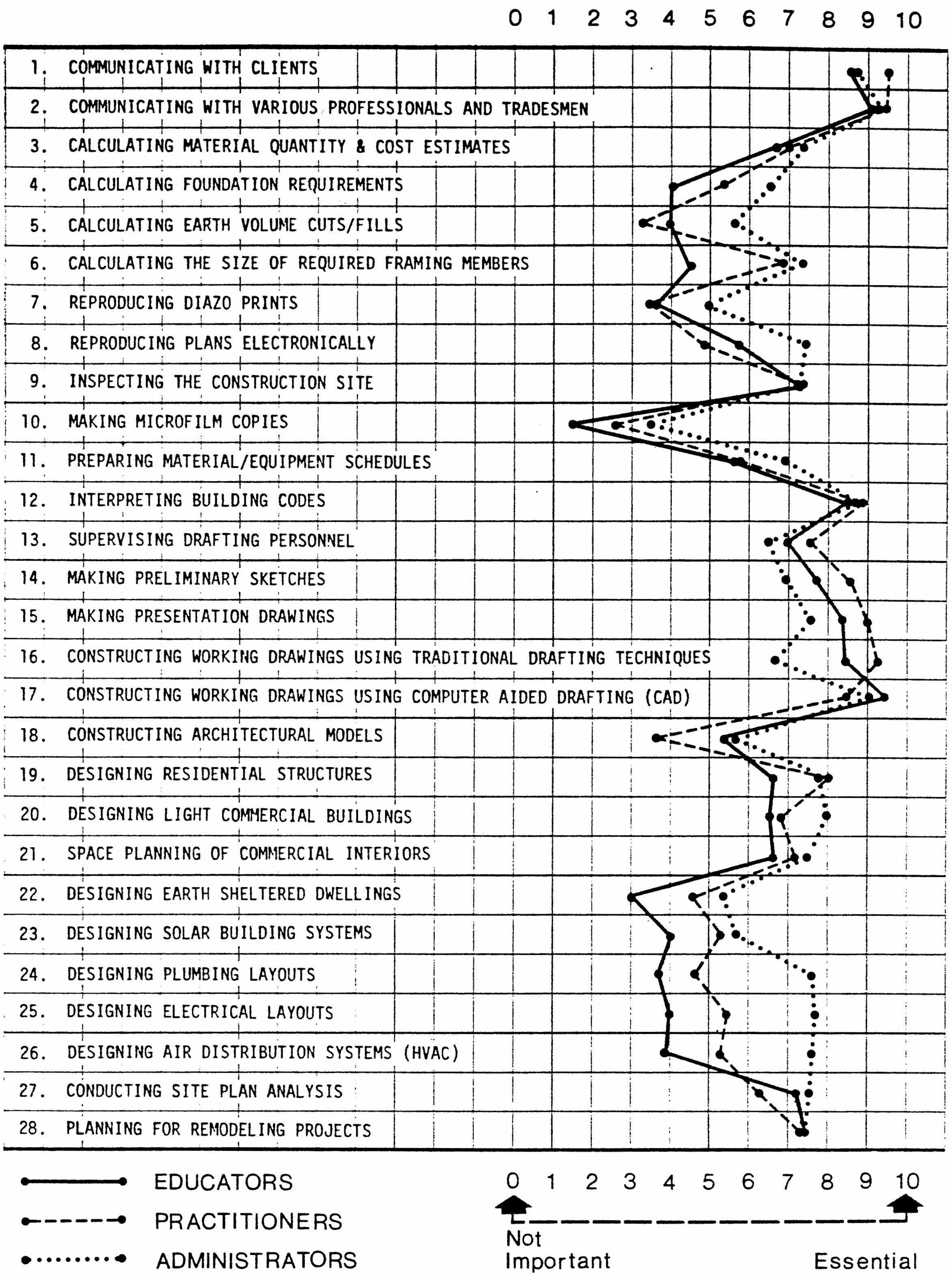

Figure 5. Graph of Response Deviations According to Sample Strata Concerning Those Duties Which Are Expected to Be Performed in Five Years

Research Question Three

What statistically significant changes will occur within the next five years regarding the degree of perceived importance of those duties performed by the architectural technologist?

The correlated nonindependent t-Test was utilized as the statistical procedure for determining if there were significant differences in the perceived degree of importance of those duties listed, as performed today and as expected to be performed in five years. The number of subjects responding, mean difference, standard deviation, and the t value for each duty are presented in Table VIII. The mean difference refers to the mean degree of importance of the duty as performed "in five years" minus the mean degree of importance as performed "today" (See Table IX).

With 81 degrees of freedom (N minus 1) and a critical t value of 2.00, significant differences were found in nine of the 28 duties at the .05 level of significance. Eight of the duties (1) reproducing plans electronically, (2) interpreting building codes, (3) supervising drafting personnel, (4) making presentation drawings, (5) constructing working drawings using computer aided drafting, (6) designing solar building systems, (7) conducting site plan analysis, and (8) planning for remodeling projects reported a positive t value, thus indicating that the duty was predicted to become more important in five years. One of the nine duties, constructing working drawings using traditional drafting techniques, reported a negative correlation that was significantly different, indicating that the duty was expected to become less important in five years.

TABLE VIII

CALCULATED T-VALUES

ITEM	N	MD	SD	t
1. Communicating With Clients	82	0.63	3.21	1.76
2. Communicating With Various Professionals and Tradesmen	82	0.38	2.30	1.46
3. Calculating Material Quantity & Cost Estimates	82	0.50	3.27	1.38
4. Calculating Foundation Requirements	82	0.41	4.01	0.93
5. Calculating Earth Volume Cuts/Fills	82	0.22	3.86	0.52
6. Calculating the Size of Required Framing Members	82	0.48	3.76	1.14
7. Reproducing Diazo Prints	82	-0.44	3.96	-1.00
8. Reproducing Plans Electronically	82	1.45	4.15	3.12*
9. Inspecting the Construction Site	82	0.74	3.77	1.78
10. Making Microfilm Copies	82	0.24	3.73	0.59
11. Preparing Material/Equipment Schedules	82	0.77	3.77	1.83
12. Interpreting Building Codes	82	0.82	3.25	2.23*
13. Supervising Drafting Personnel	82	1.05	3.38	2.79*
14. Making Preliminary Sketches	82	0.39	2.99	1.18
15. Making Presentation Drawings	82	0.68	2.70	2.25*
16. Constructing Working Drawings Using Traditional Drafting Techniques	82	-0.77	2.89	-2.38*
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	82	2.73	2.79	8.50*
18. Constructing Architectural Models	82	-0.20	3.30	-0.54
19. Designing Residential Structures	82	0.72	4.05	1.60
20. Designing Light Commercial Buildings	82	0.76	3.92	1.74
21. Space Planning of Commercial Interiors	82	0.78	3.62	1.95
22. Designing Earth Sheltered Dwellings	82	0.46	3.44	1.22
23. Designing Solar Building Systems	82	1.11	3.42	2.91*
24. Designing Plumbing Layouts	82	0.46	3.84	1.09
25. Designing Electrical Layouts	82	0.54	3.83	1.27
26. Designing Air Distribution Systems (HVAC)	82	0.59	3.67	1.44
27. Conducting Site Plan Analysis	82	0.98	3.87	2.27*
28. Planning for Remodeling Projects	82	0.88	3.10	2.54*

N = Number of subjects responding
MD = Mean difference ("In Five Years" minus "Today")
SD = Standard deviation

Critical value = 1.98 for 81 degrees of freedom ($p < .05$)
*$t > 1.98$

TABLE IX

MEAN VALUE COMPARISON

ITEM	As Performed Today			As Expected to be Performed in Five Years		
	N	SD	M	N	SD	M
1. Communicating With Clients	82	2.61	8.35	82	2.00	8.99
2. Communicating With Various Professionals and Tradesmen	82	1.87	8.95	82	1.44	9.33
3. Calculating Material Quantity & Cost Estimates	82	2.40	6.59	82	2.28	7.09
4. Calculating Foundation Requirements	82	2.84	4.82	82	2.88	5.23
5. Calculating Earth Volume Cuts/Fills	82	2.74	4.06	82	2.75	4.28
6. Calculating the Size of Required Framing Members	82	2.71	5.71	82	2.67	6.18
7. Reproducing Diazo Prints	82	2.95	4.49	82	2.69	4.05
8. Reproducing Plans Electronically	82	2.76	4.59	82	3.21	6.04
9. Inspecting the Construction Site	82	2.83	6.54	82	2.55	7.28
10. Making Microfilm Copies	82	2.47	2.26	82	2.85	2.50
11. Preparing Material/Equipment Schedules	82	2.65	5.41	82	2.75	6.18
12. Interpreting Building Codes	82	2.46	7.88	82	2.25	8.70
13. Supervising Drafting Personnel	82	2.55	5.99	82	2.28	7.04
14. Making Preliminary Sketches	82	2.23	7.35	82	2.04	7.74
15. Making Presentation Drawings	82	2.21	7.37	82	1.66	8.05
16. Constructing Working Drawings Using Traditional Drafting Techniques	82	1.92	8.87	82	2.24	8.10
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	82	2.23	6.27	82	1.89	9.00
18. Constructing Architectural Models	82	2.33	5.12	82	2.37	4.93
19. Designing Residential Structures	82	2.95	6.73	82	2.86	7.45
20. Designing Light Commercial Buildings	82	2.82	6.34	82	2.79	7.10
21. Space Planning of Commercial Interiors	82	2.63	6.28	82	2.54	7.06
22. Designing Earth Sheltered Dwellings	82	2.30	3.78	82	2.60	4.24
23. Designing Solar Building Systems	82	2.17	3.84	82	2.71	4.95
24. Designing Plumbing Layouts	82	2.72	4.82	82	2.75	5.28

TABLE IX (Continued)

ITEM	As Performed Today			As Expected to be Performed in Five Years		
	N	SD	M	N	SD	M
25. Designing Electrical Layouts	82	2.74	5.11	82	2.72	5.65
26. Designing Air Distribution Systems (HVAC)	82	2.61	4.95	82	2.63	5.54
27. Conducting Site Plan Analysis	82	2.80	6.04	82	2.74	7.01
28. Planning for Remodeling Projects	82	2.31	6.50	82	2.14	7.38

N = Total number of subjects responding
SD = Standard deviation
M = Grand mean of all three groups of the sample (Educators, Practitioners and Administrators)

Additional Duties and Comments by Respondents

At the bottom of each questionnaire two additional spaces were provided for respondents to write in any additional duties or other comments which they felt were important. Those duties and other comments are as follows:

1. writing specifications
2. specification writing
3. financing projects
4. site selection
5. listening to employer
6. following instructions
7. drawing techniques
8. ability to letter
9. obtain project
10. design-build project
11. interior residential layouts
12. construction materials
13. construction contracts and specifications
14. understand legal limitations and responsibilities
15. high energy efficiency designs
16. operation of a design firm - procedures, fees, etc.
17. A study of this type has been greatly needed.
18. Skill levels vary greatly with recent graduates; some have difficulty communicating and following instructions and procedures.

Summary

Data for this study was obtained from 82 returned questionnaires; 26 educators, 25 practitioners, and 31 administrators. The instrument was designed to ascertain the perceived degree of importance of those duties which are performed and will be performed in five years by architectural technologists.

Response frequencies, percentages and group means were used to both rate and rank the duties and a correlated t-Test for nonindependent samples was implemented to determine significant differences in the importance of the duties ("today" versus "in five years"). Significant differences were found in nine of the 28 duties listed; eight of the nine were predicted to become more important in five years with one of the duties becoming less important.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

A variety of professional and governmental organizations have suggested that architectural technology is a new and emerging career field in which practitioners are becoming responsible for a wider range of occupational duties, many of which were previously performed exclusively by registered architects and engineers. Due to the evolving nature of the occupation, a concise delineation and analysis of those duties which are presently performed by practitioners has yet to be established. Therefore, through the systematic process of occupational and content work systems analysis, the purpose of this study was to answer the following research questions:

1. Within the occupational field of environmental design, what duties are presently performed by architectural technologists and what duties will be required in five years?

2. What is the mean level of importance of those duties identified as perceived by architectural technology educators, established practitioners, and administrators of comprehensive environmental design firms?

3. What statistically significant changes will occur within the next five years regarding the degree of perceived importance of those duties performed by the architectural technologist?

Question one was accomplished through an extensive review of the literature and through subsequent refinement by a four-member advisory committee.

In order to accomplish research questions two and three a mailed questionnaire was developed and administered to a random stratified sample composed of 44 educators, 44 practitioners, and 44 administrators from the Four-State Industrial Technology Conference Region (Arkansas, Kansas, Missouri, and Oklahoma). A total of 82 subjects responded--26 educators, 25 practitioners, and 31 administrators.

The instrument consisted of a listing of 28 duties which were identified during the accomplishment of objective one and utilized a set of bipolar semantic differential scales for each duty listed. One scale asked the respondent to indicate the degree of importance on a scale of zero to ten (zero being "not important" and ten "being essential") of the duty as performed today and an exact scale asked the respondent to rate the degree of importance of the duty as expected to be performed in five years. The instrument was pre-tested with members of the advisory committee.

The statistical procedures used to make generalizations from the data included both descriptive and inferential statistics. Response frequencies, percentages and means were used to determine rating values for the degree of importance of each duty which allowed the duties to be ranked according to perceived importance today and in five years. A correlated t-Test for nonindependent samples was used to determine if differences in degree of perceived importance of the duties over the five year time period were statistically significant.

Conclusions

Research Question One

> Within the occupational field of environmental design, what duties are presently performed by architectural technologists and what duties will be required in five years?

The literature stated that the occupational scope of the architectural technologist was expected to expand from a primary emphasis on the performance of drafting duties to include additional responsibilities in building design and the completion of routine engineering and technical calculations. In an attempt to address this issue and thus describe the current status of architectural technology within the "four-state region", the following conclusions were drawn as based upon the descriptive and inferential statistics obtained:

1. Architectural technologists are presently responsible for the performance of a wide range of duties which generally fall into one or more of these categories: (a) drafting, (b) design, (c) project management and supervision, (d) engineering and technical calculations, and (e) ancillary office duties.

2. Architectural technologists will utilize their skills in a variety of occupational areas and levels within environmental design including architecture, construction, engineering, interior design/planning, landscape architecture, and urban planning. Depending upon the level of education and experience, practitioners will work under varying degrees of supervision by a registered architect or engineer or they may be independently employed.

Research Question Two

According to educators, practitioners and administrators in the field, what is the mean level of importance of those duties identified as perceived by architectural technology educators, established practitioners, and administrators of comprehensive environmental design firms?

Regarding research question two, the findings appeared to indicate that architectural technologists within the geographic scope of this study were already heavily involved with design responsibilities. Conclusions relevant to this finding and other issues relating to question two are as follows:

1. The more important duties presently performed by architectural technologists tend to be related to some phase of the building design or planning process. Nine of the 14 duties ranked in the upper fiftieth percentile of the duty rankings were either a direct fundamental design responsibility or a direct subcomponent thereof; for example, Communicating with Clients (ranked number 3), Interpreting Building Codes (ranked number 4), Making Presentation Drawings (ranked number 5), Making Preliminary Sketches (ranked number 6), Designing Residential Structures (ranked number 7), Planning for Remodeling Projects (ranked number 10), Designing Light Commercial Buildings (ranked number 11), Space Planning for Commercial Interiors (ranked number 12), and Conducting Site Plan Analysis (ranked number 14).

2. As suggested by conclusion one above, greater importance was associated with residential design and lesser degrees of importance were associated with other classifications of building design.

3. Project management and supervision appeared to be a relatively important area of responsibility. Five of the 15 most important duties were directly related to the management and supervision of certain aspects of the building project; Communicating with Various Professionals and Tradesmen (ranked number 1), Interpreting Building Codes [also a function of design] (ranked number 4), Calculating Material Quantity and Cost Estimates (ranked number 8), Inspecting the Constructing Site (ranked number 9), and Supervising Drafting Personnel (ranked number 15).

4. The importance of designing building subcomponent systems; electrical and plumbing layouts, air distribution systems, and solar building systems were generally perceived to be of lower importance and were ranked in the lower fiftieth percentile of the duty listing.

5. The perceived importance of engineering and technical calculations depends on the specific duty. Duties so classified were not clustered within the ranking order and were widely dispersed in the lower sixtieth percentile of the rankings. Thus, the projection that architectural technologists will be increasingly required to perform routine engineering calculations in the next five years is not materially substantiated by this research.

6. The performance of traditional drafting responsibilities are still a relatively important part of the architectural technologist's job. This is evidenced by the fact that Constructing Working Drawings Using Traditional Drafting Techniques was ranked second and Constructing Working Drawings Using Computer Aided Drafting (CAD) was ranked thirteenth.

7. Based upon conclusion six, it appeared that traditional drafting skills are more important today than CAD drafting abilities.

Research Question Three

> According to educators, practitioners and administrators in the field, what statistically significant changes will occur within the next five years regarding the degree of perceived importance of those duties performed by the architectural technologist?

As based upon statistical tests for significance and the ranking of duties expected to be required in five years, significant changes were expected to occur in these duty categories; drafting, design, and project management and supervision. The specific conclusions drawn were:

1. The use of computer aided drafting may become more important to the production of working drawings than traditional manual drafting techniques though it is not anticipated that CAD will replace the need for traditional drafting skills during the next five years (CAD was rated as the second "most important" duty to be performed in five years, but traditional drafting skills were ranked fifth in the 28 duties listed).

2. Drafting and the production of working drawings will continue to be an important function of the architectural technologist, though other media and forms of graphic communications will become increasingly important, for example, making presentation drawings (also categorized as a subcomponent of design due to its use as a design related medium.

3. Architectural technologists will become increasingly responsible for project management in the areas of (a) supervising drafting personnel and (b) interpreting building codes (also a design subcomponent).

4. Regarding building design duties, the findings indicated that increasing importance would be placed on the interpretation of building codes, conducting site plan analysis, and planning for remodeling projects, and designing solar building systems.

Recommendations

The following are recommendations pertinent to this study and would make significant contributions to the profession of technology education and architecture.

1. It is recommended that the findings of this study be considered by administrators and coordinators of educational programs in architectural technology. The findings would have particular application to the process of curriculum development, evaluation and updating.

2. It is also recommended that the findings be reviewed by those representatives of the various regulatory and accreditation organizations which would be responsible for the formulation of professional competency examinations for practitioners in architectural technology.

3. Recommended follow-up studies include:

a. A task analysis study designed to delineate individual subcomponents, elements, and work processes that are required within each of the 28 occupational duties which were established by this study.

b. A validation study concerning the additional duties that were provided by respondents of this study.

c. A comparison study which would address significant differences in the perceived degree of importance of duties performed as perceived by educators, practitioners, and administrators.

d. A survey of current post-secondary curricula in architectural technology in order to determine if there is a correlation between existing courses of instruction and those duties identified within the scope of this study.

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APPENDIXES

APPENDIX A

FREQUENCY TABLES CONCERNING RAW DATA

TABLE X

ITEM	As Performed Today										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	0	1	1	1	0	5	2	0	4	2	15
2. Communicating With Various Professionals and Tradesmen	0	0	0	0	0	2	3	1	5	1	19
3. Calculating Material Quantity & Cost Estimates	0	0	5	1	0	10	2	4	5	0	4
4. Calculating Foundation Requirements	5	1	9	2	1	6	3	0	2	0	2
5. Calculating Earth Volume Cuts/Fills	2	1	8	9	2	6	0	0	1	0	2
6. Calculating the Size of Required Framing Members	2	1	5	7	1	8	4	2	0	0	1
7. Reproducing Diazo Prints	3	2	7	4	3	6	1	4	0	0	1
8. Reproducing Plans Electronically	3	3	4	5	6	3	3	2	2	0	0
9. Inspecting the Construction Site	1	0	5	0	5	4	1	2	3	3	7
10. Making Microfilm Copies	14	6	6	3	0	1	0	0	1	0	0
11. Preparing Material/Equipment Schedules	3	0	3	1	7	7	0	3	5	2	0
12. Interpreting Building Codes	0	0	1	0	6	5	4	0	2	2	11
13. Supervising Drafting Personnel	0	0	6	2	4	6	2	3	1	0	7
14. Making Preliminary Sketches	0	0	2	3	0	4	1	6	8	1	6
15. Making Presentation Drawings	0	0	3	2	0	4	2	4	9	0	7
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	2	0	1	1	0	3	3	1	20
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	0	0	2	1	0	9	2	6	8	0	3
18. Constructing Architectural Models	0	0	3	3	4	7	3	2	7	2	0
19. Designing Residential Structures	2	1	3	3	1	6	0	5	4	5	1
20. Designing Light Commercial Buildings	1	2	1	2	2	6	4	6	4	2	1
21. Space Planning of Commercial Interiors	1	0	1	2	7	6	2	3	5	3	1
22. Designing Earth Sheltered Dwellings	5	2	6	7	7	2	1	0	1	0	0
23. Designing Solar Building Systems	5	2	7	7	6	1	2	0	0	1	0
24. Designing Plumbing Layouts	3	2	7	7	3	6	3	0	0	0	0
25. Designing Electrical Layouts	3	0	7	9	2	4	5	0	0	1	0
26. Designing Air Distribution Systems (HVAC)	3	0	7	9	3	4	4	1	0	0	0
27. Conducting Site Plan Analysis	0	0	5	3	4	3	3	2	5	3	3
28. Planning for Remodeling Projects	0	0	3	1	4	3	6	5	4	0	5

0 = Not Important 10 = Essential
N = 31

TABLE XI

ITEM	As Expected to be Performed in Five Years										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	0	0	1	1	0	1	1	1	5	4	17
2. Communicating With Various Professionals and Tradesmen	0	0	0	0	0	1	2	1	3	3	21
3. Calculating Material Quantity & Cost Estimates	0	0	2	1	2	6	1	4	8	0	7
4. Calculating Foundation Requirements	5	2	4	1	3	7	5	0	2	0	2
5. Calculating Earth Volume Cuts/Fills	2	2	5	6	2	9	2	1	0	0	2
6. Calculating the Size of Required Framing Members	2	2	2	1	2	13	6	2	0	0	1
7. Reproducing Diazo Prints	3	4	7	3	3	5	1	0	3	0	2
8. Reproducing Plans Electronically	3	2	0	3	2	4	1	1	12	0	3
9. Inspecting the Construction Site	1	0	0	1	2	5	1	7	2	1	11
10. Making Microfilm Copies	12	11	2	2	1	1	0	0	0	2	0
11. Preparing Material/Equipment Schedules	4	1	0	0	4	5	1	4	6	2	4
12. Interpreting Building Codes	0	0	0	0	2	0	4	4	1	4	16
13. Supervising Drafting Personnel	0	0	2	2	1	3	6	2	6	0	9
14. Making Preliminary Sketches	0	0	0	1	0	4	1	8	5	5	7
15. Making Presentation Drawings	0	0	0	0	0	7	3	6	2	4	9
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	1	0	1	1	0	3	8	5	12
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	0	0	0	0	0	1	0	2	2	4	22
18. Constructing Architectural Models	0	0	2	8	2	7	1	6	2	2	1
19. Designing Residential Structures	2	2	1	2	2	1	0	4	4	8	5
20. Designing Light Commercial Buildings	1	1	1	2	0	1	8	5	5	4	3
21. Space Planning of Commercial Interiors	1	0	0	2	2	5	5	1	9	3	3
22. Designing Earth Sheltered Dwellings	5	3	6	5	4	4	2	0	2	0	0
23. Designing Solar Building Systems	5	3	2	7	0	4	2	1	6	0	1
24. Designing Plumbing Layouts	2	1	5	4	9	5	4	0	1	0	0
25. Designing Electrical Layouts	2	1	5	4	8	3	5	1	1	1	0
26. Designing Air Distribution Systems (HVAC)	2	1	5	4	7	5	4	2	1	0	0
27. Conducting Site Plan Analysis	0	0	1	1	4	4	1	3	7	3	7
28. Planning for Remodeling Projects	0	0	1	0	0	5	4	7	4	2	8

0 = Not Important 10 = Essential

N = 31

TABLE XII

ITEM	As Performed Today										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	1	0	1	0	0	0	0	2	2	2	17
2. Communicating With Various Professionals and Tradesmen	0	0	0	2	0	1	0	2	3	3	14
3. Calculating Material Quantity & Cost Estimates	0	0	0	5	1	4	5	4	1	2	3
4. Calculating Foundation Requirements	2	1	3	2	5	3	4	5	0	0	0
5. Calculating Earth Volume Cuts/Fills	4	5	5	4	1	1	1	3	0	0	1
6. Calculating the Size of Required Framing Members	2	0	0	3	0	1	5	7	4	0	3
7. Reproducing Diazo Prints	4	3	3	5	1	4	2	0	0	0	3
8. Reproducing Plans Electronically	1	2	7	4	3	4	0	0	1	0	3
9. Inspecting the Construction Site	2	0	1	2	0	4	2	5	0	3	6
10. Making Microfilm Copies	8	6	8	0	1	1	0	0	0	0	1
11. Preparing Material/Equipment Schedules	2	0	4	3	5	1	1	4	2	2	1
12. Interpreting Building Codes	1	0	0	0	0	2	1	2	4	3	12
13. Supervising Drafting Personnel	3	0	0	0	2	3	7	3	5	0	2
14. Making Preliminary Sketches	0	0	0	0	0	3	2	3	4	5	8
15. Making Presentation Drawings	0	0	2	0	0	0	1	5	9	2	6
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	0	0	0	1	0	0	1	4	19
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	1	0	3	1	2	8	2	1	6	1	0
18. Constructing Architectural Models	5	0	1	3	7	7	1	0	1	0	0
19. Designing Residential Structures	2	0	0	1	2	3	1	0	1	10	5
20. Designing Light Commercial Buildings	4	0	0	0	2	3	3	5	2	2	4
21. Space Planning of Commercial Interiors	4	0	0	0	2	1	6	3	6	0	3
22. Designing Earth Sheltered Dwellings	2	2	2	7	6	3	0	0	1	0	2
23. Designing Solar Building Systems	2	0	2	7	4	8	0	0	2	0	0
24. Designing Plumbing Layouts	3	0	1	3	7	6	1	0	3	0	1
25. Designing Electrical Layouts	2	0	1	3	5	7	2	0	2	0	3
26. Designing Air Distribution Systems (HVAC)	3	0	1	2	3	6	6	0	2	0	2
27. Conducting Site Plan Analysis	4	1	0	0	0	7	5	0	6	1	1
28. Planning for Remodeling Projects	1	0	0	0	0	7	12	1	3	0	1

0 = Not Important   10 = Essential

N = 25

TABLE XIII

ITEM	As Expected to be Performed in Five Years										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	0	0	0	0	1	0	0	0	0	3	21
2. Communicating With Various Professionals and Tradesmen	0	0	0	0	0	1	0	0	1	7	16
3. Calculating Material Quantity & Cost Estimates	0	0	0	1	1	7	2	4	2	3	5
4. Calculating Foundation Requirements	2	1	2	2	0	6	3	5	1	2	1
5. Calculating Earth Volume Cuts/Fills	4	5	3	4	3	1	0	3	1	0	1
6. Calculating the Size of Required Framing Members	2	0	0	2	1	1	1	4	7	4	3
7. Reproducing Diazo Prints	4	3	5	4	0	4	0	2	0	0	3
8. Reproducing Plans Electronically	2	2	2	2	6	4	0	0	2	0	5
9. Inspecting the Construction Site	2	0	0	0	1	5	0	3	3	4	7
10. Making Microfilm Copies	9	6	5	0	1	2	0	1	1	0	2
11. Preparing Material/Equipment Schedules	2	0	1	2	3	4	3	1	4	2	3
12. Interpreting Building Codes	2	0	0	0	0	0	0	1	1	2	19
13. Supervising Drafting Personnel	1	0	0	0	0	1	4	3	8	3	5
14. Making Preliminary Sketches	0	0	0	0	0	3	0	2	4	6	10
15. Making Presentation Drawings	0	0	0	0	0	0	0	1	8	6	10
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	0	0	0	1	0	2	2	5	15
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	1	0	0	0	0	1	3	0	4	4	12
18. Constructing Architectural Models	5	0	3	2	6	4	1	1	3	0	0
19. Designing Residential Structures	1	0	0	2	0	0	2	1	5	3	11
20. Designing Light Commercial Buildings	4	0	0	0	0	1	0	7	4	5	4
21. Space Planning of Commercial Interiors	3	0	0	0	0	1	2	5	5	4	5
22. Designing Earth Sheltered Dwellings	2	2	0	3	5	6	2	1	2	1	1
23. Designing Solar Building Systems	1	0	0	5	5	3	2	5	2	2	0
24. Designing Plumbing Layouts	3	1	0	1	8	4	4	1	1	0	2
25. Designing Electrical Layouts	2	0	0	1	5	5	6	2	1	0	3
26. Designing Air Distribution Systems (HVAC)	1	1	1	1	4	6	6	2	1	0	2
27. Conducting Site Plan Analysis	4	1	0	0	0	1	5	2	5	4	3
28. Planning for Remodeling Projects	0	0	0	0	0	4	5	5	5	1	5

0 = Not Important 10 = Essential
N = 25

TABLE IV

ITEM	As Performed Today										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	0	1	1	0	0	2	0	0	3	5	14
2. Communicating With Various Professionals and Tradesmen	0	1	0	0	0	0	0	0	0	7	18
3. Calculating Material Quantity & Cost Estimates	0	1	0	0	0	1	1	7	5	7	4
4. Calculating Foundation Requirements	0	1	1	1	2	2	3	3	8	2	3
5. Calculating Earth Volume Cuts/Fills	0	1	1	4	3	3	2	4	6	0	2
6. Calculating the Size of Required Framing Members	0	1	1	0	1	1	2	2	13	3	2
7. Reproducing Diazo Prints	0	0	0	5	4	1	7	0	2	0	7
8. Reproducing Plans Electronically	0	1	0	3	3	0	7	3	5	0	4
9. Inspecting the Construction Site	0	0	1	2	0	2	4	4	7	3	3
10. Making Microfilm Copies	1	5	5	1	1	5	2	3	3	0	0
11. Preparing Material/Equipment Schedules	0	0	0	0	5	4	5	4	2	1	5
12. Interpreting Building Codes	0	0	1	0	1	1	0	4	3	5	11
13. Supervising Drafting Personnel	0	0	1	2	1	2	2	12	2	4	0
14. Making Preliminary Sketches	0	0	1	0	2	3	5	4	4	1	6
15. Making Presentation Drawings	0	0	1	0	1	0	3	8	5	5	3
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	0	1	0	2	0	1	7	5	10
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	1	0	0	0	1	3	4	4	8	4	1
18. Constructing Architectural Models	0	0	0	3	2	6	3	5	3	4	0
19. Designing Residential Structures	0	0	1	1	1	4	1	0	2	11	5
20. Designing Light Commercial Buildings	1	0	1	0	0	2	1	7	2	7	5
21. Space Planning of Commercial Interiors	0	0	2	0	1	1	3	5	4	7	3
22. Designing Earth Sheltered Dwellings	1	0	2	2	6	4	5	3	3	0	0
23. Designing Solar Building Systems	1	0	2	2	5	4	6	3	3	0	0
24. Designing Plumbing Layouts	0	0	1	0	2	2	4	3	5	6	3
25. Designing Electrical Layouts	0	0	1	1	1	3	1	7	3	6	3
26. Designing Air Distribution Systems (HVAC)	0	0	1	0	1	4	6	3	6	1	4
27. Conducting Site Plan Analysis	0	1	0	1	1	4	5	3	3	0	8
28. Planning for Remodeling Projects	1	0	0	1	0	5	1	1	7	5	5

0 = Not Important 10 = Essential
N = 26

TABLE XV

ITEM	As Expected to be Performed in Five Years										
	0	1	2	3	4	5	6	7	8	9	10
1. Communicating With Clients	0	1	1	0	0	0	1	1	2	5	15
2. Communicating With Various Professionals and Tradesmen	0	1	0	0	0	0	0	0	0	7	18
3. Calculating Material Quantity & Cost Estimates	0	1	0	0	2	2	1	6	4	6	4
4. Calculating Foundation Requirements	0	1	1	1	2	2	4	4	6	1	4
5. Calculating Earth Volume Cuts/Fills	0	1	1	4	3	4	1	4	5	1	2
6. Calculating the Size of Required Framing Members	0	1	1	0	0	1	1	7	6	7	2
7. Reproducing Diazo Prints	0	1	0	5	4	6	5	3	2	0	0
8. Reproducing Plans Electronically	0	1	0	2	2	3	0	2	3	3	10
9. Inspecting the Construction Site	0	0	1	1	1	2	2	3	8	5	3
10. Making Microfilm Copies	3	4	2	3	1	2	5	1	3	0	0
11. Preparing Material/Equipment Schedules	0	0	0	0	3	2	6	8	2	0	5
12. Interpreting Building Codes	0	0	1	0	1	1	0	1	4	4	14
13. Supervising Drafting Personnel	0	0	2	1	1	2	3	10	3	4	0
14. Making Preliminary Sketches	0	0	1	1	1	4	5	4	3	1	6
15. Making Presentation Drawings	0	0	0	0	1	1	3	7	5	8	1
16. Constructing Working Drawings Using Traditional Drafting Techniques	0	0	2	2	3	2	1	4	4	5	3
17. Constructing Working Drawings Using Computer Aided Drafting (CAD)	1	0	0	0	0	0	0	0	5	4	16
18. Constructing Architectural Models	0	0	1	3	1	9	4	3	2	3	0
19. Designing Residential Structures	0	0	1	1	1	2	1	1	4	10	5
20. Designing Light Commercial Buildings	1	0	1	0	0	0	1	5	3	9	6
21. Space Planning of Commercial Interiors	0	0	2	0	0	2	3	4	2	10	3
22. Designing Earth Sheltered Dwellings	1	0	3	2	4	2	5	6	0	1	2
23. Designing Solar Building Systems	1	0	2	3	0	4	4	9	0	0	3
24. Designing Plumbing Layouts	0	0	1	0	1	1	3	3	6	6	5
25. Designing Electrical Layouts	0	0	1	0	1	2	1	3	7	6	5
26. Designing Air Distribution Systems (HVAC)	0	0	1	0	1	1	1	6	7	3	6
27. Conducting Site Plan Analysis	0	1	0	1	0	1	4	4	6	1	8
28. Planning for Remodeling Projects	1	0	0	1	1	4	3	0	4	6	6

0 = Not Important 10 = Essential
N = 26

APPENDIX B

CORRESPONDENCE

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

July 15, 1987

In order to keep abreast of future curriculum needs, we need your assistance in completing a study of the occupational duties performed by the Architectural Technologist. For the purpose of this research an architectural technologist is defined as an environmental design specialist who typically works either (1) under the direction of a registered architect, contractor, engineer, or landscape architect on large building or planning projects or (2) independently as the designer of residential or light commercial buildings.

Your personal input is critical to the accomplishment of the study if we are to obtain representative data from the environmental design profession as a whole. Your cooperation is therefore needed in completing the attached questionnaire which will require approximately ten minutes to complete. Each questionnaire is coded for the purpose of response tracking, but all replies will be held strictly confidential.

For your convenience a self-addressed stamped envelope is attached. Your timely attention to this matter is greatly appreciated.

Sincerely,

Jimmie L. King
Research Associate

Enclosure

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

July 29, 1987

Recently, you were mailed a research questionnaire concerning the occupational duties which are performed by architectural technologists. If you responded to the original instrument dated July 15, 1987 please disregard this letter, otherwise, for your convenience a self-addressed stamped envelope and additional instrument are attached.

Your individual input is crucial to the study and your timely attention to the matter is greatly appreciated.

Sincerely,

Jimmie L. King
Research Associate

Enclosure

APPENDIX C

QUESTIONNAIRE

Architectural Technology

OCCUPATIONAL ANALYSIS QUESTIONNAIRE

DIRECTIONS: Based upon your experience, indicate the degree of importance of each duty as performed (1) TODAY and (2) IN FIVE YEARS by circling the appropriate number on the scales to the left and right of each duty. Additional spaces are provided for duties which you may wish to add.

DEGREE OF IMPORTANCE TODAY	OCCUPATIONAL DUTIES	DEGREE OF IMPORTANCE IN FIVE YEARS
Not Important ——— Essential		Not Important ——— Essential
0 1 2 3 4 5 6 7 8 9 10	COMMUNICATING WITH CLIENTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	COMMUNICATING WITH VARIOUS PROFESSIONALS AND TRADESMEN	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CALCULATING MATERIAL QUANTITY & COST ESTIMATES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CALCULATING FOUNDATION REQUIREMENTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CALCULATING EARTH VOLUME CUTS/FILLS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CALCULATING THE SIZE OF REQUIRED FRAMING MEMBERS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	REPRODUCING DIAZO PRINTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	REPRODUCING PLANS ELECTRONICALLY	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	INSPECTING THE CONSTRUCTION SITE	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	MAKING MICROFILM COPIES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	PREPARING MATERIAL/EQUIPMENT SCHEDULES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	INTERPRETING BUILDING CODES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	SUPERVISING DRAFTING PERSONNEL	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	MAKING PRELIMINARY SKETCHES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	MAKING PRESENTATION DRAWINGS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CONSTRUCTING WORKING DRAWINGS USING TRADITIONAL DRAFTING TECHNIQUES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CONSTRUCTING WORKING DRAWINGS USING COMPUTER AIDED DRAFTING (CAD)	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CONSTRUCTING ARCHITECTURAL MODELS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING RESIDENTIAL STRUCTURES	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING LIGHT COMMERCIAL BUILDINGS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	SPACE PLANNING OF COMMERCIAL INTERIORS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING EARTH SHELTERED DWELLINGS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING SOLAR BUILDING SYSTEMS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING PLUMBING LAYOUTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING ELECTRICAL LAYOUTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	DESIGNING AIR DISTRIBUTION SYSTEMS (HVAC)	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	CONDUCTING SITE PLAN ANALYSIS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	PLANNING FOR REMODELING PROJECTS	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	(other)	0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10	(other)	0 1 2 3 4 5 6 7 8 9 10

APPENDIX D

THE SAMPLE

ARCHITECTURAL TECHNOLOGY EDUCATORS:

Prof. David D. Almes **
Industrial Education Department
Wichita State University
1845 N. Fairmont
Wichita, Kansas 67208

Prof. Edward L. Antrim **
Industrial Education Department
Wichita State University
1845 N. Fairmont
Wichita, Kansas 67208

Dr. Richard Baugher
Department of Industrial Education and Technology
Southwestern Oklahoma State University
100 Campus Drive
Weatherford, Oklahoma 73096

Dr. Charles R. Barrick **
Department of Industrial Education and Technology
East Central University
Ada, Oklahoma 74820

Dr. Joe Beckham **
Department of Industrial Education
Central State University
Edmond, Oklahoma 73034

Dr. Craig L. Benedict **
Department of Industrial Education and Technology
East Central University
Ada, Oklahoma 74820

Dr. Jerry R. Brownrigg, Chairman **
Industrial Education Department
Northwestern Oklahoma State University
Alva, Oklahoma 73717

Dr. Merl Case **
Department of Graphics
Central Missouri State University
Grinstead Building
Warrensburg, Missouri 64093

Dr. Ginger Clark **
Department of Industrial Education and Technology
East Central University
Ada, Oklahoma 74820

Dr. Leslie H. Cochran
Department of Industrial Technology and Education
Southeast Missouri State University
Cape Girardeau, Missouri 63701

Prof. Duane R. Cole
Department of Industrial Education
Northeast Missouri State University
East Normal Street
Kirksville, Missouri 63501

Dr. Herman G. Collins
Department of Technology
Northwest Missouri State University
Maryvill, Missouri 64468-6001

Dr. LeRoy Crist **
Department of Technology
Northwest Missouri State University
Maryville, Missouri 64468-6001

Prof. Lee Dahl.
Department of Graphics
Central Missouri State University
Grinstead Building
Warrensburg, Missouri 64093

Dr. Leon G. Devlin **
Department of Industrial Education
Northeast Missouri State University
East Normal Street
Kirksville, Missouri 63501

Dr. Lawrence D. Drake **
Department of Industrial Technology
Southwest Missouri State University
901 S. National Avenue
Springfield, Missouri 65804

Prof. Trenton D. Fagg
Division of Administration, Education, and Indus. Tech.
Emporia State University
1200 Commercial, Box 23
Emporia, Kansas 66801

Prof. Steve Fightmaster **
Department of Industrial Education
Central State University
Edmond, Oklahoma 73034

Dr. Donald M. Froelich **
Division of Administration, Education, and Indus. Tech.
Emporia State University
1200 Commercial, Box 23
Emporia, Kansas

Dr. George G. Gow
Department of Industrial Education
Northeastern State University
Tahlequah, OK 74464

Dr. William L. Havice
Depatrment of Adult & Occupational Education
Kansas State University
Manhattan, KS 66506

Dr. Kenneth F. Jordan, Chairman
Department of Industrial Education
University of Central Arkansas
Conway, AR 72032

Dr. Charles Keseman **
Department of Graphics
Central Missouri State University
Grinstead Building
Warrensburg, MO 64093

Dr. Yuan H. Liu
Department of Industrial Technology
Southwest Missouri State University
901 S National Ave.
Springfield, MO 65804

Prof. Annie T. Lowrey
Industrial Education Department
Wichita State University
1845 N Fairmount
Wichita, KS 67208

Dr. Charles R. McKenzie **
Department of Industrial Technology
Southwest Missouri State University
901 S National Ave.
Springfield, MO 65804

Prof. Ronald J. Morgan
Industrial Arts Department
Missouri Southern State College
Newman & Duquesne Roads
Joplin, MO 64801-1595

Prof. Elmer Ott **
Division of Administration, Education, & Indus. Tech.
Emporia State University
1200 Commercial, Box 23
Emporia, KS 66801

Prof. James Otter **
Engineering Technology Department
Pittsburg State University
Pittsburg, KS 66762

Prof. Kyle Palmer
Department of Industrial Education
Northeast Missouri State University
East Normal Street
Kirksville, MO 63501

Prof. Wesley Pauls
Department of Industrial Education
McPherson College
Box 1402
McPherson, KS 67460

Dr. Joe Porter **
Engineering Technology Department
Pittsburg State University
Pittsburg, KS 66762

Dr. Jerry D. Routh
Department of Industrial Technology
Southwest Missouri State University
901 S National Avenue
Springfield, MO 65804

Prof. Gene Russell **
Engineering Technology Department
Pittsburg State University
Pittsburg, KS 66762

Dr. Gary Schreiner
Department of Industrial Technology & Education
Southeast Missouri State University
900 Normal Avenue
Cape Girardeau, MO 63701

Dr. James R. Seawood
Department of Industrial & Agricultural Technology
University of Arkansas at Pine Bluff
1100 University Drive
Pine Bluff, AR 71601

Dr. Eugene G. Sherrell **
Department of Industrial Technology
Southwest Missouri State University
901 S. National Avenue
Springfield, MO 65804

Prof. James Snow **
Industrial & Technical Education
University of Arkansas at Fayetteville
Fayetteville, AR 72701

Dr. William P. Spence **
Engineering Technology Department
Pittsburg State University
Pittsburg, KS 66762

Dr. Gary Waisner
Department of Graphics
Central Missouri State University
Grinstead Building
Warrensburg, MO 64093

Dr. Alvin M. White, Head **
Department of Industrial Education & Technology
Southeastern Oklahoma State University
7th & Chuckwa
Durant, OK 74701

Dr. A. Emerson Wiens **
Department of Industrial Arts Education
Bethel College
300 E. 27th Street
North Newton, KS 67117

Dr. Jon H. Wiggins **
Department of Industrial Technology
Southwest Missouri State University
901 S. National Avenue
Springfield, MO 65804

Dr. J. Eldon Yung **
Department of Graphics
Central Missouri State University
Grinstead Building
Warrensburg, MO 64093

** Those subjects responding to the instrument.

PRACTICING ARCHITECTURAL TECHNOLOGISTS:

Allee Design
9507 E. 63rd
Kansas City, MO 64133

Artech Associates **
1120½ N. Kickapoo
Shawnee, OK 74802

Baugh-Deines Inc. **
3210 W. Kellogg Drive
Wichita, KS 67213

Beverly's **
14400 University
Wichita, KS 67235

B&G Drafting **
1950-W S. Glenstone Avenue
Springfield, MO 65804

Bickford Kietzman & Associates **
7800 College Blvd.
Kansas City, MO 64132

Bontz Brothers Design
107 W. Central Andover
Wichita, KS 67202

Brueggeman & Caulder Architects **
3700 Old Cantrell Rd.
Little Rock, AR 72202

Steven Busch & Associates Inc. **
3533 S. Trenton
Tulsa, OK 74105

Coats & Associates Designers **
4444 E. 66
Tulsa, OK 74136

Coulter Whitesitt Inc. **
2121 S. Brentwood Blvd.
St Louis, MO 63144

Design Associates
702 S.W. 52
Lawton, OK 73505

Design Service
5301 McClanaham Drive
Little Rock, AR 72205

Directions in Design Inc. **
15340 Olive Street
St Louis, MO 63103

Disapio Design
2270 Industrial Blvd.
Norman, OK 73069

D.W. Design **
600 E. 103
Kansas City, MO 64131

Robert Fillmore Home Designer **
124 N.W. 67
Oklahoma City, OK 73116

J.D. Finney Residential Design Service
6405 E. Icellog
Wichita, KS 67209

General Plan Service Inc. **
11324 Kanis Rd.
Little Rock, AR 72211

Gulf Construction Company Inc.
218 E. Eufaula
Norman, OK 73069

Joe Gutknecht & Associates **
710 N. Tucker Blvd.
St Louis, MO 63101

Houck & Associates
1811 Industrial Blvd.
Norman, OK 73069

Lynn Leake-Design Group
812 Quail Ridge Rd.
Edmond, OK 73013

Johnatnan Majid **
Underground & Solar Design & Construction
3324 Classen Blvd.
Oklahoma City, OK 73118

Wm. Gary Mellenbruch Studio **
8118 N.W. Forest Drive
Kansas City, MO 64152

D.L. Middleton & Associates
110 S. Main
Tulsa, OK 74103

Donald C. Middleton **
6339 Blue Ridge Blvd.
Kansas City, MO 64133

New Trend Design
2568 Raymond
St Louis, MO 63113

Overnigh Drafting Inc. **
117 S.W. 10
Topeka, KS 66612

Pellham-Phillps Architects & Engineers **
1121 S. Glenstone Avenue
Springfield, MO 65804

Don Pisoni Inc.
515 N. Lindbergh Blvd.
St Louis, MO 63141

Ragan & Associates **
18506 E. 27 Terr.
Kansas City, MO 64108

Renditions **
3114 Illinois Avenue
St Louis, MO 63118

Robert Renshaw & Associates
7506 Melrose Ln.
Oklahoma City, OK 73127

Scheffer-Coleman
7930 State Line
Kansas City, KS 66103

Dick Sneary
4050 Broadway
Kansas City, MO 64111

Hugh Spraque & Associates **
10804 N. May
Oklahoma City, OK 73120

Bill Stigler **
Route 3 Box 239 N. Main
Muskogee, OK 74401

The Design Group
123 E. Tonkawa
Norman, OK 73069

Steven J. Turley
3534 Cherry
Kansas City, KS 66104

Ernest Van Horn & Associates Designers **
6130 E. 32
Tulsa, OK 74135

Tim L. Walker **
Route 1 Fair Grove
Springfield, MO 65803

Western Building & Development Company
205 E. Maine
Enid, OK 73701

John H. Yarbrough Designers
4040 Lincoln Blvd.
Oklahoma City, OK 73105

** Those subjects responding to the instrument.

ENVIRONMENTAL DESIGN ADMINISTRATORS:

Albertson Architects-Planners **
225 N. Market
Wichita, KS 67202

John Allison, AIA
Allison Moses Redden
217 W. 2
Little Rock, AR 72701

Architectural Group Inc.
8336 E. 73rd Street
Tulsa, OK 74133

Robert J. Bailey, AIA **
Associated Architect & Planners
11 Delray Drive
Little Rock, AR 72207

Associated Engineers Inc.
200 S.W. 30
Topeka, KS 66611

Bernoudy Associates Inc. **
281 N. Lindbergh Blvd.
St Louis, MO 63141

Blass Chilcote Carter Lanford & Wilcox
Capitol Center Building
303 W. Capitol
Little Rock, AR 72201

Bruton Knowles & Love Inc. **
6311 E. Tecumseh
Tulsa, OK 74115

Thomas Buchanan & Schwerdt **
2231 S.W. Wanamaker Rd.
Topeka, KS 66614

Bucher Willis & Ratliff, AIA **
9140 Ward Parkway
Kansas City, MO 64114

Burks Associates Architects & Planners **
1221 Locust Street
St Louis, MO 63103

Campbell Design Group **
8301 State Line
Kansas City, MO 64114

Christner Partnership Architects & Planners Inc.
3663 Lindell Blvd.
St Louis, MO 63108

Cluffa AA Architects-Planners **
629 N. New Ballas
St Louis, MO 63141

Cromwell Truemper Levy Parker & Woodsmall Inc. **
One Spring Street
Little Rock, AR 72201

Frank L. Davies Jr., AIA **
Davies & Poe Inc.
1420 W. Owen K Garriott Rd.
Enid, OK 73701

Robert L. Funk, R.A.
Felt Kingdom Associates Inc.
715 W. 13
Wichita, KS 67203

Jim W. Bruza, AIA **
Frankfurt-Short-Bruza-Associates
5701 N. Shartel, Suite 400
Oklahoma City, OK 73118

Ben L. Graves, AIA
Graves-Boynton-Williams & Associtees
900 36 Avenue N.W., Suite 100
Norman, OK 73069

Hammett-Schultz & Associates **
3324 E. 46
Tulsa, OK 74135

Richard T. Henmi, AIA **
Henmi & Associates Inc.
1221 Locust, Suite 1100
St Louis, MO 63103

Hollis & Miller Group **
9417 W. 75
Kansas City, KS 66204

James Ireland, AIA **
800 W. 47th, Suite 608
Kansas City, MO 64112

Kenneth A. Karkau, AIA
Karkau & Associates
501 S.E. 15
Edmond, OK 73013

Jack R. Bradley, AIA **
Keine & Bradley Design Group
First National Bank Tower
Topeka, KS 66603

B.J. Kingdom, AIA **
Law-Kingdom Inc.
345 Riverview Street
Wichita, KS 67203

Robt W. Marshall, AIA **
Marshall-Waters-Woody Associates
1736 E. Sunshine
Springfield, MO 65804

Matthews-Kahmann Architects & Engineers **
1949 E. Sunshine
Springfield, MO 65804

Michael L. Brockett, AIA
M B Associates Inc.
411 Adele
Joplin, MO 64801

Charles McAfee, FAIA **
2600 N. Grove Street
Wichita, KS 67219

Nathaniel Curtis Riddick **
First Commercial Building
Little Rock, AR 72201

Perr-Riehart-Thompson
Room 324 Lincoln Center
Ardmore, OK 73402

John H. Gates **
Planning Development Service Inc.
727 N. Waco Street
Wichita, KS 67203

Chris P. Ramos, AIA
Ramos Group Inc.
101 W. 11
Kansas City, MO 64116

Robert Riley, AIA **
7301 Mission Rd.
Kansas City, KS 66103

Stephen M. Rousseau, AIA
Rousseau-Fikes Inc.
913 S. Cumberland
Little Rock, AR 72202

Theodore Seligson, FAIA **
Seligson-Associates
106 W. 14
Kansas City, KS 66118

Robert E. Smith, AIA **
1623 N. Meridian
Wichita, KS 67203

Tegethoff Associates Inc.
910 W. 6
Little Rock, AR 72201

Jerry L. Brasier, AIA **
The Benham Group, Inc.
P.O. Box 20400
Oklahoma City, OK 73156

Warren & Goodin Architects-Engineers **
420 South Avenue
Springfield, MO 65806

Wilkins-Riedmann & Associates **
941 Park Avenue
St Louis, MO 63104

Wilson & Company Engineers & Architects
8047 Parallel Parkway
Kansas City, KS 66104

Witsell Evans & Rasco **
1302 Cumberland
Little Rock, AR 72202

** Those subjects responding to the instrument.

APPENDIX E

MEMBERS OF THE ADVISORY COMMITTEE

1. Dr. Joe Beckham, Professor of Drafting and Design, Central State University, Edmond, Oklahoma. Eighteen years teaching experience and five years experience as an architectural designer.

2. Mr. Richard Harrell, registered architect and civil engineer with 12 years practical experience in residential and light commercial building design and construction, Norman, Oklahoma.

3. Dr. Jose Tejada, registered civil engineer and former general manager of Integral Incorporated, Colombia, international design experience with significant advisory contributions to the field of engineering education.

4. Mr. John Wilhelm, architectural designer and construction contractor, Norman, Oklahoma, 14 years practical experience.

APPENDIX F

FORMULAS USED

$$t = \frac{\overline{D}}{\sqrt{\dfrac{\sum D^2 - \dfrac{(\sum D)^2}{N}}{N\,(N - 1)}}}$$

t = the t-value for nonindependent (correlated) means

D = the difference between the paired scores

$\overline{D}$ = the mean of the differences

D^2 = the sum of the squared difference scores

N = the number of pairs

VITA

Jimmie L. King

Candidate for the Degree of

Doctor of Education

Thesis: TECHNOLOGIST EDUCATION IN ARCHITECTURE: A STUDY OF CURRENT AND FUTURE OCCUPATIONAL RESPONSIBILITIES

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in Sallisaw, Oklahoma, July 24, 1953, the son of James W. and Opal L. King. Married to Adelaida Tejada-King.

Education: Graduated from Moore High School, Moore, Oklahoma, in May 1971; received Bachelor of Science Degree with major course work in Environmental Design from Central State University in December, 1978; received Master of Arts from Central State University in July, 1984; received Master of Education in Industrial Arts from Central State University in December, 1985; completed requirements for the Doctor of Education degree at Oklahoma State University in December, 1987.

Professional Experience: Police officer for 11 years; awarded the Medal of Valor on two occasions, four Meritorious Service Awards, two citations for wounds received; Commercial Diving Instructor since 1980; Professor, Department of Industrial Technology, Northeastern State University, August, 1987.