THE ATTITUDES OF TECHNOLOGY GRADUATES AND EMPLOYERS RELATIVE TO THE INSTRUCTIONAL CONTENT IDENTIFIED FOR A BASIC ELECTRONIC COURSE FOR NON-ELECTRONIC MAJORS IN THE SCHOOL OF TECHNOLOGY AT OKLAHOMA STATE UNIVERSITY

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The writer wishes to dedicate this study to his wife, Sally, and two daughters, Christy and Ashli.

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CHAPTER I

THE PROBLEM

Introduction

The professional technical educators who are a part of today's rapidly advancing technological age are being confronted with the problems of curriculum development and course construction/revision to such an extent that in many technology fields nothing is constant except the constancy of change. The electronics technology serves as an example. During the last ten years, technological changes have advanced the state of the art from tubes and tube theory to integrated circuits and micro-miniaturization. But, what has happened to the educators, administrators, supervisors, and instructors who have made attempts to update technical curriculums to keep pace with technology? Often the products of their labor have fallen short due to the lack of information available from the technical curriculum. Such was the case at Oklahoma State University with the course, General Technology 3104, an introductory electronics course for non-electronic technology students.

Statement of the Problem

In 1971, a research study was undertaken by Richard L. Castillucis (2), electronics instructor in the School of Technology at Oklahoma State University, to identify the instructional content deemed appropriate for inclusion into a basic electronics course for non-electronic majors in the School of Technology. His approach to the study correlated the desires of twenty professional technical educators in eight different technologies outside the electronics field as to (1) the feasibility of such a course and (2) the actual course content. The results of his study were implemented within the existing introductory course and eventually the course was retitled, GENT 3104, as it exists today.

During the restructuring of this course in 1971, one of the major problems encountered in attempting to define instructional content was the lack of feedback information concerning the attitudes of technology graduates and industry, i.e. employers, towards both the course and its content. Because of the nonavailability of feedback information, General Technology 3104 as it then existed was based upon the educational and industrial experiences of a minority.

The problem for this study was the lack of specific feedback information concerning the attitudes of technology graduates and the industrial community which could be utilized for the purpose of revising the instructional content of GENT 3104.

Purpose of the Study

The purpose of this study was to ascertain the attitudes of technology graduates and their respective employers relative to the instructional content considered appropriate for inclusion into an introductory course of electronics (GENT 3104) which was offered by the School of Technology at Oklahoma State University.

Research Questions

The following research questions were investigated in the study.

1. How do graduates perceive the importance of the instructional content to their job?
2. How do employers perceive the importance of the instructional content to the job being performed by the graduate?
3. How do graduate and employer perceptions of the importance of the instructional content to the job relate?

In addition to these research questions, the null hypothesis (Ho) tested in this study was that no relationship existed between the attitudes of the graduates and the attitudes of employers towards the importance of the instructional content of GENT 3104.

Need for the Study

The need for this type research study was made evident through two sources, the review of literature and curriculum development/revision process used in many educational institutions today.

One of the major stumbling blocks in curriculum design and revision is deciding what additions and deletions must be made to ensure the attainment of specified educational standards. The curriculum development process, especially in technical education, should be a cooperative venture between professional educators, students, and industry. In many cases, this process has been undertaken with incomplete data. Often no feedback data concerning attitudes of the student-industry segments has been available to curriculum designers. This was the case for GENT 3104. This research study made data from the student-industry segments available to curriculum designers so that a more realistic approach may be taken toward the content revision of GENT 3104.

Scope

The scope of this study included:

1. The measurement of the attitudes of technology graduates and their respective employers relative to the instructional content considered appropriate for inclusion into GENT 3104.
2. The population selected was limited to graduates of those technology areas from the School of Technology at Oklahoma State University designated below:
   a. Petroleum Technology
   b. Mechanical Power Technology
   c. Radiation and Nuclear Technology
   d. Aeronautical Technology
   e. General Technology
   f. Fire Protection Technology
   g. Mechanical Design Technology

   Individuals polled either completed degree requirements after the spring semester, 1971, or completed the GENT 3104 course requirements after that date.
3. The instructional content contained in the questionnaires included those topics defined by Castellucis (2) and the topics taken from the GENT 3104 course outline.

Definitions of Terms

General Technology 3104 (GENT 3104)

Fundamentals of Electronics. An introduction to electronics for non-electronic majors. Presents the fundamentals of electronic physics, electronic device principles and characteristics and operating principles of tube and transistor circuits. Also, the application of electronic circuits to measure and control instruments used in the field of mechanical technology, such as deflections, loads, frequencies, transducers, etc.

Topic Areas

Subject matter given in broad terms such as Safety, Magnetism. The term topic areas may be interchanged with the term instructional content throughout this study.

Basic Course

A course covering topics at an introductory level. The word basic may be interchanged with the word introductory throughout this study.

Attitude

An emotionalized tendency, organized through experience, to react positively or negatively toward a psychological object. Attitudes are, irrevocably linked to emotions and may be roughly defined as feeling for or against something (10).

Perception

An awareness on the part of an individual of his attitude toward a condition, event, a training activity, or person (11).

Graduate

Those individuals who have completed the course, GENT 3104.

CHAPTER II

REVIEW OF LITERATURE

Curriculum development has been an area of much concern to those in the field of education. Attempting to build better curriculums has not been an easy job. There are no short cuts, no easy roads to better curriculums. The field of curriculum and instruction has become a highly specialized area of study and endeavor. In order that this field may offer the leadership necessary to growth and improvement in all areas of education, many changes in methods of current school operation are essential.

With the purpose of this study being to ascertain the attitudes of technology graduates and employers towards the instructional content/development of GENT 3104, several factors were considered while reviewing the literature. The review of literature pertinent to this study was, therefore, subdivided into two basic sections as follows:

1. Curriculum development
2. Participants and their roles in curriculum improvement

Curriculum Development

Definition of Curriculum

The term curriculum has been defined by many, however it is exceedingly difficult to find any definition that will be accepted by everybody. Webster's Seventh New Collegiate Dictionary (11) defines the term curriculum as "the courses offered by an educational institution or one of its branches."

Donald F. Cay (3, p. 1) states:

> Curriculum is the professional educational term that covers school experiences like an umbrella. Name any facet of school activity you like, and it will be included in a modern concept of the term curriculum. It is the master plan, devised by educators and other adults in a community, state, or nation that will best serve their needs, and as they see it, the needs of their children. It consists of a preconceived design of educational experiences that should lead to desired goals, eventually benefiting the individual and the society.

Finally, Albert L. Oliver (6) defines curriculum as (1) all the experiences the learner has under the guidance of the school, and (2) all the courses which a school offers.

Determination of Curriculum Needs

One method of determining the needs of a curriculum was used by Richard L. Castillucis (2) in his determination of the instructional content of a basic electronics course for non-electronic majors. He established as his objective to tabulate those topic areas dealing with basic electronics most needed by students in technology fields other than the electronics field.

To meet his objective, he interviewed twenty professional technical educators in eight different technologies. By rating and evaluating interview data, he was able not only to list the twenty-three desirable topic areas, he was also able to rank them in order of importance.

John B. Baker (1) in his feasibility study for establishing a training program for calibration technicians used a different approach. Through the use of questionnaires, he solicited information from three segments, (1) students, (2) educators and (3) industry, concerning calibration technician programs. His results showed considerable agreement and enthusiasm among all three segments for initiation of more comprehensive calibration technicians programs throughout the nation.

In his evaluation of the adequacy of training of vocational-technical students at the Texas State Technical Institute, Joseph A. Vicars (10) tabulated data only from TSTI graduates and their employers through the use once again of written questionnaires. Based on the data obtained during this study, comments by graduates and their employers, and the conclusions drawn from analysis of that data, he was able to make recommendations to administrative officials and department heads concerning methods of revising offered programs and their instructional content.

John W. Trego (8) in his study of technical institutes found that "it was imperative that each technical institute make its curriculum meet the job requirements in the occupation for which training is given." His findings also indicated that the industrial complex placed its emphasis on preparation in basic skills, principles and fundamentals.

Participants and Their Roles in Curriculum Improvement

Today, the roles of improvers of the curriculum are becoming amplified and confused. The problems of who is to assume specific responsibility for improving curriculum, and what sources of input should be considered when revising curricula, become especially difficult.

ones. Whereas curriculum improvers were once found mainly within an educational establishment, persons and organizations outside these establishments are now assuming more and more responsibility.

As described by Ronald C. Doll (4), the definition of the term role would include: (1) positions within organizations or hierarchies, (2) behaviors of the performers of tasks, and (3) expectations concerning work to be accomplished by role-takers. Further, Doll presents a random list of role-takers outside local educational establishments which would include:

1. State legislatures, state boards of education, and state departments of education.
2. Regional accrediting associations
3. Colleges and Universities
4. National and state pressure groups
5. Producers of sponsored teaching aids
6. Textbook authors and publishers
7. Consultants
8. Specialist groups in subject-matter
9. Laymen who author books and magazine articles
10. The federal government
11. Professional organizations in education and individual educational leaders.

Finally Doll states:

> The heart of the improvement process still resides in the American community. Involved in the educational process at the local level are school boards, individual laymen and groups of laymen, school administrators and supervisors, teachers, and pupils.

As with any other type education, vocational-technical education curriculum development and improvement is influenced by sources from without as well as within. As described by Leighbody (5), vocational curriculum planners must start with basic educational decisions which take into account at least four major determinants. These include:

1. the nature and needs of society
2. the nature and needs of the learner
3. the nature of the learning process
4. the nature and role of the teacher

In addition he states:

> The only curriculum a teacher is likely to take seriously is one he has helped to plan. The more competent and professional the teacher, the more this will be true.

In summary, the literature has served as a tool for providing a basic knowledge, understanding, and definition of the somewhat nebulous term curriculum and curriculum development. It was a further aid in showing how other individuals have approached similar problems and the steps taken while attempting to find solutions of such problems.

In addition, the literature gave a perspective view into the complexity of roles as played by individuals, groups, and organizations which as a cooperative effort design and revise educational curricula. This cooperative effort is an absolute necessity in general education as well as vocational-technical education, if educational institutions are to meet their objectives.

CHAPTER III

PROCEDURES AND ANALYSIS OF DATA

The purpose of this study was to ascertain the attitudes of technology graduates and their respective employers relative to the instructional content considered appropriate for inclusion into an introductory course of electronics for non-electronic technology students. To accomplish this stated objective, it was necessary to collect data on a group of non-electronic technology graduates and the employers of those graduates.

This chapter is the description of the research procedure used to determine their respective attitudes.

Population

For this study, the population was comprised of all non-electronic technology graduates from the School of Technology at Oklahoma State University and their respective employers. In addition, the graduates had to meet these two prerequisites:

1. Graduation from the School of Technology at O.S.U. after the spring semester 1971, or must have completed GENT 3104 course requirements after that date.
2. Must have taken GENT 3104 as part of their technology curriculum.

Procedure

In order to obtain data that could be analyzed meaningfully and tabulated efficiently for use with statistical analysis, and because of the large number of persons involved, the large geographical area to be covered, and the limitation of time, it was decided that a mailed questionnaire would be the most effective method of data collection. Van Dalen (9, p. 324) had this to say about the effectiveness of a questionnaire:

> Questionnaires are widely used by educators to obtain facts about past, present, and anticipated events, conditions, and practices and to make inquiries concerning attitudes and opinions. For some studies or certain phases of them, presenting respondents with carefully selected and ordered questions is the only practical way to elicit the data required to confirm or disconfirm a hypothesis.

In this study, the questionnaire with a cover letter and an enclosed self-addressed stamped return envelope was sent to the graduates of the School of Technology at Oklahoma State University. Non-respondents were mailed a reminder letter three weeks later. Graduate returns were examined to determine if the respondents were currently employed in an area relating to their technology training. For those graduates who indicated that their current employment was related to their technology training, an employer questionnaire was sent to their employer or if available their immediate supervisor. The same remail schedule was followed with non-responding employers as was used with the graduate portion of the population.

The data received was organized into groups both by technology graduate and employer and submitted to appropriate statistical analysis.

Development of Questionnaire

The basis for the development of the questionnaires for this study was the instructional content, i.e. specific topic areas deemed appropriate for inclusion in GENT 3104. The topic areas chosen for inclusion in the questionnaires came from the results of a research study done by Richard L. Castillucis (2) in May 1971, and from course outlines.

Following consultation with the Technical Education Department of Oklahoma State University, the present questionnaires were then submitted to Dr. James P. Key and to the Agriculture Education 5980 class, Research Design in Occupational Education, to determine the suitability of the questionnaires as to format, content, and data desired.

In the questionnaires, the topic areas are rated by both graduate and employer across a three point Likert Scale involving the importance of the topic areas to the job presently being performed by the graduate. A final open-ended item is included on each questionnaire to allow the respondent to make any comments he feels are pertinent or to list additional topic areas he feels should become a part of the instructional content of GENT 3104.

Following this development and piloting process, the questionnaires were printed and mailed out.

Statistical Analysis

Frequency distributions and percentages are given on the data collected. For this study, the graduate/employee and employer attitudes towards the importance of instructional content to job performed were correlated using the Spearman Rank Order Coefficient (7).

The Spearman Rank Order Coefficient, r_s is a statistical correlation referring to a quantifiable relationship between two variables. Furthermore, it is a measure of the strength and direction of the relationship. The computational formula for the correlation is:

$$r_s = 1 - \frac{6\Sigma d^2}{n^3-n}$$

Where,

n = the number of topics

d^2 = the sum of the squared differences between topics' ranks.

The steps for computation of the Spearman Rank Order Coefficient are:

1. List all scores of the topics on both of the variables
2. Assign ranks to each topic
3. Determine the differences, d, between topics' ranks
4. Determine the sum of the squared differences between topics' ranks
5. Determine the number of topics
6. Substitutes the calculated values determined above into the formula and solve for r .

The resulting calculated value of r was compared with numerical values presented in tables of correlation coefficients to determine whether or not the null hypothesis (Ho) was rejected or accepted, and to determine at what level the results are statistically significant.

An additional calculation was made to determine a t value utilizing the following computational formula:

$$t = r_s\sqrt{\frac{n-2}{1-r_s{}^2}}$$

Where,

n = number of topics

r_s = Spearman Rank Order Coefficient

The resulting t value was compared with tables of numerical values (two tailed test) to confirm rejection or acceptance of the null hypothesis and to confirm level of statistical significance.

The null hypothesis in this study being that no relationship exists between the attitudes of the graduates and the attitudes of the employer towards the importance of the instructional content of GENT 3104.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The purpose of this study was to ascertain the attitudes of technology graduates and their respective employers relative to the instructional content considered appropriate for inclusion into an introductory course of electronics which was offered by the School of Technology at Oklahoma State University.

The purpose of this chapter is to present and analyze the data collected in the study relating to the three research questions stated in Chapter I. The statistical analysis includes the use of arithmetic means to allow the placement of the twenty-three defined topic areas into a rank order of importance, and a correlation coefficient using the Spearman Rank Order Correlation to show the relationship, if any, between the perceptions of the graduates versus those of their employers.

A mail questionnaire was developed in two forms, one for the graduate of the School of Technology, the second for his employer.

The twenty-three topic areas examined for importance to the job were common to both forms. Copies of the questionnaires are included in Appendix D and E.

Examination and evaluation of the returns provided data regarding the research questions stated in Chapter I. Item twenty-four on the questionnaire was an open-ended item which allowed the respondent to include any additional topic areas of major importance which should be included in the course. The data will be presented in two sections. First, a description of the population and the return. Second, a discussion of the three research questions. Selected comments made by respondents are included in Appendix F.

Description of Population and Return

The population for this study was comprised of the graduates of those technology areas designated in Chapter I, who either completed degree requirements after the spring semester, 1971, or those individuals who completed the GENT 3104 course requirements after that date. In addition, the population included the employers of those respondents who indicated employment in a job related to their educational training.

Table I shows the distribution of the graduate population and return. Of the original 265 graduate questionnaires mailed, 35 were returned by the postal service as undeliverable, resulting in a net population of 230.

Table II shows the distribution of the graduate return in regard to current status of the graduates. An examination of the data presented in Table II indicates that 49 individuals, or 45.79%, were employed in an area related to their educational background. In order to prevent any undue bias or the collection of erroneous data, the employers of these 49 individuals only comprised the total employer population.

Table III presents the employer population versus the return.

TABLE I

GRADUATE POPULATION AND DISTRIBUTION OF RETURN

	Return	
	Number	Percent
Aeronautical Technology	15	14.01
Fire Protection Technology	2	1.86
General Technology	6	5.60
Mechanical Design Technology	25	23.36
Mechanical Power Technology	36	33.64
Petroleum Technology	6	5.60
Radiation Nuclear Technology	17	15.88
Total	107	46.52

TABLE II

CURRENT STATUS OF GRADUATES

Status	Number (N = 107)	Percent
Continuing Education	36	33.64
Military Service	5	4.67
Unemployed	2	1.86
Employed Part Time	2	1.86
Self Employed	2	1.86
Employed in Area Related to Educational Background	49	45.79
Employed in Area Not Related to Educational Background	11	10.28

TABLE III

EMPLOYER POPULATION VERSUS RETURN

Number of Employers polled	Number of Respondents	Percent Return
49	29	59.18

Research Questions

Research Question 1.

How do graduates perceive the importance of the instructional content to their job?

This question was evaluated by first calculating the arithmetic means of the responses to the twenty-three topic areas presented on the three point Likert scale, and then placing the topic areas in rank order in descending order of perceived importance of the topic to the job.

Table IV through Table XI show the perceptions of graduates of each of the seven technologies being considered in this study, as well as the perceptions of all technologies combined. In addition, Table XII shows the perceptions of employees working at a job related to their educational background.

Research Question 2.

How do employers perceive the importance of the instructional content to the job being performed by the graduate?

TABLE IV

RANKING AS PERCEIVED BY AERONAUTICAL TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Safety	2.333	1
Motors & Generators	2.000	2
Reading Electronic Schematics	2.000	2
Instrumentation	1.933	3
Use of Test Equipment	1.933	3
Electrical Power-Power Distribution Systems	1.933	3
Component Identification	1.933	3
Electronic Terminology and Symbols	1.867	4
A. C. Circuits	1.867	4
Proper Connections of Electrical Meters	1.867	4
D. C. Circuits	1.800	5
Power Supplies	1.733	6
Transistors	1.667	7
Circuit Construction	1.667	7
Amplifiers	1.600	8
Electronic Control Systems	1.533	9
Wiring Practices-Residential and Industrial	1.533	9
Integrated Circuits	1.467	10
Test Equipment Const. & Theory of Operation	1.400	11
Two-way Radio	1.400	11
Television	1.333	12
Logic Circuits and Computers	1.267	13
Electronic Math	1.142	14

TABLE V

RANKING AS PERCEIVED BY FIRE PROTECTION TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Use of Test Equipment	3.000	1
Reading Electronic Schematics	3.000	1
D. C. Circuits	2.500	2
Safety	2.500	2
Electronic Terminology and Symbols	2.500	2
A. C. Circuits	2.500	2
Transistors	2.500	2
Power Supplies	2.500	2
Integrated Circuits	2.500	2
Amplifiers	2.000	3
Proper Connections of Electrical Meters	2.000	3
Component Identification	2.000	3
Circuit Construction	2.000	3
Wiring Practices-Residential and Industrial	2.000	3
Logic Circuits and Computers	2.000	3
Electronic Control Systems	2.000	3
Instrumentation	1.500	4
Motors and Generators	1.500	4
Electrical Power-Power Distribution Systems	1.500	4
Two-way Radio	1.500	4
Television	1.500	4
Electronic Math	1.500	4
Test Equipment Const. and Theory of Operation	1.000	5

TABLE VI

RANKING AS PERCEIVED BY GENERAL TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Use of Test Equipment	2.500	1
Safety	2.333	2
Electronic Terminology and Symbols	2.333	2
Instrumentation	2.333	2
Motors and Generators	2.167	3
A. C. Circuits	2.167	3
Electrical Power-Power Distribution Systems	2.167	3
Proper Connections of Electrical Meters	2.167	3
D. C. Circuits	2.000	4
Electronic Control Systems	2.000	4
Wiring Practices-Residential and Industrial	2.000	4
Power Supplies	1.833	5
Reading Electronic Schematics	1.833	6
Test Equipment Const. and Theory of Operation	1.667	7
Component Identification	1.667	7
Amplifiers	1.500	8
Circuit Construction	1.500	8
Transistors	1.333	8
Two-way Radio	1.333	9
Electronic Math	1.333	9
Logic Circuits and Computers	1.167	10
Integrated Circuits	1.167	10
Television	1.000	11

TABLE VII

RANKING AS PERCEIVED BY MECHANICAL DESIGN TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Electronic Terminology and Symbols	2.000	1
Instrumentation	1.958	2
Safety	1.916	3
Use of Test Equipment	1.916	3
Reading Electronic Schematics	1.791	4
Motors and Generators	1.750	5
Proper Connections of Electrical Meters	1.750	5
Power Supplies	1.667	6
D. C. Circuits	1.667	6
A. C. Circuits	1.625	7
Electronic Control Systems	1.583	8
Component Identification	1.583	8
Electrical Power-Power Distribution Systems	1.541	9
Test Equipment Const. and Theory of Operation	1.541	9
Electronic Math	1.500	10
Transistors	1.458	11
Amplifiers	1.458	11
Circuit Construction	1.458	11
Wiring Practices-Residential and Industrial	1.458	11
Integrated Circuits	1.333	12
Logic Circuits and Computers	1.291	13
Television	1.166	14
Two-way Radio	1.125	15

TABLE VIII

RANKING AS PERCEIVED BY MECHANICAL POWER TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Use of Test Equipment	2.702	1
Instrumentation	2.621	2
Motors and Generators	2.324	3
Proper Connections of Electrical Meters	2.243	4
Safety	2.162	5
D. C. Circuits	2.135	6
Electronic Terminology and Symbols	2.135	6
Reading Electronic Schematics	2.081	7
Electronic Control Systems	2.000	8
Component Identification	2.000	9
Test Equipment Const. and Theory of Operation	1.945	9
Circuit Construction	1.918	10
A. C. Circuits	1.891	11
Power Supplies	1.864	12
Transistors	1.756	13
Wiring Practices-Residential and Industrial	1.675	14
Logic Circuits and Computers	1.675	14
Amplifiers	1.621	15
Electrical Power-Power Distribution Systems	1.567	16
Integrated Circuits	1.540	17
Electronic Math	1.513	18
Two-way Radio	1.243	19
Television	1.108	20

TABLE IX

RANKING AS PERCEIVED BY PETROLEUM TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Safety	2.666	1
Electronic Terminology and Symbols	2.166	2
Motors and Generators	2.166	2
Component Identification	2.166	2
Instrumentation	2.000	3
A. C. Circuits	2.000	3
Wiring Practices-Residential and Industrial	2.000	3
D. C. Circuits	1.833	4
Electronic Control Systems	1.833	4
Use of Test Equipment	1.833	4
Power Supplies	1.833	4
Circuit Construction	1.833	4
Proper Connections of Electrical Meters	1.666	5
Reading Electronic Schematics	1.666	5
Test Equipment Const. and Theory of Operation	1.666	5
Electronic Math	1.666	5
Transistors	1.500	6
Electrical Power-Power Distribution Systems	1.500	6
Amplifiers	1.333	7
Logic Circuits and Computers	1.333	7
Integrated Circuits	1.166	8
Two-way Radio	1.166	8
Television	1.166	8

TABLE X

RANKING AS PERCEIVED BY RADIATION NUCLEAR TECHNOLOGY STUDENTS

Topic Area	Mean	Rank Order
Safety	2.588	1
Instrumentation	2.294	2
D. C. Circuits	2.058	3
A. C. Circuits	2.058	3
Reading Electronic Schematics	2.058	3
Electronic Control Systems	2.000	4
Power Supplies	2.000	4
Electronic Terminology and Symbols	1.941	5
Use of Test Equipment	1.941	5
Amplifiers	1.882	6
Proper Connections of Electrical Meters	1.882	6
Electrical Power-Power Distribution Systems	1.823	7
Circuit Construction	1.764	8
Transistors	1.705	9
Test Equipment Const. and Theory of Operation	1.705	9
Component Identification	1.705	9
Logic Circuits and Computers	1.705	9
Integrated Circuits	1.705	9
Wiring Practices-Residential and Industrial	1.647	10
Motors and Generators	1.411	11
Electronic Math	1.411	11
Two-way Radio	1.117	12
Television	1.117	12

TABLE XI

RANKING AS PERCEIVED BY ALL GRADUATES

Topic Area	Grand Mean	Rank Order
Safety	2.213	1
Use of Test Equipment	2.161	2
Instrumentation	2.132	3
Electronic Terminology and Symbols	2.000	4
Reading Electronic Schematics	1.919	5
Motors and Generators	1.904	6
D. C. Circuits	1.889	7
Proper Connections of Electrical Meters	1.875	8
A. C. Circuits	1.823	9
Component Identification	1.808	10
Power Supplies	1.786	11
Electronic Control Systems	1.779	12
Circuit Construction	1.705	13
Electrical Power-Power Distribution Systems	1.676	14
Test Equipment Const. and Theory of Operation	1.654	15
Transistors	1.602	16
Wiring Practices-Residential and Industrial	1.595	17
Amplifiers	1.558	18
Logic Circuits and Computers	1.455	19
Integrated Circuits	1.455	19
Electronic Math	1.429	20
Two-way Radio	1.198	21
Television	1.125	22

TABLE XII

RANKING AS PERCEIVED BY EMPLOYEED GRADUATES

Topic Area	Mean	Rank Order
Use of Test Equipment	2.310	1
Electronic Terminology and Symbols	2.276	2
Instrumentation	2.241	3
Safety	2.103	4
Reading Electronic Schematics	2.034	5
Motors and Generators	1.966	6
D. C. Circuits	1.862	7
Component Identification	1.862	7
Electronic Control Systems	1.828	8
Proper Connections of Electrical Meters	1.828	8
A. C. Circuits	1.793	9
Circuit Construction	1.756	10
Power Supplies	1.724	11
Wiring Practices-Residential and Industrial	1.724	11
Test Equipment Const. and Theory of Operation	1.690	12
Transistors	1.655	13
Electrical Power-Power Distribution Systems	1.621	14
Amplifiers	1.551	15
Logic Circuits and Computers	1.551	15
Integrated Circuits	1.551	15
Electronic Math	1.310	16
Two-way Radio	1.138	17
Television	1.069	18

This question was evaluated by first determining the arithmetic means of the responses to the twenty-three topic areas presented on the three point Likert scale, and then placing the topic areas in rank order in descending order of perceived importance of the topic to the job being performed by the technology graduate. Table XIII shows the perceptions of all employers to the importance of the instructional content.

TABLE XIII

RANKING AS PERCEIVED BY EMPLOYERS

Topic Area	Mean	Rank Order
Safety	2.103	1
Use of Test Equipment	1.862	2
Electronic Terminology and Symbols	1.793	3
D. C. Circuits	1.689	4
Instrumentation	1.689	4
Reading Electronic Schematics	1.689	4
Component Identification	1.689	4
Motors and Generators	1.655	5
Electrical Power-Power Distribution Systems	1.655	5
Electronic Control Systems	1.620	6
Power Supplies	1.620	6
Circuit Construction	1.620	6
A. C. Circuits	1.586	7
Test Equipment Const. and Theory of Operation	1.517	8
Proper Connections of Electrical Meters	1.482	9
Transistors	1.448	10
Wiring Practices-Residential and Industrial	1.413	11
Amplifiers	1.379	12
Electronic Math	1.379	12
Integrated Circuits	1.344	13
Logic Circuits and Computers	1.310	14
Two-way Radio	1.103	15
Television	1.000	16

Research Question 3.

How do graduate and employer perceptions of the importance of the instructional content to the job relate?

This question was evaluated by computing a Spearman Rank Order coefficient between responses of employees and responses of employers. This coefficient was calculated to show the correlation, if any, between these responses. In order to determine statistical significance of the Spearman coefficient, two additional tests were performed. First, the Spearman r_s was compared with numerical values presented in tables of correlation coefficients to determine the level of significance and to determine whether or not the null hypothesis (Ho) should be accepted or rejected. Secondly, a t value was calculated and again the t value compared with numerical values presented in statistics tables to determine statistical significance in a two tailed test. Table XIV shows the computation of r_s and comparison with table values.

The Spearman coefficient is interpreted in basically the same way as the standard product-moment r, where a coefficient near +1.00 reflects a strong positive relationship, a coefficient near -1.00 reflects a strong negative relationship and a coefficient near zero reflects little or no relationship.

Analysis of Table XIV shows an r_s of .908 which definitely shows a strong positive relationship between responses of employees and employers. Comparing the Spearman coefficient of .908 with the table value at the .01 level (one tailed test), it can be seen that the value of r_s is significant beyond the .01 level.

TABLE XIV

SPEARMAN RANK ORDER COEFFICIENT

Topic	Employees Mean	Rank	Employers Mean	Rank	d	d^2
D. C Circuits	1.862	7.5	1.689	5.5	2.0	4.00
Safety	2.103	4.0	2.103	1.0	3.0	9.00
Electronic Terminology and Symbols	2.276	2.0	1.793	3.0	-1.0	1.00
Electronic Control Systems	1.828	9.5	1.620	11.0	-1.5	2.25
Instrumentation	2.241	3.0	1.689	5.5	-2.5	6.25
Motors and Generators	1.966	6.0	1.655	8.5	-2.5	6.25
Use of Test Equipment	2.310	1.0	1.862	2.0	-1.0	1.00
A. C. Circuits	1.793	11.0	1.586	13.0	-2.0	4.00
Transistors	1.655	16.0	1.448	16.0	-0-	-0-
Amplifiers	1.551	19.0	1.379	18.5	0.5	0.25
Power Supplies	1.724	13.5	1.620	11.0	2.5	6.25
Electrical Power-Power Distribution Systems	1.621	17.0	1.655	8.5	8.5	72.25
Proper Connections of Electrical Meters	1.828	9.5	1.482	15.0	-5.5	30.25
Reading Electronic Schematics	2.034	5.0	1.689	5.5	-0.5	0.25
Test Equipment Construction and Theory of Operation	1.690	15.0	1.517	14.0	1.0	1.00
Component Identification	1.862	7.5	1.689	5.5	2.0	4.00
Circuit Construction	1.756	12.0	1.620	11.0	1.0	1.00
Wiring Practices-Residential and Industrial	1.724	13.5	1.413	17.0	-3.5	12.25
Logic Circuits and Computers	1.551	19.0	1.310	21.0	-2.0	4.00
Integrated Circuits	1.551	19.0	1.344	20.0	-1.0	1.00

TABLE XIV (Continued)

Topic	Employees Mean	Rank	Employers Mean	Rank	d	d^2
Two-way Radio	1.138	22.0	1.103	22.0	-0-	-0-
Television	1.069	23.0	1.000	23.0	-0-	-0-
Electronic Math	1.310	21.0	1.379	18.5	2.5	6.25
						$\Sigma d^2 = 172.50$

$$r_s = 1 - \frac{6(172.5)}{23^3-23} \qquad r_s = 1 - \frac{1035}{11144}$$

$$r_s = 1 - \frac{1035}{11167-23} \qquad r_s = 1 - .092$$

$$r_s = .908$$

table value of r_s at .01 level = .4965 (N=23)

Significance of r_s

$$t = r_s\sqrt{\frac{N-2}{1-r_s^2}} \qquad t = .908\sqrt{119} \qquad \text{two tailed test}$$

$$t = .908\sqrt{\frac{23-2}{1-(.908)^2}} \qquad t = .908\ (10.98) \qquad \text{t value at .01 level}$$

$$t = .908\sqrt{\frac{21}{1-.824}} \qquad t = 9.969 \qquad \text{21 degrees of freedom} = 2.831$$

$$t = .908\sqrt{\frac{21}{.176}}$$

Comparing the calculated t value of 9.969 with the table value at the .01 level, it can be seen that the Spearman coefficient is significant beyond the .001 level. From the above statistical analysis, the null hypothesis which states that no significant relationship exists between the perceptions of the employees and the perceptions of the employers towards the instructional content of GENT 3104, is rejected.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem with which this study was concerned was the lack of specific feedback information concerning the attitudes of technology graduates and the industrial community which could be utilized for the purpose of revising the instructional content of GENT 3104. This chapter includes a summary of the study, conclusions and recommendations.

Summary

The purpose of this study was to ascertain the attitudes of technology graduates and their respective employers relative to the instructional content considered appropriate for inclusion into an introductory course of electronics (GENT 3104) which is offered by the School of Technology at Oklahoma State University.

Research questions which were considered in the study are stated as follows:

(1) How do graduates perceive the importance of the instructional content to their job?

(2) How do employers perceive the importance of the instructional content to the job being performed by the graduate?

(3) How do graduate and employer perceptions of the importance of the instructional content to the job relate?

The data was obtained by a mailed questionnaire which was developed in two forms, one for the graduate of the School of Technology, the second for his employer. The twenty-three topic areas of instructional content to be examined for importance to the job being performed were common to both questionnaires.

The questionnaires used as data collecting instruments in this study were obtained after a trial run of a similar questionnaire and personal consultations with individuals interested in the study. The mailings were completed and all data tabulated during the 1974 spring semester.

Findings Related to Research Questions

Research Question 1.

How do graduates perceive the importance of the instructional content to their job? Based on the findings of this study as shown on Tables IV through Table XI, the twenty-three topic areas are listed with the degree of importance indicated. The results also indicate the relative order of importance of the topic areas, and selection of topics for teaching purposes should be partly based on this rank order.

The following five topic areas were evaluated by all graduates as being the most important: Safety, Use of Test Equipment, Instrumentation, Electronic Terminology and Symbols, Reading Electronic Schematics.

In addition, those graduates who were employed indicated the same five topic areas as being the most important.

Research Question 2.

How do employers perceive the importance of the instructional content to the job being performed by the graduate? As shown in Table

XIII, the twenty-three topic areas are listed with the degree of importance indicated by the employers. Again the results also indicate the relative order of importance of the topic areas, and selection of topics for teaching purposes should be partly based on this rank order.

The following five topic areas were evaluated by employers as being the most important: Safety, Use of Test Equipment, Electronic Terminology and Symbols, D. C. Circuits, Instrumentation.

Research Question 3.

How do graduate and employer perceptions of the importance of the instructional content to the job relate? Based on the results of the study as shown in Table XIV, the Spearman coefficient indicates a strong positive relationship between the perceptions of employees and employers. This relationship is statistically significant beyond the .01 level.

Conclusions

1. Both graduates and employers were able to perceive the relative importance of the outlined topic areas with regards to job performance.

2. There was a very strong positive relationship between perceptions of employees and employers regarding the importance of the instructional content of GENT 3104 towards the job being performed by graduates of the School of Technology at Oklahoma State University.

3. Many of those graduates/employees and employers surveyed suggested that this type research study be utilized in revising instructional content of additional courses in the School of Technology curricula.

Recommendations

1. That the results of this study be used in conjunction with the study done by Richard L. Castellucis to revise the instructional content of GENT 3104.

2. Consideration be given to the priority of topic areas according to available time and preference of selection as shown in this study.

3. That research techniques utilized in this study be used as a basis for additional research in content revision of other courses offered by the School of Technology.

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APPENDIX A

GRADUATE COVER LETTER

January 1974

Dear

A research study has been undertaken at Oklahoma State University to assist in the revision of instructional content of General Technology 3104, an introductory course of electronic fundamentals. As a graduate of this course and of the School of Technology at O.S.U., I request your consideration and cooperation to make this study as meaningful as possible. Please take the time from your busy schedule to complete the survey form which I have enclosed.

Enclosed is a stamped, self-addressed envelope for return mailing.

Sincerely,

Gail C. Phillips
Research Foundation
301 Whitehurst
Stillwater, Oklahoma
74074

APPENDIX B

EMPLOYER COVER LETTER

January 1974

Dear

I have undertaken a research study at Oklahoma State University to ascertain the attitudes of both graduates and employers relative to the instructional content of General Technology 3104, an introductory course dealing with electronic fundamentals.

As an employer of an O.S.U. technology graduate, I request your consideration and cooperation to make this study as meaningful as possible. Please take time from your busy schedule to complete the survey form which I have enclosed.

Enclosed is a stamped, self-addressed envelope for return mailing.

Sincerely,

Gail C. Phillips
Research Foundation
301 Whitehurst
Stillwater, Oklahoma
74074

APPENDIX C

FOLLOW-UP LETTER FOR GRADUATES

AND EMPLOYERS

January 1974

Dear

I recently sent you a survey form relating to the instructional content of General Technology 3104. According to my records, I have not received your response.

Your cooperation is essential if Oklahoma State University is to satisfy its responsibilities to the students as well as the industrial community.

Please complete and return the above mentioned survey form. Thank you for your consideration.

Sincerely,

Gail C. Phillips
Research Foundation
301 Whitehurst
Stillwater, Oklahoma
74074

APPENDIX D

GRADUATE QUESTIONNAIRE

All Information on this questionnaire will be held in strict confidence and used for educational purposes only.

NAME ______________________________ DATE ____________
Last First Middle

NAME OF EMPLOYER ______________________________

ADDRESS OF EMPLOYER ______________________________
Street City State Zip Code

JOB TITLE ______________________________

NAME OF IMMEDIATE SUPERVISOR ______________________________

If not employed please indicate status
Circle one
1. Continuing Education
2. Military Service
3. Unemployed
4. Employed Part-time only

Graduation Date __________

Technology Studied __________

Is employment related to education background? Check one: YES__ NO__

For each of the topic areas listed below, answer the question at the right. Indicate answers by marking appropriate boxes.	How important is knowledge of topic area to present job or technology studied?		
	no importance (1)	considerable importance (2)	critical importance (3)
1. D. C. Circuits			
2. Safety			
3. Electronic Terminology & Symbols			
4. Electronic Control Systems			
5. Instrumentation			
6. Motors & Generators			
7. Use of Test Equipment			
8. A. C. Circuits			
9. Transistors			
10. Amplifiers			
11. Power Supplies			
12. Electrical Power-Power Distribution Systems			
13. Proper Connections of Electrical Meters			
14. Reading Electronic Schematics			
15. Test Equipment Const. & Theory of Operation			
16. Component Identification			
17. Circuit Construction			

For each of the topic areas listed below, answer the question at the right. Indicate answers by marking appropriate boxes.	How important is knowledge of topic area to present job or technology studied?		
	no importance (1)	considerable importance (2)	critical importance (3)
18. Wiring Practices-Residential & Industrial			
19. Logic Circuits & Computers			
20. Integrated Circuits			
21. Two-way Radio			
22. Television			
23. Electronic Math			
24. Other Topic Areas Add what you feel applies to your job & is not covered above: ______ ______ ______			

APPENDIX E

EMPLOYER QUESTIONNAIRE

All Information on this questionnaire will be held in strict confidence and used for educational purposes only.

COMPANY OR FIRM ______________________ DATE ____________

ADDRESS ______________________________

NAME OF EMPLOYEE ______________________

DEPARTMENT OR SHOP ______________________

RATING SUPERVISOR ______________________

JOB TITLE ______________________

For each of the topic areas listed below, answer the question at the right. Indicate answers by marking appropriate boxes.	How important is knowledge of topic area to present job?		
	no importance (1)	considerable importance (2)	critical importance (3)
1. D. C. Circuits			
2. Safety			
3. Electronic Terminology & Symbols			
4. Electroni- Control Systems			
5. Instrumentation			
6. Motors & Generators			
7. Use of Test Equipment			
8. A. C. Circuits			
9. Transistors			
10. Amplifiers			
11. Power Supplies			
12. Electrical Power-Power Distribution Systems			
13. Proper Connections of Electrical Meters			
14. Reading Electronic Schematics			
15. Test Equipment Const. & Theory of Operation			
16. Component Identification			
17. Circuit Construction			
18. Wiring Practices-Residential & Industrial			
19. Logic Circuits & Computers			
20. Integrated Circuits			
21. Two-way Radio			
22. Television			
23. Electronic Math			

For each of the topic areas listed below, answer the question at the right. Indicate answers by marking appropriate boxes.	How important is knowledge of topic area to present job?		
	no importance (1)	considerable importance (2)	critical importance (3)
24. Other Topic Areas Add what you feel applies to the job & is not covered above: __________ __________ __________			

APPENDIX F

SELECTED COMMENTS FROM RESPONDENTS

"The course content of GENT 3104 was adequately presented and needed for a mechanical design background..."

"First, I would like to say I am more than happy to supply this information. I realize this will assist in forming more job related substance to courses. This is one reason I picked a technology major. I was taught the necessary subjects to do a job and not the information necessary to be a professor.

My job requires a lot of information about radiation detection. This includes not only the detection instrument but also the compatability of power supplies, alarm systems, and read-out systems."

"Mr. Vincent is a development engineer in the safety test group. His direct involvement is in restraint system interlock for '76 trucks, all D. C. integrated circuits. He also reviews acceleration data from vehicle impacts.--All very well."

"Not enough categories to properly evaluate. Categories shown are biased for answering."

"I feel this is an excellent idea and should be applied to other classes and departments."

"I do feel that a background is electronic fundamentals is desirable for our organization."

"Please tell somebody to get rid of 3104. It was boring, although some parts were OK. Overall though, the course was not good for anything."

"This survey is a good idea for all subjects."

VITA

Gail Carpenter Phillips

Candidate for the Degree of

Master of Science

Thesis: THE ATTITUDES OF TECHNOLOGY GRADUATES AND EMPLOYERS RELATIVE TO THE INSTRUCTIONAL CONTENT IDENTIFIED FOR A BASIC ELECTRONIC COURSE FOR NON-ELECTRONIC MAJORS IN THE SCHOOL OF TECHNOLOGY AT OKLAHOMA STATE UNIVERSITY

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Education: Graduated from Lawton Senior High School, Lawton, Oklahoma, in May, 1964; received the Associate in Science degree from Oklahoma State University with a specialty in Electronics Technology in 1969; received the Bachelor of Science degree from Oklahoma State University with a major in Technical Education in 1969; completed requirements for the Master of Science degree in Technical Education at Oklahoma State University in July, 1974.

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