THE IDENTIFICATION OF CONTENT APPROPRIATE FOR A BASIC ELECTRONIC COURSE FOR NON-ELECTRONIC MAJORS IN THE SCHOOL OF TECHNOLOGY AT OKLAHOMA STATE UNIVERSITY

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CHAPTER I

THE PROBLEM

Introduction

In todays highly specialized world of work, it is often necessary for an individual to possess knowledge outside his major field in order to perform it, or near his full potential. This is quite evident at the technician level in many areas of employment. While it is true that there is an interrelationship between many of the technologies, certain technologies are more interrelated than others. One such technology upon which others tend to depend is electronics. This dependency becomes apparent in the following examples: (1) In the machine design technology it is seen in the form of automated and numerical control processes for bench lathes and milling machines; (2) the radiation technologists has a need for electronics to adequately use his array of data recording instruments; (3) a similar case is the automotive technologists' array of tools for analyzing automobile engines; (4) the petroleum and medical technologists use electronics instrumentation to gather and analyze data; and (5) the drafting technologists' language includes electronic symbolization.

It can be seen that some knowledge of electronics could be a valuable tool to most technicians. The amount of knowledge required in general will depend on the major field of work the individual chooses. While it is true that each field will require some specialization pertaining to its own particular needs, each separate technology will probably want the same basic information made available to those being trained in schools of technology.

One such approach to this problem has been recently adopted by the School of Technology at Oklahoma State University (O.S.U.). A basic or introductory course in electronics (TEC 3104 Essentials of Electronics) is being offered for those students not enrolled in the electronic program. The purpose of this course is many fold. It not only provides an introduction to electronics for those who will receive further specialized training in their own departments, but it will in some cases be the students only exposure to a formal course in electronics.

Statement of the Problem

With the need for some knowledge of electronics established, it becomes imperative to make the level and scope of that knowledge as meaningful to those who will receive it as possible. In order to do this, the content of all courses should be as relevant to student needs as possible. In particular, the basic course (in some cases the only course) needs to be carefully analyzed and constructed.

At the School of Technology (O.S.U.), TEC 3104 is the basic course. It has students enrolled each year from other than electronic technological areas. See Table XIII for the technological areas and number of students from each area enrolled in TEC 3104, during the current semester.

The problems of including the right topics in such a course and coordinating such a course with each department the course serves cannot be solved by any preconceived notions. Each department has its own criteria for amount and type of knowledge required for its students. Therefore these departments need to be made aware of the course content proposed and their advice on additions or methods of coverage must be sought.

Purpose of the Study

The purpose of this study is to identify those topic areas which are considered appropriate for inclusion in a course such as TEC 3104. The study will seek to determine which topic areas are deemed to be most important and necessary by professional technical educators outside of the electronic field.

Research Questions

The following research questions are investigated in the study.

1. What specific topic areas should be included in the course content?
2. To what depth should the topics be covered?
3. Should a course of this type be required for all non-electronic majors in a school of technology?
4. To what degree do administrators and users of such a course agree on its content?

Need for the Study

A need for a study of this type was made evident through a review of the literature. It is further made apparent by a schools constant struggle to update its curriculum, and by its desire to continually seek new ways to better revise its curriculum by additions and deletions. Decisions as to what to add, and what to cut must be made. These decisions must be based on more than guess work. Often those who must make the decisions find they have little time to do the necessary "leg work" required. The schools must therefore seek help in obtaining the answers to those questions which will aid them in selecting the correct courses and course content. The graduate of a school of technology will be expected to immediately put his skills to use in both large and small companies (1). He may be required to perform tasks which lie outside his major job assignment.

Delimitations

The purpose of this study is to identify the most meaningful content for an introductory course in electronics for non-electronic majors.

The population of this study was limited to the instructors, full and part time, employed by the School of Technology (O.S.U.) in the following areas:

a. Petroleum Technology
b. Machine Design Technology
c. Mechanical Power Technology
d. Radiation and Nuclear Technology
e. Aeronautical Technology
f. General Technology
g. Metals Technology
h. Fire Protection Technology

Definition of Terms

Topic Areas - subject matter given in broad terms such as transistors, safety, etc.

Technical Institute - an educational institution at the post-secondary level which is distinct in character from a college or university. The curriculum is usually two years in length, and the main objective is to prepare technicians who lie between the skilled craftsman and the professional (2).

School of Technology - a school offering a four year program leading to a B.S. degree in Engineering Technology (3).

Professional Technical Educators - those instructors employed by the O.S.U. School of Technology who have regular teaching assignments.

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

CHAPTER II

REVIEW OF LITERATURE

Curriculum development has been the subject of much concern to those in the field of education. Usually it has been found that in the case where a curriculum must be developed to meet a specific need such as electronics technician preparation or machine tool or metal technologist preparation, the easiest part of the task is in the hard core of the curriculum. The specific knowledge or skill needed to do the job for which training if given can often be easily ascertained. For an electronics technician, a study of amplifiers, for the machinist, machine lathe operation are the specific knowledges for example. When the question of related knowledge is approached, the area has become cloudy. While the literature points out these problems, it fails to give any clear cut patterns but tends to suggest each area be tackled on its own ground.

With the main purpose of this study being the identification of course content for an electronics course which serves several technologies, several factors were considered while reviewing the literature. The review of literature pertinent to this study is, therefore, divided into the following sections: (1) the technician and (2) curriculum development.

The Technician

Identification of the Technician

The literature indicates that the title "technician" is indeed a nebulous one. The investigators have included selected references which do appear to be most representative of those attempting to identify the technician. The following references to the technician view his occupational talent as lying somewhat between that of the skilled occupation or trades and the professions. This view appears to be most consistent in the literature.

The literature points out two methods of attempts to identify the technician which appears more frequent than others. One method is to actually attempt to define the technician, while the other tries to provide an understanding of the technician by describing those technical abilities common to technical occupations.

One definition of the technician was provided by Cecil W. Dugger in "An Analysis of Oklahoma School-Industry Practices in the Placement and Employment of Technician Graduates (5); he states:

> "(Technicians) All persons engaged in work requiring knowledge of physical, life, engineering, and mathematical sciences comparable to knowledge acquired through technical institute, junior college, or other formal post high school training, or through equivalent on-the-job training or experience. Some typical job titles are: laboratory assistants, physical science aids, and electronic technicians."

Maurice W. Roney, in the U. S. Office of Education publication, <u>Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs</u> (4) stated five general abilities of the technician. They were given as follows:

1. Facility with mathematics; ability to use algebra and trigonometry as tools in the development of ideas that make use of scientific and engineering principles; and understanding of, though not necessarily facility with, higher mathematics through analytical geometry, calculus, and differential equations, according to the requirements of the technology.
2. Proficiency in the application of physical science principles, including the basic concepts and laws of physics and chemistry that are pertinent to the individual's field of technology.
3. An understanding of the materials and processes commonly used in the technology.
4. An extensive knowledge of a field of specialization with an understanding of the engineering and scientific activities that distinguish the technology of the field. The degree of competency and the depth of understanding should be sufficient to enable the individual to do such work as detail design using established design procedures.
5. Communication skills that include the ability to interpret, analyze, and transmit facts and ideas graphically, orally, and in writing.

Roney (4) further identified twelve criteria for identifying occupations that require a technician education. He emphasized these twelve criteria are not necessarily to be given equal weight in identifying technician occupations, and that no single occupation may require all of them. The twelve criteria state that the individual in the occupation:

1. Applies knowledge of science and mathematics extensively in rendering direct technical assistance to scientists or engineers engaged in scientific research and experimentation.
2. Designs, develops, or plans modifications of new products and processes under the supervision of engineering personnel in applied engineering research, design, and development.
3. Plans and inspects the installation of complex equipment and control systems.
4. Advises regarding the maintenance and repair of complex equipment with extensive control systems.
5. Plans production as a member of the management unit responsible for efficient use of manpower, materials, and machines in mass production.
6. Advises, plans, and estimates costs as a field representative of a manufacturer or distributor of technical equipment and/or products.
7. Is responsible for performance or environmental tests of mechanical, hydraulic, pneumatic, electrical, or electronic components or systems and the preparation of appropriate technical reports covering the tests.
8. Prepares or interprets engineering drawings and sketches.
9. Selects, compiles, and uses technical information from references such as engineering standards, handbooks, and technical digests of research findings.
10. Analyzes and interprets information obtained from precision measuring and recording instruments and makes evaluations upon which technical decisions are based.

11. Analyzes and diagnoses technical problems that involve independent decisions.

12. Deals with a variety of technical problems involving many factors and variables which require an understanding of several technical fields.

The Technicians Education

The U. S. Office of Education in Standard Terminology for Instruction in Local and State School Systems (2) defined the technicians education as being a planned sequence of school experiences usually at the post-secondary level designed to prepare persons for a cluster of jobs in a specialized field of technology.

In the study Occupational Education Beyond the High School in Oklahoma (6), Roney and Paul V. Braden submitted a definition of technician education adopted by the Oklahoma Technical Education Council. The definition as adopted by the council was stated as follows:

> Technical Education is a planned sequence of classroom and laboratory experiences, usually at the post-secondary level, designed to prepare men and women for a range of job opportunities in well-identified fields of technology. The program of instruction normally includes study in mathematics, the sciences inherent in a technology, and selected skills, materials, and processes commonly used in the technology. Complete technical education programs provide intensive training in a field of specialization, and include basic communication skills as well as general education studies. Instruction in technical programs gives major emphasis to principles rather than to specific techniques or skills. Industrial applications of these principles are used wherever possible in the instructional program.

The Engineering Technologist

Donald W. Brown in Goals & Objectives (3) offers a short definition of the Engineering Technologists, as follows: "The Engineering Technologist is a technician who has undergone additional education in the technical specialties and sciences, in other areas which broaden his general knowledge, and in areas designed to prepare for managerial and supervisory positions."

Curriculum Development

Definition of Curriculum

The term curriculum has been defined by many, with most definitions leading to the same meaning. The Webster's Dictionary (7) has this to say about the term, "the courses offered by an educational institution or one of its branches-a set of courses, J. W. Giachino and Ralph O. Gallington (8), Course Construction in Industrial Arts, Vocational and Technical Education define curriculum as--"an orderly arrangement of integrated subjects, activities and experiences which students pursue for the attainment of a specific goal." James L. McGraw (9) Characteristics of Excellence in Engineering Technology Education, American Society for Engineering Education, says "...a curriculum is planned to fulfill a particular objective within a specific time."

Determination of Curriculum Needs

One method of determining the needs of a curriculum was used by Herbert E. Hansen (10) in his study of the Competencies in Welding Needed for Agricultural Machinery Maintenance. He established as his objective to tabulate the ten most needed competencies in arc welding and to rank them in their order of importance.

To meet this objective, he sent a questionnaire to 185 farmers familiar with welding. Similar questionnaires were sent to 96 job-shop welders. Mr. Hansen felt this represented 40% of the vocational agricultural department of Iowa. By rating and evaluating the questionnaires returned, he was able not only to list the ten most needed competencies of arc welders, he was also able to describe them.

Angelo C. Gillie (11) in his study to determine curriculum content for Electronic programs at community colleges used a different approach. He had a group of selected experts submit a number of topics they considered essential for the present day electronic technician. From this, a list of 72 topics in the form of a questionnaire was sent to 370 educators and industrialists. This study showed considerable agreement between industry and the educators. Part of this agreement was that emphasis be placed on fundamentals instead of specialized courses.

In its Evaluation of Vocational Education Now and Tomorrow, J. F. Kennedy High School (12) determined that periodic reviews and evaluations should be made of all vocational programs.

John W. Trego (13) 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." Further findings of his study showed that industry placed its emphasis on preparation in basic skills, principles and fundamentals.

Development of Curriculum Content

In a workshop conducted by Paul V. Rogler (14), materials were developed to be used in the instruction of tenth grade general mathematics. Through a six week workshop, using members of the economic community as well as experienced tenth grade math teachers, mathematical problems exemplifying the practical world were established. The general purpose of such a project was to meet the needs of the "non-academic student".

Robert J. Weber (15) in an effort to determine if a given kind of information is best encoded in visual or speech imagery, will provide educators with another tool for use in the development of curriculum content. He hopes to aid in early instruction, through the use of speech imagery and visual imagery, those items which can best be encoded by each form of instruction. This type of information is hoped to give users a better understanding and retention of the fundamentals and basics of a topic.

In summary, the literature has served as a tool for the defining of those whose education we seek to improve. It was a further aid in showing how others have approached similar problems and the steps taken in the attempted solution of such problems.

The literature did show that much was being done in the area of curriculum development. It also indicated, through its lack of information, that much more needs to be done in the area of related course material for vocational and technical education.

CHAPTER III

PROCEDURES AND ANALYSIS OF DATA

Introduction

The major purpose of this study was to identify those topics which were considered as appropriate for inclusion into an introductory course of electronics for non-electronic technology students.

This chapter is the description of the research procedure used to arrive at an answer to that question.

Population

Subjects employed in this study were selected on the basis of the following criteria:

Professional educators - Must be from other than the electronics technology. Full and part-time faculty from the School of Technology (O.S.U.) were chosen because of their most recent exposure to the problem.

Procedure

In order to obtain data that could be analyzed meaningfully a series of personal interviews with the faculty members involved were conducted. While the interviews were conducted in a relaxed atmosphere, the underlying question was, do you feel a course in electronics is essential for students enrolled in your program? If this question was answered in the affirmative, further quizzing was done to ascertain which topic areas should be covered. If answered in the negative, reasons for such an answer would have been sought. An indication as to the depth of coverage of each topic area was also sought. While the interview was so structured as to receive similar responses from the faculty, care was given not to lead or answer questions for the interviewee.

Using a checklist devised through the assistance of members of the Electronics Department of the School of Technology (O.S.U.) the results of each individual interview were analyzed. This checklist was comprised of topics felt necessary for an elementary understanding of electronics by those members of the electronics department.

After each initial interview, the results were recorded and studied. Comparisons were made of answers given by department heads and by the general faculty. If felt necessary, second and third interviews were held to further clarify any points which may have been rather vaguely discussed or entirely overlooked.

After all the data was collected from those interviewed, a final discussion was held with the electronics department faculty for the purpose of establishing if any further questioning would be needed to fill gaps in the information sought by the electronics department. All the necessary data seemed to be in and it was felt that valid conclusions could be drawn.

CHAPTER IV

RESULTS

The purpose of this study was to identify specific topic areas which are considered appropriate for inclusion in a basic electronic course. Results of the data obtained in this study are presented in this chapter.

Table I reflects the composition of the population whose responses were used to obtain data for this study. As shown, a total of twenty (20) individuals were contacted representing eight (8) technologies.

TABLE I

COMPOSITION OF STUDY POPULATION

Group
I. Aeronautical Technology
A. Fred Beihler
B. Hugh Evens
C. Owen McGruder
II. Petroleum Technology
A. A. G. Comer
III. Mechanical Design Technology
A. R. D. Brumfield
B. G. R. McClain
IV. Mechanical Power Technology
A. R. G. Murray
B. S. O. Powers

TABLE I (Continued)

Group
V. Metalurgical Technology
A. J. C. Scheihing
B. G. W. Taylor
VI. Radiation and Nuclear Technology
A. K. J. Eger
B. A. J. Armstrong
C. R. J. Everett
D. M. D. Morriss
VII. Fire Protection Technology
A. David Ballenger
B. Paul J. Scanlon
C. E. D. Steiner
VIII. General*
A. P. R. McNeill
B. Robert Reed
C. J. Shoemaker

*Group VIII, the General Group, was picked to include one each of the following: the head of General Technology under whose supervision the current basic course in electronics is presented; a part-time instructor for the course; and an instructor from a newly formed technical sciences department whose job it will be to offer service courses to the School of Technology.

Table II is a listing of questions asked during the interviews. Table III is the individual responses to those questions. Table IV is the overall group concensus after awarding a multiplying (weighting) factor to each group based on the number of students enrolled in the technology. The multiplying factor was arrived at by awarding each technology a number equal to its percentage of student enrollment.as shown in Table XIII. Student enrollment in this instance refers to those students enrolled in one of the eight technologies used as a population for this study. Table V is the consensus of the eight groups responses to the question.

TABLE II

LIST OF INTERVIEW QUESTIONS

Question
1. Do you feel your students should have a basic course in electronics?
2. Do they take university physics or technical physics?
3. Would such a course be used as a building block for other courses in your curriculum?
4. Will they take another course in electronics at this school?
5. Should the basic course be taught by your department or by the electronics department?
6. Do your students handle, or operate electronic equipment in any of their other courses?
7. Do you want such a course to be more practical or theoretical?
8. Would you want the topics given an in-depth presentation or would a block diagram survey of the systems be adequate?
9. Would you prefer a course taught specifically for your students or would a common course taken along with students from other departments be better?
10. If your students do not take another formal course in electronics, do they take a course in which their electronics skills are to be used?

TABLE III

INDIVIDUAL RESPONSES TO QUESTIONS 1-6 & 10 OF TABLE II

	Yes		No		Other	
Question	No.	Percent	No.	Percent	No.	Percent
1	20	100	0	0	0	0
2	20	100	0	0	0	0
3	8	40	10	50	2	10
4	3	15	11	55	6	30
5	16	80	2	10	2	10
6	15	75	2	10	3	15
10	10	50	5	25	5	25

Table III refers only to those questions which could most easily be answered by a yes or no response.

Questions seven, eight, and nine were not of a type that could be answered with a yes or no response. Those questions are as follows:

7. Do you want such a course to be more practical or theoretical?
8. Would you want the topics given an in-depth presentation or would a block diagram survey of the systems be adequate?
9. Would you prefer a course taught specifically for your students or would a common course taken along with students from other departments be better?

The responses to these questions gave the following answers:

1. To question seven (7) it was strongly urged that the material presented in such a course be presented with a very practical rather than theoretical approach.
2. To question eight (8), the responses favored using a block diagram approach to the study of most topics.
3. To question nine (9), the responses favored using a common course, but good indications were given to the interviewer that this may have been answered on a purely economical basis.

Table VI shows a list of topics recommended for possible inclusion into a basic electronic course. Table VII shows individual preferences for such topics as well as the weighted group consensus value for each topic. Table VIII shows the number of topics chosen by each technology group.

TABLE IV

WEIGHTED RESPONSES BY GROUP TO
QUESTIONS OF TABLE III

Question	Aeronautical Technology	Fire Protection Technology	General	Mechanical Design Technology	Mechanical Power Technology	Metalurgical Technology	Petroleum Technology	Radiation & Nuclear Technolocy	Total
1	22	9	5	20	20	7	6	11	100
2	22	9	5	20	20	7	6	11	100
3	22	9	0	0	20	0	0	0	51
4	22	0	0	0	0	0	0	0	22
5	22	9	5	20	20	7	6	11	100
6	22	9	0	20	20	7	6	11	95
10	0	0	5	20	20	0	6	0	51

TABLE V

GROUP CONSENSUS OF ANSWERS TO QUESTIONS OF TABLE III

Questions	Yes		No	
	No.	Percent	No.	Percent
1	8	100	0	0
2	8	100	0	0
3	3	37.5	5	62.5
4	1	12.5	7	87.5
5	8	100	0	0
6	7	87.5	1	12.5
10	4	50	4	50

TABLE VI

TOPICS RECOMMENDED FOR POSSIBLE INCLUSION INTO A BASIC ELECTRONIC COURSE

Item No.	Topic
1	Electrical Power - Power Distribution Systems.
2	D. C. Circuits
3	Instrumentation
4	Use of Test Equipment
5	A. C. Circuits
6	Amplifiers
7	Electronic Control Systems
8	Motors and Generators
9	Logic Circuits and Computers
10	Electronic Terminology and Symbols
11	Transistors
12	Proper Connections of Electrical Meters
13	Test Equipment Construction and Theory of Operation
14	Power Supplies
15	Safety
16	Reading Electronic Schematics
17	Component Identification
18	Circuit Construction (soldering etc.)
19	Integrated Circuits
20	Electronic Math
21	Two Way Radio
22	Television
23	Wiring Practices - Residential and Industrial

TABLE VII

INDIVIDUAL PREFERENCE AND WEIGHTED GROUP CONSENSUS VALUE FOR EACH TOPIC

Item	Individual	Aero	Fire Prot.	Gen.	Mech. Des.	Mech. Power	Metal.	Pet.	Rad. T.	Total	Above 50%	Above 75%
1	14	22	9	5	0	20	7	6	0	69		
2	17	22	9	5	20	20	7	6	11	100		
3	17	22	0	5	20	20	7	6	11	91		
4	16	22	9	5	0	20	7	6	11	80		
5	17	22	9	5	20	0	7	6	11	80		
6	11	22	0	5	0	20	0	6	11	73		
7	14	22	9	5	20	20	0	6	0	93		
8	14	22	9	5	20	20	7	6	0	89		
9	7	0	0	5	0	20	0	0	11	36		
10	16	22	9	5	20	20	0	0	11	94		
11	15	22	9	5	0	20	7	0	11	74		
12	11	22	0	5	0	20	7	0	0	54		
13	8	22	0	5	0	20	0	0	0	47		
14	15	22	9	5	0	20	0	6	11	73		
15	16	22	9	5	20	20	7	6	11	100		
16	12	22	0	5	0	0	7	0	0	54		
17	8	22	0	5	0	0	0	0	0	47		
18	6	22	0	0	0	0	0	0	0	42		
19	6	22	0	0	0	0	0	0	0	22		
20	3	0	0	0	0	0	0	0	0	0		
21	5	0	9	0	0	0	0	6	0	15		
22	3	0	9	0	0	0	0	0	0	9		
23	10	0	9	5	20	20	0	6	0	40		

TABLE VII (Continued)

Item	Individual	Aero	Fire Prot.	Gen.	Mech. Des.	Mech. Power	Metal.	Pet.	Rad. T.	Total	Above 50%	Above 75%
I	20	22	9	5	20	20	7	6	11	100		
II	20	22	9	5	20	20	7	6	11	100		
III	8	22	9	0	0	20	0	0	0	51		
IV	3	22	0	0	20	0	0	0	0	22		
V	16	22	9	5	20	20	7	6	11	100		
VI	15	22	9	0	20	20	7	6	11	95		
X	10	0	0	5	20	20	0	6	0	51		

TABLE VIII

TOTAL NUMBER OF TOPICS CHOSEN BY GROUPS

Group	Aero	Fire Prot.	Gen.	Mech. Design	Mech. Power	Metals	Pet.	Rad. Nuclear
Number of Topics	18	13	18	10	15	10	12	10

Table IX is a comparison between the percentage of individuals and the percentage of groups favoring a particular topic.

TABLE IX

COMPARISON OF INDIVIDUAL AND GROUP RESPONSE

Topic No.	Percent of Individual	Percent of Group
1	70	75
2	85	100
3	85	88
4	80	88
5	85	88
6	55	62
7	70	75
8	70	88
9	35	36
10	80	75
11	75	75
12	55	50
13	40	36
14	75	75
15	80	100
16	60	50
17	40	36
18	30	25
19	30	12
20	15	0
21	25	25
22	15	12
23	50	50

Table X is a comparison of the response of the General group to the overall group consensus with the General group omitted from overall groups.

TABLE X

COMPARISON OF AGREEMENT BETWEEN GENERAL GROUP AND OVERALL GROUP

		Overall Group			
Topic No.	General Group	Yes	No	Agree	Disagree
1	yes	5	2	x	
2	yes	7	0	x	
3	yes	6	1	x	
4	yes	6	1	x	
5	yes	6	1	x	
6	yes	4	3	x	
7	yes	5	2	x	
8	yes	6	1	x	
9	yes	2	5		x
10	yes	5	2	x	
11	yes	5	2	x	
12	yes	3	4		x
13	yes	2	5		x
14	yes	5	2	x	
15	yes	7	0	x	
16	yes	3	4		x
17	yes	2	5		x
18	no	2	5	x	
19	no	1	6	x	
20	no	0	7	x	
21	no	2	5	x	
22	no	1	6	x	
23	yes	3	4		x

Table XI is a comparison of the response of the Fire Protection group to the overall group consensus with the Fire Protection group omitted from the overall group.

TABLE XI

COMPARISON OF AGREEMENT BETWEEN FIRE PROTECTION GROUP AND GENERAL GROUP

		Overall Group			
Topic No.	Fire Protection	Yes	No	Agree	Disagree
1	yes	5	2	x	
2	yes	7	0	x	
3	no	7	0		x
4	yes	6	1	x	
5	yes	6	1	x	
6	no	5	2		x
7	yes	5	2	x	
8	yes	6	1	x	
9	no	3	4	x	
10	yes	5	2	x	
11	yes	5	2	x	
12	no	4	3		x
13	no	3	4	x	
14	yes	5	2	x	
15	yes	7	0	x	
16	no	4	3		x
17	no	3	4	x	
18	no	2	5	x	
19	no	1	6	x	
20	no	0	7	x	
21	yes	1	6		x
22	yes	0	7		x
23	yes	3	4		x

Table XII is the rank order of topic elements as preferred by overall group consensus. This ranking is based on the values given in Table VII.

TABLE XII

RANK ORDER OF TOPICS CONSIDERED FOR INCLUSION IN A BASIC ELECTRONIC COURSE

Rank	Topic No.	Percent *
1	2	100
2	15	100
3	10	94
4	7	93
5	3	91
6	8	89
7	4	80
8	5	80
9	11	74
10	6	73
11	14	73
12	1	69
13	12	54
14	16	54
15	13	74
16	17	47
17	18	42
18	23	40
19	9	36
20	19	22
21	21	15
22	22	9
23	20	0

*Percent is percentage of groups favoring inclusion.

TABLE XIII

SCHOOL OF TECHNOLOGY-SPRING ENROLLMENT 1971*

Technology	Freshmen	Sophomores	Upper Division	Total	Percent of Enrollment
Aeronautical	47	45	29	121	22
Fire Protection	26	21	--	47	9
General	--	--	27	27	5
Mechanical Design	47	30	33	110	20
Mechanical Power	41	38	28	107	20
Metallurgical	11	14	11	36	7
Petroleum	13	14	8	35	6
Radiation & Nuclear	31	17	9	57	11
Total	216	179	145	540	100

*Only for those technologies contained in the study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem with which this study was concerned was the lack of appropriate information concerning topics which should be included in a basic electronic course. This chapter includes a summary of the study, conclusions, and recommendations.

Summary

The purpose of this study was to identify specific topic areas which are considered appropriate for inclusion in a basic electronic course.

Research questions which were considered in the study are stated as follows: (1) What topic areas should be included in an introductory course in electronics?; (2) What is the comparision between responses from those engaged in the administering of and teaching of such a course and those who are served by the course?; (3) What is the comparison between those currently using such a course and those who may have a future need for such a course?; (4) What is the comparison between individual responses and group responses concerning the inclusion of topic elements into such a course?; and (5) Should a basic electronic course be included in your curriculum?

The data were obtained by interviewing 20 individuals employed as instructors by the School of Technology, O.S.U. These people were selected because of their knowledge of the problem and their desire to assist in its solution.

The questionnaire used as a data collecting instrument in this study was obtained after a trial run of a similar questionnaire and personal consultations with individuals interested in the study. The interviews were completed and all data tabulated during the 1971 spring semester.

Findings Related to the Research Questions

Answers to five research questions were sought in this study. In an attempt to provide answers to those questions, data was obtained from interviews with 20 instructors employed by the School of Technology, O.S.U.

Research Question 1

What topic areas should be included in an introductory course in electronics? Based on the findings of this study, it is concluded that the topic areas identified in this study should be included in an introductory course in electronics. The results as shown in Table XII indicate a relative order of preference for topics to be included. Twenty-three topic areas are listed with a wide degree of preference indicated. This study did not, however, attempt to specify any class time allocations for the individual topic areas. It would seem that the topic areas should be included on a time available basis in accordance with their ranking as indicated by Table XII.

Research Question 2

What is the comparison between responses from those engaged in the administering of and teaching of such a course and those who are served by the course? Using information from Table X, it is concluded that there is a high degree of agreement between these two groups.

Research Question 3

What is the comparison between those currently using such a course and those who may have a future need for such a course? The results of this study as shown in Table XI point out the close agreement of needs and opinion between these two groups. The group used as the group with a potential future need was the Fire Protection Technology. This group does not now use a basic electronic course.

Research Question 4

What is the comparison between individual responses and group responses concerning the inclusion of topic elements into such a course? Table IX shows that in studies of this type, while individual responses are important, group opinions are a necessary inclusion into the data collection process. As noted in Table VII there is a general agreement between individual and group responses.

Research Question 5

Should a basic electronic course be included in your curriculum? Of those interviewed, there was one hundred percent agreement that a basic electronic course should be a part of the training given to their students. While there was some disagreement on type and length, the desire for such a course in this particular institution was clearly indicated.

Conclusions

1. There was one hundred percent agreement of all twenty individuals interviewed that a basic electronic course, or courses is desired.

2. Based on answers to specific questions and general discussion with those interviewed there was agreement that such a course could best be taught by instructors from the electronics department.

3. Many of those interviewed, suggested to the interviewer that perhaps an earlier course in basic electricity could be offered as well as an electronics course.

Recommendations

1. The topic areas identified in this study, should be considered for inclusion in a basic electronic course at the School of Technology, (O.S.U.).

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

3. A more comprehensive study should be conducted to include several Schools of Technology.

4. A study should be made to correlate the responses of technology graduates with the responses of this study.

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