THE DEVELOPMENT OF A DRAFTING AND DESIGN PROGRAM FOR THE ADULT EVENING SCHOOL AT THE TULSA AREA VOCATIONAL-TECHNICAL CENTER

By

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Thesis Approved:

Thesis Adviser

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CHAPTER I

INTRODUCTION

One of the fastest growing divisions of our educational system is technical education. Our industrial development with its increasing complexities, however, has created new needs and requirements for technical manpower which are growing even more rapidly. Post-high school technical programs are developing within the framework of state vocational education services. Engineering colleges are developing those fields of technology closely associated with engineering. Industrial education is seeking to upgrade subject content to better use various technologies and to correlate them with modern-day, rapidly changing industrial aspects of our society.[1]

An estimated 295,000 draftsmen were employed in 1968. The large majority of draftsmen--about nine out of ten--are employed by machinery, electrical equipment and fabricated metal products industries. Non-manufacturing industries employing large numbers of draftsmen are engineering and architectural consulting firms, construction companies and public utilities.[2] There seems to be a definite need for additional drafting and design programs for persons in those areas. Persons presently working and not able to attend day classes should be offered an opportunity to train in the field they choose or to acquire additional training in the field in which they are presently working.

Statement of Problem

The development of curricula for preparing persons for technical employment is a difficult and complex task. Information relative to employment opportunities, students to be served and knowledge and skills required by the employee are essential for effective program planning.

The problem with which this study is concerned is the lack of information relative to knowledge and skills required by drafting and design employees.

Purpose of Study

The purpose of this study is to identify the knowledge and skills needed by drafting and design employees of selected companies in the Tulsa Metropolitan area.

Need for Study

The Tulsa Area Vocational-Technical Education Center has an obligation to fill the needs of the local community as far as occupational training is concerned. To do this many studies have to be made to determine the needs of the community. This study will help identify the skills and knowledge required of drafting and design employees.

Definition of Terms

Tulsa Area Vocational-Technical Education Center - a school serving the Tulsa area which provides an opportunity for persons to train in occupational areas.

Drafting and Design Program - a program which prepares persons for entry level employment or upgrading in a present position in the field of drafting and design.

Area Vocational-Technical Schools - schools designed to serve students from a geographical area larger than the single community or local school district. They may be developed by a consolidation of school districts for this purpose, a county board of education, a group of counties, or by a state as a whole.[3]

Programs - units of instruction which may consist of one short course covering one area of instruction or a number of courses covering another area.

FOOTNOTES

[1]C. H. Prewett, "An Integrated Approach to Technical Education," School Shop, XXVII (June, 1968), pp. 25-26.

[2]Oklahoma State Department of Vocational and Technical Education - Division of Research, Planning and Evaluation, "Drafting" (pamphlet, 1970), p. 2.

[3]Walter J. Brooking (ed.), Engineering Technicians (Chicago, J. G. Ferguson Publishing Co., 1969), p. 37.

CHAPTER II

REVIEW OF THE LITERATURE

The review of literature will be presented as follows: (1) Historical advancement of technology in the United States; (2) Historical advancement of drafting and design; (3) Adult education; (4) Technical education; and (5) The development of the Tulsa Area Vocational-Technical Center. It should be noted that only a few studies were available pertaining to the implementation and development of drafting and design programs.

Historical Advancement of Technology in the United States

Colonial American technology was essentially medieval in character. The Europeans who came to the new land across the Atlantic brought with them a strong tradition of technology - plows and muskets, windmills and sailing ships. The Middle Ages had been rich in technical innovation, and it was largely the technical superiority these innovations gave to the colonists that allowed them to destroy or subdue the native peoples they found already occupying the land. Gradually the somewhat different demands of the new environment and the colonists' increasing exposure to the technology of the American Indians brought about changes in their European technology.[1]

Perhaps the most important fact about all our early history is the fact that the American Revolution and the Industrial Revolution took

place at the same time. In this time of political turmoil in North America, James Watt perfected his steam engine; Arkwright, Cartwright, Crompton and others mechanized the textile industry; the first canal was built and the first steamboats constructed; and the iron industry was fundamentally changed by the introduction of coal, puddling furnaces and rolling mills. This burst of technical innovation was so widespread and so fundamental that the term "Revolution" is always used to describe it.[2]

During the period of time ranging from the time of the American Revolution to the outbreak of the Civil War, young America astonished the world by her rapid growth. Territorially she expanded to the Pacific Coast. In manufacturing, her mills and factories turned out products that challenged the output of the Old World's seasoned industries. In technology, her inventive genius was developing improved tools, techniques and new machines.[3]

During the Civil War leaders looked to science as a source of innovation. This animated some industrial leaders as well in the years after the war. Like the Revolutionary War, the Civil War tended to depress the indices of economic growth and divert for a time the nation's attention from industrial innovation and an awareness of British developments. After the war, however, the American economy continued its expansion - the new Bessemer steel industry and the engineering feat of constructing a transcontinental railroad nicely stimulated each other and the nation to new heights of developments. At the same time a number of entirely new industries based upon a knowledge of recent scientific discoveries sprung up to create new fields for investment and profit.[4]

The era preceeding World War I is often referred to as the "Progressive Era." This was a critical time for American technology. Until this time, engineers and mechanics worked individually to advance their crafts and in small groups to further their professional standing; but for technical advancement World War I was a technical crusade, a great national planning. Profit was subordinate to production and innovation was applauded rather than fought. It was, in short, a crusade of heroic proportions, one which dwarfed in scale and significance whose efforts that had been made against wasteful resources exploitation or municipal corruption. With large hopes and good hearts, the nation's technical men, from draftsmen to engineers to corporation presidents, set about the task of making a better world.[5]

The golden years of the 1920's after the war were cut off with savage abruptness when the stock market crashed in October of 1929. From the dizzying heights of optimism and good times, the nation slid precipitously into a decade of pessimism and despair.[6]

Throughout our nation's history wars have had a pronounced effect on technological development, and the application of scientific discoveries has been a determining factor in all of our armed conflicts.[7] World War II was no exception. Technological advancements have been on a rapid increase since that time. Yes, technical change has done well by Americans. It has contributed mightily to the improvement of health, the spread of leisure and the enrichment of life generally. If results be the standard, the institutions of the American economy that foster and adjust to technical change have been remarkably effective.[8]

Historical Advancement of Drafting and Design

From the beginning of recorded history, man has been forced to prepare drawings. Without them, it is questionable if man could have produced what is still in evidence - the fine old buildings, bridges, aqueducts, and other structures, some of which are recognized as "Wonders of the World."[9] The Bible states that Solomon's Temple was "built by stone, made ready before it was brought together" indicating that drawings were used to describe the forms and sizes of their individual members. Likewise, the ancient Greek temples, so complex in arrangement and refined in detail--as the Parthenon for example--could not have been constructed without accurate drawings to guide the building and assembly.

Vitruvius, in 30 B. C., wrote a treatise on architecture in which he referred to projection drawings for structures, but it was not until the early part of the fifteenth century that the subject was well developed by the Italian architects Brunilleschi, Alberti and others.[10] Now drafting is the accepted means of expression used by the scientist, engineer, designer, technician and tradesman. Regardless of their work, these people either make sketches or drawings or must be able to read them. Usually an idea starts with a rough sketch, then the sketch is refined and made into a finished mechanical drawing.[11]

In the distant past a person who had become skilled in the art of design had first been trained as an apprentice to a master and then as a probationer in the unsympathetic grip of experience. Years later he became a master himself. In the last century the physical sciences and mathematics progressively have become such valuable tools that the designer now develops competence in them before essaying the field.[12]

Written or spoken language is inadequate to describe any but the most elementary forms. Specifications which accompany the drawings used in the buildings of structures are worthless without the drawings for which they were prepared. Together the drawings and the specifications are the instruments which enable the designer to convey his ideas to the builder and which enable the builder and owner to agree on a definite undertaking.[13]

Adult Education

In spite of signs to the contrary, our nation is still committed to the worth and dignity of the individual.[14] Adult education can help fulfill these goals. Adult education may be defined as any purposeful effort toward self-development carried on by an individual without direct legal compulsion and without such effort becoming his major field of activity. It may be concerned with any or all of the three aspects of his life: his work life, his personal life and his life as a citizen.[15]

There are a number of crucial problems that lie ahead for adult education to tackle. These problems are with us today, but it remains for the future to attack them with the power and the vigor that their solution will require. A number of these problems are listed below:

1. Helping large masses of people to adjust to a Space Age environment, an environment which has come upon us so rapidly that we have not learned how to react to it or to live in it.
2. Preparing people to make wise decisions on such momentous questions as war and peace, civilian defense, maintaining a demo-

cratic way of life, providing a high standard of living, helping underdeveloped countries, planning and financing education at all levels, analyzing and combatting malicious propaganda, carrying on extensive programs of research and scientific investigations, providing justice for all, and living ethically and morally.

3. Helping over 300,000 women each year to switch from housework to jobs. Wives, mothers and widows will need marketable skills in order to be gainfully employed. Adult education will help them brush up on old skills and acquire new ones.
4. Preparing several million young workers each year to get started on and to grow in new jobs which require considerable technical competence for starting and considerable flexibility for holding.
5. Assisting large numbers of the sixty-odd millions of workers now employed to keep pace with the ever increasing technological developments in their work through guidance and through training and retraining.[16]

The question often arises "Are we seeking a society where adult education, for all intents and purposes, would be as compulsory as is elementary and secondary education?"[17] To answer this question, one must examine a few characteristics concerning adult learning. If an adult class were to be divided into two sections, one expected to make slow progress, age would be practically worthless as a basis for the division. Capacity, interest, energy and time are the essentials.[18] Adults are interested in performing their jobs at a higher level of skill and qualifying for positions of greater responsibility than those they

presently occupy. This suggests an infinite number of possibilities for vocational preparation, retraining and in-service growth experiences among industrial, commercial and distributive lines.[19] Adult education takes advantage of the older person's superior ability to solve problems which require reason and judgment. Adult education ties in the experiences of adults with other behavior patterns, with their basic loyalties, with their aptitudes and with their environment.[20] Therefore, it can be seen that adult education should not become compulsory as other types of education.

It must be remembered, if adult persons are to be served, that adult programs must be geared to their convenience with instruction offered at unusual times even during wee small hours. Nor should we feel that all sessions of a particular activity must occur on the same hourly schedule. Once organized, a learning group may adapt its work schedule in many ways to expedite group action and take advantage of special opportunities for fruitful learning experiences.[21] It should also be remembered that the evening student has made sacrifices to attend class. It isn't easy for him to come earlier, stay later, or come another night. His main interest is the class he has elected to attend.[22]

Engineers say a machine is efficient if the amount of power produced is high in comparison to the amount of fuel put into it. In this sense it may be said that adult education is efficient. The achievement is high in comparison to the time and money invested.[23]

Technical Education

It has been found that the demand for workers education for technical occupations has increased greatly during the past few years.[24]

Technicians are among the fastest growing occupational groups in the United States. In recent years the needs on an expanding and increasingly technical economy have greatly intensified the demand not only for engineers and scientists, but also for those technical workers who assist them.[25] The need for technical workers is more evident in industry than in other occupational fields. A study made by the Bureau of Labor Statistics for the National Science Foundation indicated that there were about 594,000 technicians in American industry in 1960. This was an increase of eight percent over the comparable figure for 1959.

Development of Tulsa Area Vocational-Technical Education Center

The Tulsa Area Vocational-Technical Education Center first opened for operation in September of 1965. The doors were first opened to high school students to attend three hours a day, either morning or afternoon. The students would attend their home high schools the other half day. Only students needing, wanting and profiting from the education were admitted to the center. The Tulsa Area Vocational-Technical Center was the first of its kind to open in the state.

The Vocational Education Act of 1963 provides for training of the following: (1) high school students (2) full-time study for persons who have completed or left high school (3) persons presently employed but who need training or retraining to achieve stability or advance in employment and (4) persons who have academic, socio-economic or other handicaps that prevent them from succeeding in the regular education programs.[26]

The Tulsa Area Vocational-Technical Education Center now offers numerous vocational and technical night courses under adult education.

There are twenty-three day high school programs and five day post-secondary programs. Advisory committees work with the school to help establish, maintain and evaluate the courses offered.

FOOTNOTES

[1] Carroll W. Pursell, Jr., Readings in Technology and American Life (New York, Oxford University Press, 1969), p. 5.

[2] Ibid, p. 27.

[3] John W. Oliver, History of American Technology (New York, Ronald Press Co., 1956), p. 123.

[4] Carroll W. Pursell, Jr., Readings in Technology and American Life (New York, Oxford University Press, 1969), p. 111.

[5] Ibid, p. 281.

[6] Ibid, p. 337.

[7] John W. Oliver, History of American Technology (New York, Ronald Press Co., 1956), p. 89.

[8] Richard R. Nelson, Merton J. Peck, and Edward D. Kalachek, Technology Economic Growth and Public Policy (Washington, Brookings Institution, 1967), p. 171.

[9] J. W. Giachino and H. J. Beukema, Drafting Technology (Chicago, American Technical Society, 1964), p. 4.

[10] F. E. Giesecke, Alva Mitchell, and H. C. Spencer, Technical Drawing (New York, The Macmillan Co., 1940), p. 1.

[11] J. W. Giachino and H. J. Beukema, Drafting Technology (Chicago, American Technical Society, 1964), p. 5.

[12] Thomas T. Woodson, Introduction to Engineering Design (New York, McGraw-Hill Book Co., Inc., 1966), pp. 2-3.

[13] F. E. Giesecke, Alva Mitchell, and H. C. Spencer, Technical Drawing (New York, The Macmillan Co., 1940), p. 2.

[14] Stephen Romine, "A Personal Professional Tradition," Adult Leadership, XVII (December, 1968), p. 281.

[15] F. W. Reeves, T. Fansler, and C. O. Houle, Adult Education (New York, McGraw-Hill Book Co., Inc., 1938), p. 3.

[16] Barton Morgan, Glen Holmes, and Clearance Bundy (2 ed.), Methods in Adult Education (Danville, Ill., Interstate Printers and Publishers, 1963), pp. 177-178.

[17] John Ohliger, "Lifelong Learning - Voluntary or Compulsory," Adult Leadership, XVII (September, 1968), p. 124.

[18] Edward L. Thorndike et al., Adult Learning (New York, The Macmillan Co., 1928), pp. 178-179.

[19] Robert H. Snow, Community Adult Education (New York, Putnam, 1955), p. 13.

[20] Barton Morgan, Glen Holmes, and Clearance Bundy (2 ed.), Methods in Adult Education (Danville, Ill., Interstate Printers and Publishers, 1963), p. 17.

[21] Robert H. Snow, Community Adult Education (New York, Putnam, 1955), p. 13.

[22] Terry O'Banion, "For Adults Only," Adult Leadership, XVII (June, 1968), pp. 57-58.

[23] Barton Morgan, Glen Holmes, and Clearance Bundy (2 ed.), Methods in Adult Education (Danville, Ill., Interstate Printers and Publishers, 1963), p. 9.

[24] Roy W. Roberts (2 ed.), Vocational and Practical Arts Education (New York, Harper and Row, 1965), p. 31.

[25] United States Department of Labor, Occupational Outlook Handbook (1966-67 Ed.), Bulletin No. 1450, p. 220.

[26] State Department of Vocational-Technical Education, Pamphlet given out by Area Vocational-Technical Center in Oklahoma, p. 2.

CHAPTER III

METHODOLOGY AND RESULTS

Introduction

This chapter will be divided into two parts as follows: (1) Methodology and (2) Results.

Methodology

A list of companies hiring draftsmen and designers was furnished by the Tulsa Chamber of Commerce. From this list, thirty-one companies were selected for the study. See Appendix D for a list of the companies.

Some large companies such as North American Rockwell were eliminated because of large layoffs and if there is any future employment of designers and draftsmen, they will have their own in-service programs and call back persons with tenure.

Other companies were eliminated because of the lack of a number of draftsmen and designers. Companies were chosen on the basis of willingness to cooperate.

Personal interviews with the heads of the drafting and design departments were made. A structured interview schedule was used. See Appendix A for a sample of the structured interview schedule.

A letter of introduction was written by John Marrs who is the Business and Industrial Training Coordinator of the State Department of

Vocational and Technical Education in the Tulsa area. See Appendix B for the letter of introduction. A copy of the letter was mailed to each company before the interviews were made. When the companies were visited they were shown a second copy of the letter.

The heads of the drafting and design departments were approached and were asked to answer the questions as listed on the structured interview schedule as relating to the knowledge and skills needed by their employees.

Results

Responses relative to the most convenient time for attending classes are reported in Table I. These data indicate that courses should be offered in the evening if they are to serve the needs of the employees of the companies indicated in the study.

TABLE I

TIME MOST CONVENIENT FOR ATTENDING CLASS

Time	Number of Companies Preferring
Morning	0
Afternoon	0
Evening	31

Responses relative to the best days for attending classes are listed in Table II. It was found that the best days to offer classes are Monday, Tuesday, Wednesday, and Thursday.

TABLE II

BEST DAYS FOR ATTENDING CLASS

Day	Number of Companies Preferring
Monday	31
Tuesday	29
Wednesday	31
Thursday	29
Friday	3
Saturday	1
Sunday	0

Reactions to specific subject areas showed much demand for basic drawing, machine drafting, structural drafting, electrical and electronics drafting, math, and design courses. Areas showing the least number of responses were architectural drafting and map drafting. See Table III for the numbers of companies preferring each specific unit of instruction.

TABLE III

AREAS OF INSTRUCTION RECOMMENDED BY COMPANIES

Units of Instruction	Number of Companies Preferring
BASIC DRAWING:	
Lettering Exercises	31
Orthographic Projection	31

TABLE III (Continued)

Units of Instruction	Number of Companies Preferring
Sketching	28
Inking & Reproduction	24
Auxiliary Views	29
Sectional Views	30
Dimensioning	31
Working Drawings	31
Isometric Projection	28
Oblique Projection	19
Perspective Drawings	17
Intersections & Developments	26
MACHINE DRAFTING:	
Surface Treatment of Metals	21
Tolerancing	23
General Machine Drawing	22
Casting and Forging	22
Fabrication	26
Cams	14
Gears	14
STRUCTURAL DRAFTING:	
Detail Drawings	23
Erection Drawings	23
ELECTRICAL & ELECTRONICS DRAFTING:	
Graphic Symbols	17
Connection Diagrams	13

TABLE III (Continued)

Units of Instruction	Number of Companies Preferring
Printed Circuits	12
Block Diagrams	13
Harness Diagrams	11
Schematic Diagrams	17
ARCHITECTURAL DRAFTING:	
Residential	3
Commercial	8
MAP DRAFTING:	
Survey Practice	6
Topographic Maps	2
Contour Maps	2
Profile Maps	2
PIPE DRAFTING:	
Nomenclature, Plans & Details	14
Flow Diagrams	13
Vessel Drawings	14
Exchanger Drawings	14
DESIGN:	
Hydraulics & Pneumatics	17
Mechanisms & Kinematics	13
Tool (Jigs & Fixtures)	13
Statics & Dynamics	26
Strength of Materials	29
Structural	28

TABLE III (Continued)

Units of Instruction	Number of Companies Preferring
Machine	15
Materials of Industry	22
MATH:	
Addition, Subtraction, Multiplication & Division	31
Ratio & Proportion	28
Use of Exponents	27
Use of Formulas	31
Measurement (includes areas & volumes)	31
Logarithms	27
Solutions of Triangles	31
Use of Smoley's Handbook	27
Slide Rule	27
GENERAL:	
Report Writing	10
Machine Shop	16
OTHER:	
Data Processing	2
Descriptive Geometry	9
A. W. S. (Welding Symbols)	4
Sheet Metal Fabrication	3
Use of AISC (Manual)	14
Public Relations Course	5

The existing program in drafting and design consists of trimester courses which were first set up as short job entry level courses with a few design courses used for upgrading purposes. Consequently, there was such a demand for the courses that a well-rounded curriculum was not developed. Using the information which was compiled plus an outline of the present schedules, a suggest curriculum with course descriptions was developed. The suggested curriculum is included in Appendix C.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study is to identify the knowledge and skills needed by drafting and design employees of selected companies in the Tulsa Metropolitan area. A list of companies who hire draftsmen and designers was furnished by the Tulsa Chamber of Commerce. From this list thirty-one companies were selected for the study.

The heads of the drafting and design departments were interviewed with the use of a structured interview schedule. Questions were asked relating to the most convenient times for attending classes, the best days for attending classes, and course content.

Conclusions

It was found that the classes should be offered in the evening if they were to serve the needs of the employees of the companies interviewed. It should be noted that Monday, Tuesday, Wednesday, and Thursday would be the best days for attending classes. Units of instruction which were found to be in the most demand include basic drawing, machine drafting, structural drafting, math, and design. Courses in less demand were map drafting and architectural drafting.

A suggested curriculum with course descriptions was developed by compiling information from the structured interview schedules and the

existing curriculum. The suggested drafting and design curriculum consists of a two-year six-trimester course with a total of 682 hours if the complete curriculum is followed. It should be pointed out that many persons could enroll in the suggested classes for updating and upgrading purposes, therefore, only taking a needed portion of the total curriculum.

A SELECTED BIBLIOGRAPHY

Brooking, Walter J. (ed.). Engineering Technicians. Chicago: J. G. Ferguson Publishing Co., 1969.

Giachino, J. W. and H. J. Beukema. Drafting Technology. Chicago: American Technical Society, 1964.

Giesecke, F. E., Alva Mitchell, and H. C. Spencer. Technical Drawing. New York: The Macmillan Co., 1940.

Morgan, Barton, Glen Holmes, and Clearance Bundy (2 ed.). Methods in Adult Education. Danville, Illinois: Interstate Printers and Publishers, 1963.

Nelson, Richard R., Merton J. Peck, and Edward D. Kalachek. Technology Economic Growth and Public Policy. Washington: Brookings Institution, 1967.

O'Banion, Terry. "For Adults Only." Adult Leadership, XVII (June, 1968), 57-58.

Ohliger, John. "Lifelong Learning - Voluntary or Compulsory." Adult Leadership, XVII (September, 1968), 124.

Oklahoma State Department of Vocational and Technical Education - Division of Research, Planning and Evaluation. "Drafting." (pamphlet, 1970), 2.

Oliver, John W. History of American Technology. New York: Ronald Press Co., 1956.

Prewett, C. H. "An Integrated Approach to Technical Education." School Shop, XXVII (June, 1968), 25-27.

Pursell, Carroll W., Jr. Readings in Technology and American Life. New York: Oxford University Press, 1969.

Reeves, F. W., T. Fansler, and C. O. Houle. Adult Education. New York: McGraw-Hill Book Co., Inc., 1938.

Roberts, Roy W. (2 ed.). Vocational and Practical Arts Education. New York: Harper and Row, 1965.

Romine, Stephen. "A Personal Professional Tradition." Adult Leadership, XVII (December, 1968), 281.

Snow, Robert H. Community Adult Education. New York: Putnam, 1955.

State Department of Vocational-Technical Education. (pamphlet given out by Area Vocational-Technical Center in Oklahoma), 2.

Thorndike, Edward L., et al. Adult Learning. New York: The Macmillan Co., 1928.

United States Department of Labor. Occupational Outlook Handbook (1966-67 Ed.), Bulletin No. 1450.

Woodson, Thomas T. Introduction to Engineering Design. New York: McGraw-Hill Book Co., Inc., 1966.

APPENDIX A

STRUCTURED INTERVIEW SCHEDULE

STRUCTURED INTERVIEW SCHEDULE

1. What would be the best time for you to attend classes?

_____(a) Morning
_____(b) Afternoon
_____(c) Evening
_____(d) Other (specify)

2. What would be the best days for you to attend classes?

_____(a) Monday
_____(b) Tuesday
_____(c) Wednesday
_____(d) Thursday
_____(e) Friday
_____(f) Saturday
_____(g) Sunday

3. Given the areas below, check the areas which may benefit you:

_____I. Basic Drawing

_____(a) Lettering
_____(b) Orthographic Projection
_____(c) Sketching
_____(d) Inking & Reproduction
_____(e) Auxiliary Views
_____(f) Sectional Views
_____(g) Dimensioning
_____(h) Working Drawings
_____(i) Isometric Projection
_____(j) Oblique Projection
_____(k) Perspective Drawings
_____(l) Intersections & Developments
_____(m) Other (specify)

____II. Machine Drafting

_____(a) Surface Treatment of Metals
_____(b) Tolerancing
_____(c) General Machine Drawing
_____(d) Casting and Forging
_____(e) Fabrication
_____(f) Cams
_____(g) Gears
_____(h) Other (specify)

___III. Structural Drafting

_____(a) Detail Drawings
_____(b) Erection Drawings
_____(c) Other (specify)

____IV. Electrical & Electronics Drafting

_____(a) Graphic Symbols
_____(b) Connection Diagrams
_____(c) Printed Circuits
_____(d) Block Diagrams
_____(e) Harness Diagrams
_____(f) Schematic Diagrams
_____(g) Other (specify)

_____V. Architectural Drafting

_____(a) Residential
_____(b) Commercial
_____(c) Other (specify)

____VI. Map Drafting

_____(a) Survey Practice
_____(b) Topographic Maps
_____(c) Contour Maps
_____(d) Profile Maps
_____(e) Other (specify)

___VII. Pipe Drafting

_____(a) Nomenclature, Plans & Details
_____(b) Flow Diagrams
_____(c) Vessel & Exchanger Drawings
_____(d) Other (specify)

__VIII. Design

_____(a) Hydraulics & Pneumatics
_____(b) Mechanisms & Kinematics
_____(c) Tool (Jigs & Fixtures)
_____(d) Statics & Dynamics
_____(e) Strength of Materials
_____(f) Structural
_____(g) Machine
_____(h) Materials of Industry
_____(i) Other (specify)

____IX. Math

_____(a) Addition, Subtraction, Multiplication & Division
_____(b) Ratio & Proportion
_____(c) Use of Exponents
_____(d) Use of Formulas
_____(e) Measurement (includes areas & volumes)
_____(f) Logarithms
_____(g) Solutions of Triangles
_____(h) Use of Smoley's
_____(i) Slide Rule
_____(j) Other (specify)

_____X. General

_____(a) Report Writing
_____(b) Machine Shop
_____(c) Other (specify)

____XI. Other (specify)

APPENDIX B

LETTER OF INTRODUCTION

VoTech
OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
INDUSTRIAL AND TECHNICAL SERVICES • 616 South Boston Avenue • Tulsa, Oklahoma 74119 • A. C. (918) 585-1201

Dear Sir:

The Oklahoma State Department of Vocational and Technical Education, has accepted the challenge of providing trained manpower to meet the needs of our local communities within the State. If we are to provide trained manpower appropriate to the demands of business and industry, we must know what the present and projected skill requirements are.

This is to introduce Mr. Vance McNeal, a representative of Vocational and Technical Education. He is seeking manpower skill requirements information to be utilized in developing training programs.

We earnestly solicit your cooperation during our representative's visit with your company. We plan this activity as a systematic and continuing effort to make Oklahoma's Vocational and Technical Education program more effective and responsive to your training needs.

Sincerely,

John C. Marrs

John C. Marrs
Business & Industrial Training Coordinator
State Department of Vocational & Tech. Education

JCM/evd

APPENDIX C

SUGGESTED CURRICULUM AND COURSE DESCRIPTIONS

DRAFTING AND DESIGN CURRICULUM

FIRST YEAR:

First Trimester

Basic Drafting (44 hours)
Machine Shop (44 hours)
Basic Math (22 hours)
Report Writing (22 hours)

Second Trimester

Basic Drafting II (44 hours)
Electrical & Electronic Drafting (44 hours)
Math I (22 hours)
Elective - Group No. 1 (22 hours)

Third Trimester

Machine Drafting (44 hours)
Use of Smoley's Handbook (22 hours)
Statics & Dynamics (44 hours)
Math II (22 hours)

SECOND YEAR:

Fourth Trimester

Pipe & Vessel Drafting (44 hours)
Strength of Materials (44 hours)
Elective - Group No. 1 (22 hours)

Fifth Trimester

Structural & General Design Problem (44 hours)
Elective - Group No. 2 (44 hours)

Sixth Trimester

General Design Problems (44 hours)
Elective - Group No. 2 (44 hours)

Electives

Group No. 1

English Grammar for Business
Spelling & Vocabulary Building
Algebra - Elementary or Intermediate
Geometry
Slide Rule
Blueprint Reading
Others as approved

Group No. 2

Basic Drafting III
Structural Drafting
Architectural Drafting (Residential)
Architectural Drafting (Commercial)
Map Drafting (including survey practice)
Descriptive Geometry
Others as approved

Course Descriptions for Drafting and Design

BASIC DRAFTING

Designed for beginners in drafting, this course develops skills in using instruments, lettering, orthographic projection, and isometric drawings. This is a basic course for all drafting and design courses to follow.

MACHINE SHOP

This course involves the performance of fundamental operations on the lathe, drill press, planer, shaper, milling machine, grinder, and tool grinding. This course will provide related technical knowledge and some practical experience concerning the machinist trade.

BASIC MATH

A course designed to review and teach practical applications of arithmetic. Units in addition, subtraction, multiplication, division, fractions, decimals, roots, powers, proportions, and percentages will be presented.

REPORT WRITING

A course to develop the students' potentials in writing. The course also develops effective writing habits with proper sentence structure and increased vocabulary.

BASIC DRAFTING II

This course is organized to further develop those skills learned in the first basic drafting course. Further instruction will be given in dimensioning and tolerancing and general working drawings.

ELECTRICAL AND ELECTRONIC DRAFTING

This course is designed to familiarize students with electrical and electronic drafting. Emphasis is placed on drawing of component parts, block diagrams, elementary diagrams, working and interconnection diagrams.

MATH I

A basic math course designed to teach basic algebra and geometry as applied to the drafting and design industry. Units in transposing formulas, use of exponents, measurements of area and volume and logarithms will be taught.

MACHINE DRAFTING

This course provices drafting experience in making detail drawings of machine and operating mechanisms including gears, cams, and threads.

USE OF SMOLEY'S HANDBOOK

A course designed to give the students practice solving problems with the use of the "Smoley's." All four books will be presented and covered.

STATICS AND DYNAMICS

A basic course in statics and dynamics. Solving resultants of force systems in plane and space equilibrium. Also kinematics and kinetics of particles, rigid bodies, and systems.

MATH II

An advanced math course designed to acquaint the students with advanced algebra and trigonometry. Units in use of radians, natural and logarithmic functions, right and oblique triangles will be presented.

PIPE AND VESSEL DRAFTING

Problems of dealing with design and layout of piping systems. Emphasis is placed on the use of catalogues and pamphlets as guides to selecting fittings, valves, and pipes used in industry.

STRENGTH OF MATERIALS

This course covers areas in simple stress and strains, combined stresses and strains, deflections, and buckling. Prerequisite: Statics and Dynamics.

STRUCTURAL AND GENERAL DESIGN PROBLEMS

This course consists of the designing and detailing of structural buildings, bridges, tanks, and towers. Practical problems will be presented. Use of the A.I.S.C. Manual will be a basic part of the course. Prerequisite: Strength of Materials.

GENERAL DESIGN PROBLEMS

This is a general design course covering units in welding, jigs and fixtures, belts, flywheels, springs, engineering materials, linkages, and applied design problems.

ENGLISH GRAMMAR FOR BUSINESS

A review of English grammar and the application of the principles to business correspondence.

SPELLING AND VOCABULARY BUILDING

Improve your spelling and pronunciation. Enrich your conversation by use of new and more meaningful words.

ALGEBRA - ELEMENTARY OR INTERMEDIATE

Elementary algebra is an introduction to algebra with special emphasis on formulas. Intermediate algebra includes review of elementary algebra; exponents; roots and radicals; ratio, proportion, and variation; approximate numbers and logarithms; slide rule; trigonometry functional relations and fractional equations; determinants; quadratic functions; binominal theorem; progressions and series; permutations, combinations, and probability; statistics; theory of equations; and rate of change.

GEOMETRY

The study of lines, angles, triangles, and other geometric shapes. Mathematical skill developed in this class may be applied to many areas.

SLIDE RULE

Valuable in making quick estimates in problems involving percentages, multiplication, division, square root and proportion.

BLUEPRINT READING

Learn to read industrial blueprints. The course covers the techniques of making simple shop sketches, reading and interpreting simple machine drawings as well as drawings of complex parts and mechanisms for features of design, fabrication, construction and assembly. A general understanding of conventional methods, symbols and abbreviations will be developed.

BASIC DRAFTING III

A continuation of Basic Drafting II. Units covered will be oblique projection, perspective projection, intersection and developments as used in the sheet metal industry.

STRUCTURAL DRAFTING

This course will consist of drawing details and erection drawings. The use of steel manuals will be a basic part of the course.

ARCHITECTURAL DRAFTING (RESIDENTIAL)

This course will consist of making a complete set of plans for a residential home. Material and cost estimating will also be included.

ARCHITECTURAL DRAFTING (COMMERCIAL)

Drafting problems dealing with buildings will be presented. Estimating will also be included.

MAP DRAFTING

This course will include practice using surveying equipment while solving problems. Areas including topographic maps, contour maps, profile maps.

DESCRIPTIVE GEOMETRY

The relationships between geometric elements such as points, lines, and planes are taught and skill is developed in solving problems concerning these relationships. Topics covered include point and line, plane and plane, and line and plane relationships, revolutions, intersections, and developments and vectors.

APPENDIX D

LIST OF COMPANIES INTERVIEWED

1. Aldor Manufacturing Co.
2. Allied Steel Products
3. Born Engineering Co.
4. Braden Steel Co.
5. Builders Steel Co.
6. Burtek, Inc.
7. Byron Jackson
8. CRC-Crose International, Inc.
9. Crest Engineering Co.
10. Econo-Therm Co.
11. Flint Steel Co.
12. Gemco, Inc.
13. Global Engineering Co.
14. Industrial Fabricating Co.
15. John Zink
16. Kentube Co.
17. Lowrance Electronics
18. Midwestern Instruments
19. Nelson Electronics
20. Nutter Engineering Co.
21. Oklahoma Natural Gas Co.
22. Patterson Steel Co.
23. Ramsey-Winch
24. T. D. Williams, Inc.
25. Unit Rig
26. Ventaire Corporation
27. W. C. Norris Div. of Dover Corp.
28. Webster Engineering Co.
29. Williams Bros. Pipeline Co.
30. Yuba Heat Transfer Division
31. Zephyr Metal Craft

VITA

Edward Vance McNeal

Candidate for the Degree of

Master of Science

Thesis: THE DEVELOPMENT OF A DRAFTING AND DESIGN PROGRAM FOR THE ADULT EVENING SCHOOL AT THE TULSA AREA VOCATIONAL-TECHNICAL CENTER

Major Field: Technical Education

Biographical:

Personal Data: Born at Ada, Oklahoma, October 9, 1944, the son of Erskin and Lorena McNeal.

Education: Graduated from Vanoss High School, Vanoss, Oklahoma, in 1962; graduated from East Central State College in 1966 receiving a Bachelor of Science in Education Degree; attended Oklahoma State University with courses in Trade and Industrial Education; started on requirements for Technical Education major in the summer of 1969; completed requirements for the Master of Science Degree in May, 1972.

Professional Experience: Secondary Vocational Drafting instructor at Webster High School, Tulsa, Oklahoma, from 1966 to 1968; Post-Secondary Drafting and Design instructor at the Tulsa Area Vocational-Technical Center from 1968 to 1972.