AN EVALUATION OF TEN ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS TO ASCERTAIN THEIR ADEQUACY IN MEETING CURRICULUM STANDARDS FOR THE SECONEARY SCHOOL COURSE: GENERAL ELECTRICITY

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Turner, Richard M., An Evaluation of Ten Selected Electricity Training System Laboratory Manuals to Ascertain Their Adequacy In Meeting Curriculum Standards For The Secondary School Course, General Electricity." Master of Science (Industrial Arts), August, 1971, 72 pp., 21 tables, bibliography, 8 titles.

This study involved an evaluation of laboratory manuals available to high schools for use with electricity training systems to ascertain which were most adequate in meeting curriculum standards for general electricity as specified in Bulletin 615 of the Texas Education Agency.

Data for the study were obtained from three sources. Bulletin 615 of the Texas Education Agency supplied the basic criteria to be used in evaluating the laboratory manuals. Six electricity textbooks were reviewed to further develop criteria and these criteria were expanded by Jury I in order to form a detailed evaluation instrument. Jury II was selected to evaluate the manuals of the training systems through the use of the evaluation instrument developed by Jury I. The instrument was devised whereby the jurors could evaluate the curriculum content of the student laboratory

manuals to ascertain a treatment of superior, satisfactory, weak, or no treatment.

Chapter I includes an introduction to the study, a statement of the problem, the purposes of the study, limitations of the study, related studies, definition of terms, the source of data, the manner in which the collected data were treated, the organization of the study, and the plan of procedure.

In Chapter II, a description of Bulletin 615 and the expansion of its curriculum content by Jury I is presented.

The availability of electricity laboratory manuals is the subject of Chapter III.

Chapter IV consists of the evaluation and computation of data collected from Jury II.

Chapter V contains the summary, findings, conclusions, and recommendations of the study.

The following findings are based on the data obtained in the study:

1. None of the ten evaluated manuals received an overall satisfactory rating for their treatment of atomic theory, Coulomb's Law, Lenz's Law, sources of electricity, induction, transformers, and electrical industries.

2. Four manuals received an overall satisfactory rating for their treatment of the subject heading, Ohm's Law.

3. Manual eight received an overall rating of satisfactory for the treatment of the subject heading, Kirchoff's Law.

4. Manual three received an overall rating of satisfactory for the treatment of the subject heading, motor principles.

5. Manual three received the only overall satisfactory rating for the subject heading, moter principles.

6. Only manual ten received an overall satisfactory rating for its treatment of the subject heading, alternating current.

7. Only manual four received an overall satisfactory rating for the treatment of the subject heading, electric power.

8. Only manual one received an overall satisfactory rating for its treatment of the subject heading, capacitors.

9. Three manuals received an overall satisfactory rating for the subject heading, electrical drawings.

10. Five manuals received overall satisfactory ratings for the subject heading, electrical components.

11. Four manuals received overall satisfactory ratings for the subject heading, electrical test equipment.

12. Four manuals were ascertained to have satisfactory format.

13. Each of the laboratory manuals contained satisfactory treatment of some subject headings with the exception of number seven (except for format treatment), but all were weak in their presentation of other subject headings.

14. Manual ten treated all of the subject headings most extensively.

The following conclusions are drawn based upon the findings of the study:

1. None of the evaluated manuals is satisfactory for use in the secondary school course, general electricity.

2. Additional manuals would be needed for use with each of the ten evaluated manuals in order for all subject headings of the course, general electricity, to be covered completely.

3. All of the manuals except number seven present satisfactory treatment of at least one subject heading and may be used as a source in general electricity.

The following recommendations are based on the data obtained in the study:

A. Each of the ten manuals evaluated in the study should consider providing more extensive treatment of thirty-seven of the 119 subject headings, since none of the manuals received satisfactory ratings for those thirty-seven headings.

B. It is suggested that similar studies be made as additional electricity laboratory manuals become available for use in the course, general electricity.

C. More than one manual should be accessible to students of general electricity, as each of the ten evaluated manuals contained weak treatment of some subject headings.

AN EVALUATION OF TEN ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS TO ASCERTAIN THEIR ADEQUACY IN MEETING CURRICULUM STANDARDS FOR THE SECONDARY SCHOOL COURSE: GENERAL ELECTRICITY

THESIS

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By

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CHAPTER I

INTRODUCTION

Electricity training systems are a relatively new form of student activity in electricity. Each year several new training systems are being introduced for use in industrial arts electricity courses. Laboratory manuals are available for use with these systems. Many of these manuals are well planned and designed. However, laboratory manuals differ with respect to the instructional areas of electricity they stress. Some present material in a more easily understood manner than others. The quantity of information and number of laboratory experiments vary considerably among these manuals. Because of these differences, it seems logical to determine which ones would most adequately meet Texas curriculum standards.

Statement of the Problem

This study involved an evaluation of laboratory manuals available for high school use with electricity training systems to ascertain which were most adequate in meeting

curriculum standards for general electricity as specified in Bulletin 615[1] of the Texas Education Agency.

Purposes of the Study

The purposes of the study were threefold:

1. to develop criteria suitable for evaluating electricity laboratory manuals.
2. to ascertain what experiments are outlined in each of the laboratory manuals.
3. to determine which student laboratory manuals are most adequate in meeting the requirements of Bulletin 615.[2]

Limitations of the Study

The study was limited to ten electricity laboratory manuals available for use with electricity training systems.

Related Studies

In a search to determine what previous studies have been made in relation to this one, it was discovered that

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[1]Texas Education Agency, Principles and Standards for Accrediting Elementary and Secondary Schools and Description of Approved Courses, Grades 7-12, Bulletin No. 615, Austin, Texas, 1961, p. 162.

[2]Ibid., p. 162.

Pankowski[3] conducted a study in 1966 of the content of four junior-senior high school electricity-electronic teaching systems. Pankowski's problem was to determine the content of four electricity-electronic teaching systems and to evaluate his findings in terms of recommendations by electrical specialists. He concluded, among other things, that the teaching systems should be redesigned to include a greater number of pieces of commonly used electrical test equipment. Pankowski stated that

> the advertised claims of the teaching systems as suitable for junior high school instruction is not valid, as close to fifty per cent or more of the textbook and laboratory reading material was rated at the senior high school level with considerable amounts of material at the college level.[4]

Ludeman[5] conducted a study to determine the suitability of available woodworking textbooks. He classified the available texts into two categories: general woodworking,

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[3]Dallas J. Pankowski, "An Analytical Study of the Content of Four Selected Junior-Senior High School Electricity-Electronic Teaching Systems with Recommendations by Electrical Specialists," unpublished doctoral dissertation, General Education, University of Missouri, Columbia, 1966.

[4]Ibid., p. 79.

[5]Richard Milton Ludeman, "The Suitability of Available Industrial Arts Textbooks for the Subject Area of Woodworking," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1961.

Level III; and advanced courses, Level IV. Ludeman concluded that there existed a relatively low percent of suitability in the Levels III and IV texts studied, and that supplementary books and other materials would be necessary in order for the course to be sound. He further stated that an all-inclusive textbook was not available and that while some texts were suitable for some subject matter content of woodworking, they were unsuitable for others.

In another study Dunn[6] evaluated available metal-working texts to determine their suitability as textbooks for classroom use. Using the same categories for available texts as Ludeman,[7] Dunn grouped the metalworking texts into Level III and Level IV. His conclusions were similar to those ascertained by Ludeman.

Hicks[8] performed a study in order to determine the desirability of an industrial arts electricity-electronics

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[6]Chancey Elmer Dunn Jr., "The Suitability of Available Industrial Arts Textbooks for the Subject Area of Metalworking," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1967.

[7]Ludeman, op. cit.

[8]Jacky C. Hicks, "A Study to Determine the Need for and Interest in an Electricity-Electronic Course in the Industrial Arts Department of Amarillo High School," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas 1969.

course at Amarillo High School. Among other things he concluded that there existed a definite interest for this course, that there existed job positions for those who had a basic working knowledge of electricity, and that the only classes in electronics offered in the Amarillo Public School System were in the electrical trades program.

McCain concluded that "textbooks for the areas of drawing and woodworking were considered more suitable for instructional purposes in a sound industrial arts program than the textbooks for the other subject area."[9]

McEntee[10] concluded from her study that ". . . only two of the nine [drafting] textbooks evaluated would be suitable for courses in general drafting." Further, ". . . there was only one book that received satisfactory treatment in a majority of the tables."

Definition of Terms

1. Electricity: The term "electricity" as used in the study refers to the basic principles of electron action

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[9]Jerry C. McCain, "Textbook Suitability for the Industrial Arts Programs in Texas," unpublished doctoral dissertation, Department of Education, North Texas State University, Denton, Texas, 1959, p. 77.

[10]Mary Elizabeth McEntee, "The Suitability of Available Industrial Arts Textbooks for the Subject Area of Drafting," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas 1970, p. 88.

in electrical circuits and components exclusive of electron tubes and semiconductors.

2. Electricity Training System: In the study the term "electricity training system" refers to a means of student activity, in which students use electricity components and devices that may be temporarily connected to perform experiments outlined in a laboratory manual that accompanies the system.

3. Electronics: The term "electronics" means a unit of study which includes electron tubes, semiconductors, or devices which use these components.

4. General Electricity: The term "general electricity" as used in the study refers to the curriculum prescribed in Bulletin 615[11] of the Texas Education Agency for the course general electricity.

5. Jury I: "Jury I" as referred to in the study means a selected jury of five electricity teachers who developed the criteria used in the evaluation of the available electricity laboratory manuals.

6. Jury II: In the study "Jury II" was the jury of five electricity teachers, other than those making up Jury I,

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[11]Texas Education Agency, op. cit.

who evaluated the available electricity laboratory manuals through the use of the criteria developed by Jury I.

7. Instructional Unit: Any part or division of a course that can be considered as complete in itself and can be taught as a whole.[12]

8. Laboratory Manuals: In the study, the term "laboratory manual or manuals" was construed to mean a printed form for student use which contains instructions for performing experiments with an electricity training system.

9. Subject Matter: The term subject matter, as defined in Dictionary of Education[13] is as follows:

> The facts, information, knowledge, or content constituting the substance of any course of study and to be acquired by the learner, as distinguished from the methods, disciplines, and activities that give form to a course; the content of education as contrasted with the science of education.

Source of Data

Data for the study were obtained from three sources. Bulletin 615[14] of the Texas Education Agency supplied the

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[12] Carter V. Good, Dictionary of Education (New York, 1959), p. 535.

[13] Ibid., p. 587.

[14] Texas Education Agency, op. cit.

basic criteria to be used in evaluating the laboratory manuals. A review was made of the following textbooks to form a detailed evaluation instrument (refer to Appendix G): Understanding Electricity and Electronics;[15] Electronics in Action;[16] Electricity and Electronics;[17] Energy, Electricity, and Electronics;[18] Electricity and Electronics--Basic;[19] Basic Electrical and Electronic Principles.[20] On completion of this review these criteria were approved by Jury I.

Jury II was selected to evaluate the manuals of the training systems through the use of the evaluation instrument developed by Jury I. The instrument was devised whereby the jurors could evaluate the curriculum content of the

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[15]Peter Buban and Marshall L. Schmitt, Understanding Electricity and Electronics (New York, 1962).

[16]George H. Delpit and B. Stephen Johnson, Electronics in Action (Peoria, Ill., 1959).

[17]Howard H. Derrish, Electricity and Electronics (Homewood, Ill., 1964).

[18]Rex Miller and Fred W. Culpepper, Jr., Energy, Electricity, and Electronics (Bloomington, Ill., 1964).

[19]William B. Steinberg, Electricity and Electronics--Basic (Chicago, Ill., 1961).

[20]Maurice D. Suffern, Basic Electrical and Electronic Principles (New York, 1962).

student laboratory manuals to ascertain a treatment of superior, satisfactory, weak, or no treatment.

Treatment of Data

The various categories on the evaluation instrument checked by each juror were assigned a numerical value. The "no treatment" category was given a value of zero; the "weak" category a value of one; the "satisfactory" category a value of two; and the "superior" category a value of three. By assigning each category a numerical value, an average rating was determined for each subject heading and used in comparing the ten electricity training system laboratory manuals.

Organization of the Study

Chapter I includes an introduction to the study, a statement of the problem, the purposes of the study, limitations of the study, related studies, definition of terms, the source of data for the study, the manner in which the collected data were treated, the organization of the study, and the plan of procedure.

In Chapter II, a description of Bulletin 615[21] and the expansion of its curriculum content by Jury I are presented.

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[21] Texas Education Agency, op. cit.

The availability of electricity laboratory manuals is the subject of Chapter III.

Chapter IV consists of the evaluation and computation of data collected from Jury II.

Chapter V contains the summary, findings, conclusions, and recommendations of the study.

Plan of Procedure

In order to obtain the objectives of the study as stated under the heading "purposes of the study," the following procedure was used.

1. Criteria were developed to be used in the evaluation of the ten laboratory manuals; the criteria were obtained from Bulletin 615[22] and approved by Jury I. A comprehensive discussion of the criteria developed is presented in Chapter II.

2. The laboratory manuals were obtained from the companies which had the training systems on the market. A more comprehensive treatment of the selection of the laboratory manuals is presented in Chapter III.

3. The suitability of the electricity laboratory manuals was determined through the application of the

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[22] Ibid., p. 162.

criteria to the subject matter content and format of the manuals by Jury II. Chapter IV contains a more detailed presentation of the suitability of the manuals.

4. The level of suitability of each of the selected laboratory manuals was determined through the use of numerical values to determine an average rating for each manual. A more complete discussion of determining the level of suitability is presented in Chapter IV.

5. The laboratory manuals were evaluated by Jury II, as presented more fully in Chapter IV.

6. The electricity teachers making up Jury I and Jury II were selected by the Director of Vocational and Industrial Education for the Dallas Independent School District, Dallas, Texas.

CHAPTER II

THE DEVELOPMENT OF AN INSTRUMENT SUITABLE FOR EVALUATING ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS

Bulletin 615, Principles and Standards for Accrediting Elementary and Secondary Schools and Description of Approved Courses Grades 7-12[1] was published by the Texas Education Agency in October 1961. This bulletin describes courses approved by the State Board of Education to be offered in the public schools of Texas. This publication was designed to help individual school districts develop their own courses of study. In addition, a statement of the grade placement, prerequisites, and credits for the courses was also given.

The primary function of Bulletin 615 in the study was to provide guidelines for the development of the evaluation instrument. The curriculum described under the section for general electricity is as follows:

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[1]Texas Education Agency, Principles and Standards for Accrediting Elementary and Secondary Schools and Description of Approved Courses, Grades 7-12, Bulletin No. 615, Austin, Texas, 1961, p. iii.

> General Electricity provides study of selected electrical and related industries (power generation and distribution, home appliance, component manufacture). Study in depth of electrical fundamentals is begun and students apply theories by performing a variety of electrical experiments and constructing (or assembling) individual electrical projects.
>
> Electrical fundamentals studied include: atomic theory (structure of the atom, atomic weight and number, ionization, charges), conductivity, Ohm's Law, Coulomb's Law, Kirchoff's Laws, Lenz's Law, sources of electricity (chemical and mechanical generators, static machines, piezoelectric effect, thermocouple, photo-cells), induction, motor principles, meter principles, alternating current, and transformers.
>
> Students perform experiments, assemble and test electrical devices which require a substantial understanding of circuitry, electrical components, and test equipment. Precision electrical measuring instruments (such as voltmeters, ohmmeters, and ammeters), common hand tools, and light power equipment are used with increasing skill. Electrical drawings are read and interpreted to facilitate theory study and laboratory work. Hand tool skills are those specified in the General Shop course.[2]

The curriculum as expressed above was taken in its broad form and expanded in order to devise an adequate instrument for evaluative purposes. Jury I assisted in the expansion of the data to be included in the instrument.

Atomic theory for example was suggested as one of the electrical fundamentals to be included in the course, "general electricity." In presenting this unit of study to be included in this course, Bulletin 615 states: "Atomic theory

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[2] Ibid., p. 162.

(structure of the atom, atomic weight and number, ionization, charges)."[3] This listing of subject matter under the topic of atomic theory was thought to be too limited and brief to be used in accurately evaluating electricity laboratory manuals; therefore, it was expanded to include the following: matter, mixtures and compounds, elements, molecules, atom, nucleus, nucleon, neutron, proton, electron, atomic number, atomic weight, ionization, laws of charges, electrostatic fields, electric current, direction of current flow, conductors, and insulators. Other units of study listed in Bulletin 615 under the heading general electricity were expanded in this same manner, and upon completion the proposed evaluation instrument was submitted to Jury I for additions or deletions.

Jury I was made up of five electricity-electronic teachers of the Dallas Independent School District recommended by the Director of Vocational and Industrial Education for the same school district. Four of the members of Jury I were junior high school electricity-electronic teachers, and the fifth was a high school electricity-electronic teacher.

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[3] Ibid. p. 162.

Letters were sent to the prospective jury members to solicit their help. Contact was then made with each of the jury members to gain their cooperation and to provide them with instructions for the development of suitable criteria. Each member of Jury I was provided a copy of the proposed evaluation instrument, the specifications stated in Bulletin 615 for the course general electricity, and an instruction sheet defining each level of subject matter treatment.

It was the responsibility of Jury I to delete any subject matter content listed that they intrepreted not to be a part of the industrial arts general electricity course. Jury I was also instructed to add any additional subject matter that they felt was suggested by the specifications in Bulletin 615.[4] A complete copy of the evaluation instrument can be found in Appendix G.

Upon completion of the instrument based on recommendations by Jury I, the members of Jury II were contacted by the same procedure as that described for contracting Jury I and requested to participate in the study.

Jury II was composed of five electricity-electronic teachers of the Dallas Independent School District. Two

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[4] Ibid.

of the Jury II members were junior high school teachers, and three taught in high schools. Members of Jury II were provided with ten copies of the evaluation instrument approved by Jury I, one copy to be completed for each of the ten manuals. They also received an instruction sheet defining the various degrees or levels of subject matter treatment that were to be used in evaluating the laboratory manuals (refer to Appendix F). These degrees of treatment were used by McCain[5] in his study of state-adopted textbooks.

1. Superior treatment: This term is interpreted to mean a thorough, comprehensive and extensive treatment of the subject matter. It pertains to the highest ranking treatment of the subject matter content.

2. Satisfactory treatment: This term will be construed to mean the meeting of the requirements or expectations for teaching the required subject matter content, but not thorough enough treatment to be classified as being "superior" yet above "weak" or mere inclusion.

3. Weak treatment: This term will be construed to mean a mere inclusion or bare mention of the items by the author and insufficient information concerning the required subject matter content.

4. No treatment: The subject matter content is not present in any form in the laboratory manual.

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[5]Jerry C. McCain, "Textbook Suitability for the Industrial Arts Programs in Texas," unpublished doctoral dissertation, Department of Education, North Texas State University, Denton, Texas, 1959, p. 58.

CHAPTER III

AVAILABILITY OF ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS

In order to ascertain which electricity laboratory manuals were available for use in a general electricity course the advertisement sections of professional publications from 1966 to 1970 were reviewed. This review included all issues of the Texas Industrial Arts Association Bulletin, Journal of Industrial Arts Education, Industrial Arts and Vocational Education, and School Shop. From these publications, a list was compiled of the companies who advertised as having an electricity training system to market. A letter was mailed to each of these companies to solicit its help. Each company was asked to send any manual(s) that they had so that it could be included in the study. In all, an effort was made to contact a total of twenty-two firms.

As indicated in Table I, a total of nine companies chose to participate in the study. Each company had one electricity laboratory manual with the exception of Hickok Teaching Systems Incorporated, which had two.

TABLE I

COMPANIES CONTACTED FOR PARTICIPATION IN THE STUDY

1.	Companies participating	9
2.	Companies not participating	8
3.	Companies not having laboratory manuals	2
4.	Companies that could not be contacted	1
5.	Companies whose manual was the same as that used by another in the study	2

Eight companies did not wish to participate in the study. Two companies indicated that they did not have laboratory manuals for a general electricity course, as their programs were specialized, involving integrated circuits, generators, electric motors, transformers, and motor controls.

One company was not contacted, as it had moved, leaving no forwarding address. Two companies used the same manuals as two others. Ashman Industries, Ltd., and Bell and Howell used the same laboratory manuals. Ashman Industries Ltd. is the Canadian branch of Bell and Howell. Science Electronics and Lew Bonn companies also used identical electricity laboratory manuals.

Thus, ten electricity training system laboratory manuals were made available for evaluation by nine companies. Because a percentage of companies did not reply as to whether or not they would participate, the number of electricity manuals on the market was not established.

Table II shows the ten electricity laboratory manuals and the companies offering them for secondary school use.

TABLE II

ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS USED IN THE STUDY

Manual Title and Company Marketing Manual	Manual Number
Basic Electricity--Hickok Teaching Systems, Inc.	1
Basic Electricity H1042--Philco-Ford	2
Basic Electricity--Simpson Educational Systems	3
Electricity and Electronics--Hickok Teaching Systems, Inc.	4
Laboratory Manuals F101-F109--Bell and Howell Schools	5
Electricity and Electronics--Electronic Kits Supply Co.	6
Energy, Electricity, and Electronics--McKnight and McKnight Publishing Co.	7
Experimental Electricity--Science Electronics	8
Experiments in Electricity--Electronics Aids Inc.	9
Learning Experiences in Electricity 501A--Lab Volt Educational Systems	10

CHAPTER IV

EVALUATION OF THE TEN ELECTRICITY TRAINING SYSTEM LABORATORY MANUALS

The availability of electricity training system laboratory manuals for evaluative purposes was discussed in Chapter III of the study. The purpose of this chapter is to present an interpretation of the data obtained from Jury II. These data were tabulated from the evaluation instrument referred to in Chapter II of the study, as checked by Jury II.

An average rating for each instructional unit contained within each laboratory manual was determined by assigning numerical values to the treatment categories of the evaluation instrument. The rating checked by each member of Jury II was averaged in order to compare the available electricity laboratory manuals to ascertain which would be most suitable in Texas public schools.

Table III presents information pertaining to various subject headings related to atomic theory. When each of the manuals had been reviewed to determine the treatment of information concerning matter, mixtures and compounds,

TABLE III

SUBJECT MATTER TREATMENT OF ATOMIC THEORY IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Matter	.2	.6	1.5	1.2	.0	.6	.6	.6	.3	.8
2 Mixtures and Compounds	.2	.6	1.6	.8	.0	.4	.4	.6	.2	.8
3 Elements	.2	.6	1.5	1.0	.2	.6	.6	.4	.2	.6
4 Molecule	.2	.8	1.5	1.3	.0	.6	.6	.6	.2	.5
5 Atom	.2	1.0	2.2	1.4	.0	.6	.6	.6	.2	.5
6 Nucleus	.2	.8	2.2	.8	.0	.6	.6	.6	.2	.5
7 Nucleons	.2	.8	2.0	.8	.0	.6	.2	.8	.4	.0
8 Neutrons	.2	1.0	2.0	1.0	.0	.8	.6	1.0	.4	1.5
9 Protons	.0	1.0	2.0	1.2	.0	.8	.6	1.0	.4	.8
10 Electrons	.4	1.0	2.2	1.6	.2	.8	.8	1.0	.4	.8
11 Atomic Number	.2	.6	.8	1.0	.0	.6	.6	.4	.2	.5
12 Atomic Weight	.2	.6	.8	.8	.0	.6	.6	.8	.0	.5
13 Ionization	.2	.6	1.0	.8	.0	.6	.4	.6	.2	1.0
14 Laws of Charges	.6	2.0	2.0	2.0	.2	.8	1.4	1.8	.6	2.2
15 Electrostatic Fields	.3	1.4	2.0	2.0	.3	.8	.8	1.8	.6	1.8
16 Current	1.0	2.0	2.0	2.3	.8	.8	1.0	2.0	1.2	1.5
17 Direction of Current Flow	1.0	1.8	2.0	1.8	1.2	.8	1.2	2.0	1.0	1.5
18 Conductors	.8	1.0	2.2	1.8	1.0	1.8	1.2	1.2	1.0	2.0
19 Insulators	.8	1.0	2.2	1.8	1.0	1.8	1.2	1.2	.5	2.0
Average Rating	.4	1.0	1.8	1.3	.3	.8	.7	1.0	.4	1.0

elements, molecule, atom, nucleus, nucleon, neutrons, protons, and electrons, it was found that manual three was rated consistently higher with ratings varying from 1.5 to 2.2. Manual five was rated lowest in each of the

above subject headings except in its content concerning nucleons, where manual ten was given an equal rating of 0.0, and in the subject of elements, where manuals one, five, and nine had a rating of 0.2. For these same subject headings, manual one had an average rating of 0.2, manual two 0.8, manual six 0.6, manual seven 0.6, manual eight 0.7, manual nine 0.3, and manual ten 0.7.

For the subject heading atomic number, the manual rated highest was number four. Manual five had the lowest rating for this subject heading and also for atomic weight, ionization, and laws of charges. Rated second highest was manual three with 0.8. Manuals one, two, five, six, seven, eight, nine, and ten had ratings of 0.2 to 0.6.

The highest rating for the subject heading, ionization, was given to manuals three and ten. A treatment rating of 1.0 was received by these two manuals. The other eight laboratory manuals received ratings from 0.0 to 0.8 for this subject heading.

The subject heading, laws of charges, received the highest rating in manual ten, where it was placed in the satisfactory range. Laboratory manuals two, three, and four also were rated satisfactory but to a slightly less degree. Manuals one, six, and nine were rated in the lower

weak treatment area, while manuals seven and eight received weak ratings of 1.4 and 1.8 respectively.

The treatment of electrostatic fields as presented in Table III was most extensively treated in manuals three and four. In descending order of subject matter treatment for this subject heading are manuals three and four, eight, ten, two, six and seven, nine, and one and five.

The data in Table III indicate that, of the manuals evaluated, manual four had the best treatment of the subject heading, electric current. Manuals two, three, four, and eight received a satisfactory rating; and manuals one, five, six, seven, and ten were rated weak.

As one can determine from Table III, manuals three and eight received an equivalent rating of 2.0 for the subject heading, direction of current flow. Only one manual, number six, received less than a 1.0 rating for this subject heading.

On the subject heading, conductors, manual three received the highest rating, 2.2. Manual ten followed closely with a rating of 2.0, and ranking third was manual six with a 1.8 rating. Manuals two, four, seven, eight, and nine were rated within the range of 1.0 to 1.8, indicating treatment from weak to near satisfactory. Table III further

shows that the lowest rating for the subject heading, conductors, was received by manual one.

Treatment of the subject heading, insulators, was rated identical to that of conductors except in one manual. Manual nine was calculated to have a rating of 1.0 for the subject heading, conductors, and a rating of 0.5 for the subject heading, insulators.

Data concerning the subject matter treatment of Ohm's Law are presented in Table IV. The term, omega, and its greek letter symbol, , was determined by Jury II to have been treated best in manuals one, two, five, and eight. The weakest treatment of this term was found in manual seven with a rating of 0.6.

On the subject heading, ohm (as discussed in the laboratory manuals as a unit of resistance), all manuals received ratings ranging from 1.2 to 2.0. Manuals three, five, six, and eight were placed in the satisfactory category with a 2.0 rating, followed closely by manuals one, two, four, and ten with a rating of 1.8. Manual nine was rated at 1.4 and number seven was rated lowest at 1.2.

The heading, letter symbols for resistance, volts, and amperes, as indicated in Table IV, was treated most extensively in electricity laboratory manuals one and three.

Six of the manuals evaluated were rated in the satisfactory category for this subject heading.

TABLE IV

SUBJECT MATTER TREATMENT OF OHM'S LAW IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Omega (Ω)	1.8	1.8	1.6	1.6	1.8	1.2	.6	1.8	1.0	.8
2 Ohm (as unit of resistance)	1.8	1.8	2.0	1.8	2.0	2.0	1.2	2.0	1.4	1.8
3 Letter symbols for resistance, volts, amperes	2.4	1.6	2.4	2.2	1.8	2.2	1.0	2.0	1.6	2.0
4 Resistance	2.0	1.8	2.2	2.4	2.0	2.2	1.4	2.0	1.6	2.2
5 Volts	2.0	1.8	2.4	2.4	2.0	2.2	1.2	1.8	1.8	2.0
6 Amperes	2.0	1.4	2.2	2.4	2.2	2.2	1.0	1.8	1.6	2.0
7 Transposition of symbols	2.0	1.0	2.2	2.0	2.2	2.0	.8	1.8	1.2	2.0
8 Computations using Ohm's Law	1.0	1.2	2.2	1.8	2.2	2.2	.8	1.8	1.2	2.0
Average Rating	1.9	1.6	2.2	2.1	2.0	2.0	1.0	1.9	1.5	1.9

Manual four was ascertained to have the best treatment of the subject heading, resistance, with a satisfactory rating of 2.4. The lowest rating for this subject heading was received by manual seven with 1.4. The average rating of all ten manuals evaluated for this subject heading was 2.0, which placed them in the satisfactory category.

The subject heading, volts, as indicated in Table IV received a satisfactory rating for manuals one, three, four, five, six, and ten. Rated in the near satisfactory category were manuals two, eight, and nine. Electricity manual number seven received a 1.2 rating.

Manuals one, three, four, five, six, and ten presented a satisfactory treatment for the subject heading, amperes. Manuals seven, two, nine, and eight received ratings of 1.0, 1.4, 1.6, and 1.8 respectively.

The transposition of symbols, as shown in Table IV, was discussed in manuals three and five to the most satisfactory extent. Also, receiving satisfactory ratings were laboratory manuals one, four, six, and ten. Manual eight was rated in the weak category at 1.8 followed by a 1.0 rating for manual two and 0.8 for manual seven.

A satisfactory rating of 2.2 was received by manuals three, five, and six for the subject heading, computations using Ohm's Law. This was the highest degree of suitability indicated for the evaluated electricity manuals for this subject heading. The manual acquiring the lowest rating was number seven with a 0.8 rating. Other scores of 1.0, 1.2, 1.2, 1.8, 1.8, and 2.0 were received by manuals one, two, nine, four, eight, and ten respectively, as shown in Table IV.

Table V presents data concerning the subject matter treatment of Coulomb's Law. Computations involving the use of Coulomb's Law were treated most extensively by manual three with a rating of 1.4. None of the evaluated electricity manuals presented sufficient information, but each only made a mere inclusion or bare mention of this subject heading.

TABLE V

SUBJECT MATTER TREATMENT OF COULOMB'S LAW IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
Computations using Coulomb's Law	1.0	.6	1.4	.6	.8	.6	.2	1.3	.2	.4

With respect to the subject matter treatment of Kirchoff's Laws as presented in Table VI, the subject heading, law of current and law of voltage, had identical ratings for each respective manual except for manual four, with a rating of 0.8 for the law of current and a 1.0 for law of voltage. Manual eight was rated highest for these two categories with a satisfactory rating of 2.0; rated lowest was manual seven with a weak placement of 0.2.

TABLE VI

SUBJECT MATTER TREATMENT OF KIRCHOFF'S LAWS IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Law of Current	1.2	1.0	1.0	.8	1.0	.8	.2	2.0	1.8	1.0
2 Law of Voltage	1.2	1.0	1.0	1.0	1.0	.8	.2	2.0	1.8	1.0
Average Rating	1.2	1.0	1.0	.9	1.0	.8	.2	2.0	1.8	1.0

Data concerning the subject matter treatment of Lenz's Law as indicated by Table VII was most discouraging. A rating of 1.2 for manual ten was the highest received. The lowest rating, 0.0, was received by manual nine.

TABLE VII

SUBJECT MATTER TREATMENT OF LENZ'S LAW IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
Lenz's Law	.3	.4	.5	.8	.4	.5	.2	.6	.0	1.2

Table VIII presents data concerning the subject matter treatment of the sources of electricity. The subject heading,

voltaic cell, was rated highest for its treatment in manual ten with a satisfactory rating of 2.6. The lowest rating for this subject area was awarded to manual nine, which made no mention of voltaic cells.

TABLE VIII

SUBJECT MATTER TREATMENT OF SOURCES OF ELECTRICITY IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
1 Voltaic cell	.8	2.0	1.8	1.8	.4	1.4	1.3	1.4	.0	2.6
2 Dry cell	1.6	1.6	1.4	2.0	.5	1.6	1.2	2.2	.4	1.4
3 Mercury cell	.2	1.0	.6	.8	.2	.8	.8	.6	.0	.2
4 Nickel-cadmium cell	.2	.8	.6	.8	.2	.4	.5	.6	.2	.2
5 Battery	1.0	1.4	1.6	1.8	.6	1.4	1.2	1.5	.4	1.6
6 Secondary cell	.3	1.2	1.8	2.2	.4	1.6	1.6	1.8	.4	1.8
7 Lead Acid cell	.6	1.2	1.2	1.2	.4	1.2	1.6	1.8	.4	2.3
8 Photo-cell	.4	1.2	1.2	2.0	.6	2.0	.6	1.6	.0	1.3
9 Thermocouple	.6	1.0	1.4	1.6	.6	1.8	.8	1.6	.6	1.8
10 Piezoelectric effect	.3	1.2	1.8	1.8	.4	2.2	.4	1.5	.0	2.3
11 DC generators	.8	1.6	2.0	1.6	.4	2.0	1.6	1.8	.4	2.0
12 AC generators (alternator)	.6	1.4	2.0	1.6	.6	2.0	1.6	1.5	.4	2.0
13 Static Machines	.4	.8	1.3	.6	.4	.6	.8	1.5	.4	.6
Average Rating	.6	1.3	1.4	1.5	.4	1.5	1.1	1.5	.3	1.5

The subject heading, dry cell, received ratings varying from 0.4 for manual nine to 2.2 for manual number eight. A satisfactory rating was ascertained for manual number four.

Manuals one, two, three, six, seven, and ten received weak ratings of 1.2 to 1.6, while manual five placed lower with a rating of 0.5.

The subject heading, mercury cell, as indicated in Table VIII, was rated as having weak treatment in each of the evaluated manuals. These ratings ranged from 0.0 for manual nine to the highest rating of 1.0 for number two.

The extent of treatment for the subject heading, nickel-cadmium cell, was found to be weak in all laboratory manuals. Four of the manuals rated 0.2, a fifth manual rated 0.4, a sixth 0.5, two others 0.6, and two with 0.8.

The subject heading, battery, as presented in Table VIII was considered by Jury II as treated to the best extent in manual four; the rating for this manual, however, was not satisfactory. The extent of treatment of this subject heading was determined to be least for manual number nine. The range of treatment for the remaining eight manuals was from 0.6 to 1.6.

Laboratory manual number four received a satisfactory rating for the subject heading, secondary cell. A near satisfactory rating was ascertained for manuals three, eight, and ten with a rating of 1.8. Manuals one, and five and nine were ranked as weak with scores of 0.3, 0.4, and

0.4 respectively. The remaining manuals placed within the weak category with higher ratings of 1.2 and 1.6.

The subject heading, lead acid cell, was treated satisfactorily by manual ten, as a rating of 2.3 was received. For manual number eight was determined a near satisfactory rating of 1.8. Other manuals receiving ratings within the weak category of 1.0 to, but not including, 2.0 were numbers two, three, four, six, and seven. Laboratory manuals one, five, and nine had ratings of less than 1.0.

A satisfactory rating of 2.0 was received for manuals four and six for the subject heading, photo-cell. Manual nine did not include this subject heading, and therefore received a rating of 0.0. Manuals one, five and seven received weak ratings of 0.4, 0.6, and 0.6 respectively. A 1.2 rating was determined for manuals two and three, while manual eight received a rating of 1.6 and laboratory manual number ten was also placed in the weak treatment category.

As presented in Table VIII, the subject heading, thermocouple, was treated most extensively by laboratory manual number ten, which received a rating of 1.8. No manual was rated above the weak category for this subject heading. The lowest placement was awarded to manuals one, five, and nine, as each ranked 0.6. The remaining manuals--

two, three, four, six, seven, and eight--received ratings of 1.0, 1.4, 1.6, 1.8, 0.8, and 1.6 respectively.

A rating of 2.3 was received for manual number ten for the subject heading, piezoelectric effect. As indicated in Table VIII, this was the highest rating received by the evaluated manuals, although manual six followed closely in the satisfactory category. Manuals receiving ratings of less than 1.0 were numbers one, five, seven, and nine. The remaining electricity manuals were rated within the weak category with ratings of 1.2 to 1.8. The subject heading, d.c. generators, was treated satisfactorily in manuals three, six, and ten. The two manuals that had the least extensive treatment for this subject heading were manuals five and nine. Manual one was rated 0.8, manuals two, four, and seven 1.6, and manual eight 1.8.

Manuals three, six, and ten each received a rating of 2.0, which was the highest for the subject heading, a.c. generator (alternator). Placement of the remaining seven manuals in decreasing treatment of this subject heading were manuals four and seven, eight, two, one and five, and nine.

Although none of the evaluated laboratory manuals presented a satisfactory treatment for the subject heading,

static machines, manual eight was awarded the highest rating of 1.5 followed by manual three with a 1.3 rating. The remaining manuals were rated weak with a range of 0.4 to 0.8.

Table IX presents information concerning the subject matter treatment of induction. The symbol of induction "L," was treated to the greatest extent in manual one, which was the only manual receiving a satisfactory rating for this subject heading. Manuals two, six, eight and ten received ratings greater than 1.0, while electricity manuals three, four, five, seven, and nine, received ratings of 0.4, 0.6, 0.6, 0.4, and 0.8 respectively.

For the subject heading, unit of inductance "henry," it was determined that all manuals contained a weak treatment. The lowest score, 0.6, was awarded to manuals three and four. Manual one placed highest at 1.8.

As illustrated in Table IX, the subject headings, self-inductance, mutual inductance, coupling, magnetic shielding, neutralizing, saturation, air core inductors, coefficient of coupling "K," transcient response, variable inductor, ampere-turns, polarity of coil (left hand rule), and time constant did not receive a satisfactory rating by any one of the ten evaluated manuals.

TABLE IX

SUBJECT MATTER TREATMENT OF INDUCTION IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Symbol for inductance "L"	2.2	1.2	.4	.6	.6	1.6	.4	1.6	.8	1.6
2 Unit of inductance "henry"	1.8	1.0	.6	.6	1.0	1.6	.8	1.6	.8	1.6
3 Self Inductance	1.2	1.6	.6	.8	.8	1.6	1.2	1.8	1.0	1.8
4 Mutual Inductance	1.2	1.2	.6	.8	1.0	1.4	1.0	1.8	1.8	1.8
5 Coupling	1.2	.8	.8	.6	1.2	1.0	.6	1.4	.6	1.4
6 Magnetic Shielding	1.0	.8	.8	.6	.6	1.0	.8	1.0	.4	1.0
7 Neutralizing	1.0	.8	.8	.4	.4	.8	.4	1.2	.4	.5
8 Saturation	.8	.8	.8	1.0	.8	1.0	.5	1.0	.6	.7
9 Air Core inductors	1.2	1.2	.8	1.0	.6	1.2	1.4	1.4	1.0	1.4
10 Iron Core inductors	2.0	1.2	.8	1.0	.6	1.2	1.4	1.6	1.4	1.8
11 Impedance	2.2	1.2	.8	1.3	1.0	1.2	1.2	2.0	.8	1.6
12 Coefficient of coupling "K"	1.0	.8	.8	.4	.4	.8	.4	1.0	.4	1.0
13 Inductive reaction	2.2	1.8	.6	.8	1.2	2.0	1.8	2.0	1.0	1.8
14 Transient response	.6	1.0	.4	.4	.6	1.0	.4	1.0	.4	1.2
15 Variable inductor	.8	1.0	.4	.8	.4	1.0	.8	1.0	.8	1.0
16 Phase relationship between voltage and current	2.2	1.2	.4	.6	.5	1.4	.8	1.2	1.0	1.2
17 Ampere-turns	1.2	1.0	.6	.8	.4	1.0	.8	1.4	.6	1.8
18 Polarity of coil (left hand rule)	1.4	1.0	.6	.8	.4	1.0	1.0	1.6	.4	1.7
19 Series aiding and series opposing connections	2.0	1.0	.6	.6	.8	.8	1.6	1.6	.4	1.6
20 Time constant	.8	1.0	.4	.4	.3	.6	.8	1.5	.2	1.8
Average Rating	1.4	1.1	.6	.8	.7	1.2	.9	1.4	.7	1.4

Manual one received a satisfactory rating for the subject heading, iron core inductor. Manuals two, four, six, seven, eight, nine, and ten received ratings of 1.0 to 1.8. A rating of 0.8 was determined for manual number three, and manual five was rated lowest for this subject heading with a rating of 0.6.

For the subject headings, impedance, inductive reactance, phase relationship between voltage and current, and series aiding and series opposing connections, Table IX shows that manual one received the highest rating. A rating of satisfactory was ascertained for manual one for each of the above subject headings. The only other manuals to receive satisfactory ratings were number eight for its treatment of impedance and numbers six and eight for their presentation of inductive reactance.

Table X presents data concerning the subject matter treatment of motor principles. A satisfactory rating was received for manuals two, three, eight, and ten for the subject heading, direct current motors. Manual five received the lowest rating, 0.3, followed by 0.4 for manual one, 1.2 for manual four, 1.5 for manual nine, 1.6 for manual six, and 1.8 for manual seven.

TABLE X

SUBJECT MATTER TREATMENT OF MOTOR PRINCIPLES IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 DC Motors	.4	1.0	2.4	1.2	.3	1.6	1.8	2.0	1.5	2.4
2 AC Motors	.4	1.8	2.4	1.2	.3	1.6	1.0	2.2	1.6	2.4
3 Polyphase motors	.2	1.4	1.8	.4	.3	.8	.4	1.0	1.2	1.6
4 Types of starting circuits	.4	1.4	2.2	.6	.0	.8	.6	1.6	1.6	1.4
Average Rating	.4	1.7	2.2	.9	.3	1.2	1.0	1.7	1.5	2.0

Laboratory manuals three and ten with a satisfactory rating of 2.4 placed highest for the subject heading, alternating current motors. Table X further shows that a satisfactory placement was awarded to manual eight for its discussion of this subject heading. Manual five, with its rating of 0.3, placed lowest in its treatment of this subject heading. The remaining laboratory manuals were within the weak treatment category.

A rating of weak was received for the ten electricity laboratory manuals for their treatment of the subject heading, polyphase motors. The highest rating was achieved by manual three with a calculated rating of 1.8. The rating of manual one was 0.2, the lowest for this subject heading. Manual five

received a rating of 0.3, manuals four and seven a value of 0.4, manual six 0.8, manual eight 1.0, manual nine 1.2, manual two 1.4, and manual ten 1.6.

Types of starting circuits, as indicated in Table X, were treated best by manual three with a satisfactory rating of 2.2. This manual was the only one receiving a satisfactory rating for this subject heading. Manual five received the lowest degree of treatment for this subject heading with a rating of 0.0. Manuals one, four, six, and seven had subject matter treatment averages of 0.4 to 0.8, while manuals two and ten, and eight and nine were awarded ratings of 1.4 and 1.6 respectively.

The subject matter treatment of meter principles was considered important by the authors of the evaluated manuals, as evidenced by their ratings in Table XI. No rating of less than 1.0 was tabulated for the subject headings, alternating current ammeter, direct current ammeter, alternating current voltmeter, direct current voltmeter, and ohmmeter. The manuals receiving a majority of their ratings as satisfactory for these subject headings were numbers one, three, six, and nine.

The subject heading, wattmeter, was rated satisfactory for manuals three and four. Ratings of less than 1.0 were

received for manuals one, five, seven, and eight for this subject heading, and manuals two, six, nine, and ten were considered weak with numerical values of 1.0 to 1.5.

TABLE XI

SUBJECT MATTER TREATMENT OF METER PRINCIPLES IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 AC Ammeter	1.2	1.4	1.8	1.8	1.2	1.6	1.4	1.8	2.2	1.6
2 DC Ammeter	2.0	1.8	2.4	1.8	1.4	2.0	1.8	1.8	2.2	1.8
3 AC Voltmeter	1.2	1.4	2.0	1.8	1.0	2.2	1.4	1.8	2.2	1.8
4 DC Voltmeter	2.4	1.8	2.4	1.8	1.2	2.2	1.6	1.8	2.2	2.0
5 Ohmmeter	2.4	1.8	2.4	1.8	1.2	2.2	1.6	1.8	2.2	2.2
6 Wattmeter	.8	1.0	2.0	2.2	.4	1.4	.6	.6	1.5	1.0
7 Types of meter movements	1.8	1.0	2.0	1.2	.4	1.0	1.0	1.4	1.4	1.4
Average Rating	1.4	1.5	2.1	1.8	1.0	1.8	1.3	1.6	2.0	1.7

Manual three received a satisfactory value of 2.0 for the subject heading, types of meter movements. All of the remaining nine manuals with the exception of number five had a rating of 1.0+.

Table XII presents data concerning the subject matter treatment of alternating current. Laboratory manual number ten was determined to have the best treatment of the following subject headings: definition of alternating current, frequency

of an alternating current, wave form of an alternating current, peak voltage of an alternating current, and root-mean-square of an alternating current. Manual eight received the second best rating, manual two placed third, manual six placed fourth, manual one placed fifth, manual five placed sixth, manual three placed seventh, manuals four and seven ranked eighth, and finally number nine was ascertained to have the least treatment for these subject headings.

TABLE XII

SUBJECT MATTER TREATMENT OF ALTERNATING CURRENT IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Definition	1.2	1.5	1.0	.8	.8	1.2	1.2	1.8	.7	2.2
2 Frequency	1.2	1.5	1.0	.8	1.0	1.2	1.0	2.0	.8	2.2
3 Wave form	1.0	1.5	.6	.6	.8	1.2	.4	2.0	.5	2.2
4 Peak voltage	1.4	1.3	.6	.8	.8	1.2	.6	1.8	.5	2.4
5 Root-mean-square	.6	1.3	.6	.6	.6	1.2	.4	1.6	.5	1.4
Average Rating	1.1	1.4	.8	.7	.8	1.2	.7	1.8	.6	2.1

In Table XIII one can see to what extent the ten evaluated electricity manuals presented information concerning transformers. Manual one received satisfactory ratings for the subject headings, magnetic field, primary winding, secondary

winding, and primary and secondary winding turns ratio. Manuals two, three, four, five, seven, and eight did not achieve a satisfactory rating for any of the subject headings related to transformers; but, rather, they maintained a consistent weak rating for all subject headings. Manual six was rated as weak for all subject headings pertaining to transformers except for the heading, primary winding, for which it received a rating of 2.0. Manual nine was satisfactory in its treatment of the subject headings, primary winding, secondary winding, and step up-step down. Manual ten satisfactorily presented information concerning magnetic field, primary winding, secondary winding, and types of transformers both air core and iron core.

Manual four received a rating of satisfactory for all subject headings of electric power, as presented in Table XIV. Only one other manual, number ten, received a rating of satisfactory; and this rating was for the two subject headings, fuses and circuit breakers.

Data concerning the subject matter treatment of capacitors are displayed in Table XV. Laboratory manual one gives the best treatment of capacitors in this table. This manual satisfactorily presented information for six of the nine subject headings used for evaluative purposes. Manual eight

TABLE XIII

SUBJECT MATTER TREATMENT OF TRANSFORMERS IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Magnetic field	2.0	1.8	1.2	1.6	1.6	1.8	1.5	1.6	1.5	2.3
2 Primary winding	2.2	1.6	1.2	1.2	1.6	2.0	1.4	1.6	2.2	2.2
3 Secondary winding	2.0	1.6	1.2	1.4	1.4	1.8	1.4	1.6	2.2	2.2
4 Step up-step down	1.2	1.0	1.3	.8	1.6	1.0	1.6	1.2	2.0	1.5
5 Types (air core, iron core)	1.8	1.4	.8	.8	1.6	1.0	.6	1.4	1.8	2.0
6 Primary and secondary winding turns ratio	2.2	1.8	1.2	1.0	1.4	1.4	1.4	1.6	1.8	1.8
7 Transformer losses	1.8	1.0	.6	.3	1.2	1.0	1.6	1.0	1.3	1.2
8 Kinds of transformers	1.2	1.0	1.0	.8	1.3	1.0	1.0	1.0	1.0	1.2
9 Electromotive force	1.2	1.2	1.0	1.2	1.2	1.6	.8	.8	1.4	1.6
10 Counter Electromotive force	.8	.8	.6	.6	.8	1.0	.8	.8	1.2	1.4
11 Phase relationship between primary and secondary windings	1.2	1.0	1.0	.5	1.0	.8	.6	1.2	.8	1.4
Average Rating	1.6	1.3	1.0	.9	1.3	1.3	1.2	1.3	1.6	1.7

received more satisfactory ratings than did manual one; however, the overall average rating of manual one was 2.0, while that of number eight was 1.9. Manual six received a satisfactory

TABLE XIV

SUBJECT MATTER TREATMENT OF ELECTRIC POWER IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Watt's Law	.8	1.6	1.6	2.0	1.5	1.0	.8	1.3	.6	1.2
2 Resistance heating	.2	1.8	1.0	2.0	1.0	1.0	1.6	.8	.8	1.4
3 Watt hour	.2	1.2	1.0	2.2	1.3	1.0	.5	.8	.5	1.0
4 Fuses	.4	1.2	1.5	2.0	.5	1.4	1.4	1.0	1.0	2.0
5 Circuit breakers	.0	1.8	1.5	2.0	.8	1.2	.8	1.2	1.5	2.0
Average Rating	.3	1.5	1.3	2.0	1.0	1.1	1.0	1.0	.9	1.5

rating for three subject headings and manuals nine and ten were determined to be satisfactory for two subject headings of capacitors. Manuals two, three, four, five, and seven were weak in their presentations of capacitors. The manual ascertained to be weakest in treatment for all subject headings studied with the exception of the subject, phase relationship of current and voltage, was number three.

The subject matter treatment of the electrical industries as found in each of the ten manuals is displayed in Table XVI. For the subject headings listed in this table, no rating greater than 0.8 was received for manuals one, five, seven, eight, nine and ten. Manual two received consistent

TABLE XV

SUBJECT MATTER TREATMENT OF CAPACITORS IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Types	1.6	1.2	.4	1.0	.8	2.0	1.4	2.0	1.5	1.4
2 Voltage rating	2.0	1.2	.4	.6	1.0	1.8	1.4	2.0	1.4	1.8
3 Unit of capacitance	2.0	1.6	.4	1.0	1.0	2.0	1.6	2.0	1.8	1.6
4 Properties	1.8	1.6	.2	1.2	1.4	1.8	1.8	1.8	1.8	2.0
5 Capacitive reactance	2.0	1.8	.3	.8	1.4	1.8	1.8	2.0	1.6	1.8
6 Capacitors in series	2.4	1.8	.3	.8	1.2	1.8	1.8	2.0	2.2	1.6
7 Capacitors in parallel	2.4	1.6	.4	.8	1.4	2.0	1.8	2.0	2.2	1.6
8 Time constant	1.8	1.4	.4	.8	1.0	1.0	1.0	2.0	1.6	2.2
9 Phase relationship of current and voltage	2.0	1.0	.5	.4	.8	.8	.8	1.4	1.0	1.6
Average Rating	2.0	1.5	.4	.8	1.1	1.7	1.5	1.9	1.7	1.7

averages of 1.2. Manual three received ratings of 1.6, 1.8, and 2.2, and manual four had ratings ranging from 1.0 to 2.2 for the three subject headings listed.

Table XVII presents information concerning the treatment of both pictorial and schematic drawings in the ten evaluated laboratory manuals. Manuals one and four treated both of these subject headings satisfactorily. Manual three received a rating of 2.0 for its discussion of pictorial drawings,

while manuals two, six, eight and ten received ratings of 2.0, 2.2, 2.0, and 2.0 respectively for their presentation of schematic drawings.

TABLE XVI

SUBJECT MATTER IN TREATMENT OF ELECTRICAL INDUSTRIES IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
1 Power generation and distribution	.4	1.2	2.2	1.6	.6	1.2	.8	.6	.8	.6
2 Home appliance	.2	1.2	1.8	2.2	.4	1.4	.6	.4	.8	.4
3 Component manufacture	.2	1.2	1.6	1.0	.6	.8	.6	.2	.8	.6
Average Rating	.3	1.2	1.9	1.6	.5	1.1	.7	.4	.8	.5

TABLE XVII

SUBJECT MATTER TREATMENT OF ELECTRICAL DRAWINGS IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
1 Pictorial	2.0	1.6	2.0	2.0	1.4	1.8	1.4	1.6	1.4	1.8
2 Schematic	2.4	2.0	1.8	2.2	.8	2.2	1.6	2.0	1.4	2.0
Average Rating	2.2	1.8	1.9	2.1	1.1	2.0	1.5	1.8	1.4	1.9

Data concerning the subject matter treatment of electrical components are shown in Table XVIII. Each manual was evaluated to determine the extent to which it described, explained the function of, and gave operating characteristics of electrical components. Laboratory manuals one, three, six, eight, and ten were ascertained to have a satisfactory treatment of these subject headings, while manual one received the highest placement of 2.6. Manuals seven and nine, and five, two, and four received numerical values of 1.6, 1.8, and 1.8 respectively.

TABLE XVIII

SUBJECT MATTER TREATMENT OF ELECTRICAL COMPONENTS IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
Description, function, and operation of electrical components	2.6	1.8	2.0	1.8	1.8	2.4	1.6	2.0	1.6	2.0

The types of electrical test equipment and their use are presented in Table XIX. Manuals one, three, eight, and ten were awarded a rating of satisfactory for both of these subject headings. The rating of 1.6 was determined for manuals

two, four, seven, and nine for their presentation of the subject heading, kinds of electrical test equipment. Manual five received a rating of 1.5 and manual six received a rating of 1.8 for this same subject heading. A rating of 2.0 was received for manuals five and nine, while manuals two, four, six and seven placed within the weak category for the subject heading, uses of electrical test equipment.

TABLE XIX

SUBJECT MATTER TREATMENT OF ELECTRICAL TEST EQUIPMENT IN TEN ELECTRICITY LABORATORY MANUALS

	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
Subject Headings	1	2	3	4	5	6	7	8	9	10
1 Kinds 2	2.6	1.6	2.0	1.6	1.5	1.8	1.6	2.2	1.6	2.4
2 Uses	2.6	1.8	2.0	1.6	2.0	1.8	1.6	2.2	2.0	2.4
Average Rating	2.6	1.7	2.0	1.6	1.8	1.8	1.6	2.2	1.8	2.4

Table XX shows the evaluation results of Jury II with respect to the format of the electricity laboratory manuals. The accuracy of the information presented was ascertained to be satisfactory for all laboratory manuals evaluated. The highest rating for this subject heading was 2.6 for manuals one and ten. Manuals one, nine, and ten received satisfactory ratings for all subject headings. A satisfactory rating was

received for manuals four and eight for five of the six subject headings. Manual six had four satisfactory ratings, and numbers two and three had three such ratings. Manual five was deemed satisfactory for the subject headings, accuracy of information presented, and selection of paper used. Manual seven was satisfactory only in the subject heading, accuracy of information presented.

TABLE XX

FORMAT TREATMENT IN TEN ELECTRICITY LABORATORY MANUALS

Subject Headings	Extent of Treatment In Electricity Laboratory Manuals									
	Manual Number									
	1	2	3	4	5	6	7	8	9	10
1 Accuracy of information presented	2.6	2.2	2.0	2.4	2.0	2.2	2.0	2.0	2.2	2.6
2 Organization and arrangement	2.2	1.8	2.2	2.2	1.8	1.5	1.8	1.8	2.2	2.0
3 Aids (such as table of contents, index references)	2.2	1.8	1.2	2.0	1.8	1.8	1.5	2.0	2.0	2.0
4 Illustrations	2.2	1.6	1.8	1.8	1.8	2.0	1.8	2.0	2.2	2.0
5 Durability	2.2	2.0	1.8	2.2	1.8	2.2	1.5	2.0	2.0	2.2
6 Selection of paper used	2.2	2.0	2.0	2.2	2.0	2.0	1.8	2.2	2.0	2.2
Average Rating	2.3	1.9	1.8	2.1	1.9	2.0	1.7	2.0	2.1	2.2

Table XXI presents information concerning placement of the evaluated manuals and the total points received by each

manual. Manual number ten received the best overall rating. The manual containing the least treatment of the subject headings in the evaluation instrument was manual five. A total of 191.0 was received for manual ten, and 105.4 was received for laboratory manual five.

TABLE XXI

PLACEMENT OF THE TEN ELECTRICITY LABORATORY MANUALS

Placement	Manual Number	Total Points Received	Average Rating
1st	10	191.0	1.6
2nd	8	174.?	1.5
3rd	3	161.1	1.4
4th	6	159.6	1.3
5th	2	157.4	1.3
6th	4	153.3	1.3
7th	1	146.2	1.2
8th	9	124.7	1.0
9th	7	123.1	1.0
10th	5	105.4	.9

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purposes of the study were to develop criteria suitable for evaluating electricity laboratory manuals, to ascertain what experiments are outlined in each of the laboratory manuals, and to determine which student laboratory manuals are most adequate in meeting requirements of the course general electricity as specified in Bulletin 615.

The evaluation instrument used in the study was approved by Jury I and used by Jury II to determine the adequacy of ten electricity laboratory manuals in meeting curriculum standards for the secondary school course in general electricity.

The value determined for the laboratory manuals for each subject heading was ascertained by adding the ratings received from Jury II and dividing by the number of ratings received. The value of 2.6 was the highest rating received for the treatment of subject headings of the evaluation instrument. The numerical range of 0.0 to 2.6 for the subject headings of the evaluated manuals was established.

The manuals evaluated placed in the following order: manual ten rated highest in its treatment of the subject headings on the evaluation instrument, followed by manual numbers eight, three, six, two, four, one, nine, seven, and five. This placement was determined by adding all the numerical values assigned to each sub-division in each major division.

Findings

1. None of the ten evaluated manuals received an overall satisfactory rating for their treatment of the following subject matter: atomic theory, Coulomb's Law, Lenz's Law, sources of electricity, induction, transformers, and electrical industries.

2. Manuals receiving overall satisfactory ratings for their treatment of the subject heading, Ohm's Law, were numbers three, four, five, and six.

3. The manual receiving an overall rating of satisfactory for the treatment of the subject heading, Kirchoff's Law, was number eight.

4. The one manual receiving an overall rating of satisfactory for the treatment of the subject heading, motor principles, was number three.

5. Manual three received the only overall satisfactory rating for the subject heading, meter principles.

6. The only manual receiving an overall satisfactory rating for its treatment of the subject heading, alternating current, was number ten.

7. Manual number four was the only manual that received an overall satisfactory rating for its treatment for the subject heading, electric power.

8. The only laboratory manual receiving an overall satisfactory rating for its treatment of the subject heading, capacitors, was number one.

9. Achieving an overall satisfactory rating for their treatment of the subject heading, electrical drawings, were manuals one, four, and six.

10. Manuals one, three, six, eight, and ten received overall satisfactory ratings for the subject heading, electrical components.

11. Manuals one, three, eight, and ten received overall satisfactory ratings for the subject heading, electrical test equipment.

12. The manuals that were ascertained to have satisfactory format were numbers one, four, eight, nine, and ten.

13. Each of the laboratory manuals contained satisfactory treatment of some subject headings with the exception of number seven, but all were weak in their presentation of other subject headings.

14. Manual ten treated all of the subject headings most extensively.

Conclusions

The following conclusions are drawn based upon the findings of tne study:

1. None of the evaluated manuals were found to be satisfactory for use in the secondary school course, general electricity. However, manual ten is the most adequate manual to be used in meeting curriculum standards for the secondary school course, general electricity.

2. Additional manuals would be needed for use with each of the ten evaluated manuals in order for all subject headings of the course, general electricity, to be covered completely.

3. All of the manuals except manual seven (excluding format treatment) present satisfactory treatment of at least one subject heading and may be used as a source in general electricity.

Recommendations

A. Each of the ten manuals evaluated in the study should consider providing more extensive treatment of the

following subject headings, since none of the manuals received a satisfactory rating for the following subject headings:

1. matter
2. mixtures and compounds
3. elements
4. molecule
5. atomic number
6. atomic weight
7. ionization
8. omega (Ω)
9. computations using Coulomb's Law
10. Lenz's Law
11. mercury cell
12. nickel-cadmium cell
13. battery
14. thermocouple
15. static machines
16. unit of inductance "henry"
17. self inductance
18. mutual inductance
19. coupling
20. magnetic shielding
21. neutralizing
22. saturation
23. air core inductor
24. coefficient of coupling "K"
25. transient response
26. variable inductor
27. ampere-turns
28. polarity of coil (left hand rule)
29. time constant
30. poly-phase motors
31. root-mean-square
32. transformer losses
33. kinds of transformers
34. electromotive force
35. counter electromotive force
36. phase relationships between primary and secondary windings
37. component manufacture

B. It is suggested that similar studies be made as additional electricity laboratory manuals become available for use in the course, general electricity.

C. More than one manual should be accessible to students of general electricity, as each of the ten evaluated manuals contained weak treatment of some subject headings.

APPENDIX A

523 Summit Ridge
Duncanville, Texas 75116
March 4, 1970

Mr. C. C. Miller
Assistant Superintendent-Organizations
3700 Ross Avenue
Dallas, Texas

Dear Mr. Miller:

I am teaching electronics at Justin F. Kimball High School and engaged in graduate study at North Texas State University. I am presently working on my thesis under the direction of Dr. A. F. Nelson in which I am attempting to evaluate all electricity laboratory manuals available for use on the high school level.

In planning and organizing the thesis with Dr. Nelson, it was suggested that two juries of five persons each be selected to participate in the evaluation. I would like to request permission to utilize the assistance of electronic teachers in the Dallas Independent School District as jury members who would be willing to participate. The work required of each will be limited to the shortest period of time possible due to their busy schedule.

I have discussed this with Mr. Stockton, and the study is felt to be of importance to our educational system, and I would like to request permission to utilize the assistance of ten electronics teachers in the Dallas Independent School District.

Sincerely,

Richard M. Turner

Sponsored by,

Dr. A. F. Nelson

APPENDIX B

March 17, 1970

Mr. Richard M. Turner
Justin F. Kimball High School
Dallas, Texas

Dear Mr. Turner:

Mr. Stockton and I have discussed your request to utilize the assistance of ten electronic teachers in the Dallas Independent School District to help evaluate your proposal.

We see no objection to this procedure, with the understanding that the assistance of the teachers will be on a purely voluntary basis.

If this study is made, you should keep in touch with Mr. Stockton.

Sincerely yours,

C. C. Miller
Associate Superintendent - Development

Bragg Stockton
Director - Vocational-Industrial Education

CCM:jw

APPENDIX C

Dear Sir:

I am teaching electronics at Justin F. Kimball High School in Dallas, Texas. I have also been working toward a Master of Science degree at North Texas State University where I am currently enrolled for my thesis research. In consultation with my major professor, I have arrived at a suitable topic for research involving an evaluation of electricity training manuals to determine which ones will most adequately meet the curriculum content for an electricity course at the high school level as recommended by the Texas Education Agency. It is thought that such a study will be instrumental in improving our electricity-electronics program.

I would like to know if it would be possible to secure a copy of your electricity training manual(s) to include in the study. All participants will be supplied a summary of the study.

Your cooperation will be appreciated.

Sincerely,

Richard M. Turner
523 Summit Ridge
Duncanville, Texas 75116

APPENDIX D

Dear Sir:

On March 26, 1970, I sent a letter to you requesting your help in a study that will attempt to evaluate all electricity laboratory manuals.

I have not received a copy of your manual(s), but I would like to, so that it may be included in the study.

If you do not wish to be a part of this study, please notify me at your earliest convenience.

Sincerely,

Richard M. Turner
523 Summit Ridge
Duncanville, Texas 75116

APPENDIX E

June 10, 1970

TO: Teachers of Electricity

Mr. Charles Tuckey, Hillcrest High School
Mr. Jerry Cramer, Thomas Jefferson High School
Mr. Paul Stafford, South Oak Cliff High School
Mr. Jimmy Sikes, H. Grady Spruce High School
Mr. Travis Bell, J. L. Long Junior High School
Mr. Jerry Surratt, John B. Hood Junior High School
Mr. Fred Autrey, L. V. Stockard Junior High School
Mr. Rex Jones, Edward H. Cary Junior High School
Mr. Lyle Baker, W. H. Gaston Junior High School
Mr. William Storms, Sarah Zumwalt Junior High School

Mr. Richard Turner, teacher of electricity and electronics at Justin F. Kimball Senior High School, is making a study that we think has much value for you. He will see that you have the results of the study.

Attached is a copy of a letter that was written to Mr. Turner and approved by Mr. C. C. Miller and me. It gives approval of this type of work for each individual teacher participating in studies with the Dallas Independent School District.

The subject that Mr. Turner is studying is as follows: "An Evaluation of Ten Electricity Training System Laboratory Manuals, to Ascertain Their Adequacy in Meeting Curriculum Standards for the Secondary School Course General Electricity."

Mr. Turner will be contacting each one of you, probably by phone, and he would like to talk with you and bring to you the laboratory manuals that he would like for you to evaluate.

APPENDIX E (continued)

We would appreciate very much your giving him your support in making this study. We think that it might be helpful to you in your program at your school Thank you very much.

With best wishes to you for the summer, I am

Very sincerely yours,

Bragg Stockton, Director
Vocational-Industrial Education

BS:edh
Attach.

APPENDIX F

INSTRUCTIONS FOR CHECKING THE CRITERIA FOR USE IN EVALUATING ELECTRICITY LABORATORY MANUALS

This instrument consists of items describing the subject matter content stated in Bulletin 615 of the Texas Education Agency. It is assumed that the subject matter content of the laboratory manuals will be present in varying degrees. In order that this instrument will be more meaningful, it is necessary to define the various degrees of treatment of the subject matter:

1. Superior treatment: This term is interpreted to mean a thorough, comprehensive and extensive treatment of the subject matter. It pertains to the highest ranking treatment of the subject matter content.

2. Satisfactory treatment: This term will be construed to mean that meeting of the requirements or expectations for teaching the required subject matter content, but not thorough enough treatment to be classified as being "superior" yet above "weak" or mere inclusion.

3. Weak treatment: This term will be construed to mean a mere inclusion or bare mention of the items by the author and insufficient information concerning the required subject matter content.

4. No treatment: The subject matter content is not present in any form in the laboratory manual.

APPENDIX G

Juror No. _____ Return Date _____

ADEQUACY OF AVAILABLE LABORATORY MANUALS FOR GENERAL ELECTRICITY

The purpose of this instrument is to determine the degree of treatment of the following subject matter content, as found in each of the available laboratory manuals. Please indicate with a check mark (✓), the degree of treatment of the subject matter content as found in the laboratory manual.

Subject Matter Content for General Electricity Laboratory Manual No. _____ Laboratory Manual Name _____	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
1. Atomic Theory				
A. Matter				
B. Mixtures and compounds				
C. Elements				
D. Molecule				
E. Atom				
F. Nucleus.				
G. Nucleons				
H. Neutron.				
I. Protons.				
J. Electrons.				
K. Atomic number.				
L. Atomic weight.				
M. Ionization				
N. Laws of charges.				
O. Electrostatic fields				

APPENDIX G (continued)

	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
1. Atomic Theory (continued)				
P. Electric current				
Q. Direction of current flow. . .				
R. Conductors				
S. Insulators				
2. Ohm's Law				
A. Omega (Ω)				
B. Ohm (as unit of resistance). .				
C. Letter symbols for resistance, volts, and amperes.				
D. Resistance				
E. Volts.				
F. Amperes.				
G. Transposition of symbols . . .				
H. Computations using Ohm's Law .				
3. Computations using Coulomb's Law. .				
4. Kirchoff's Laws				
A. Law of current				
B. Law of voltage				
5. Lenz's Law.				
6. Sources of Electricity				
A. Voltaic cell				
B. Dry cell				
C. Mercury cell				

APPENDIX G (continued)

	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
6. Sources of Electricity (continued)				
D. Nickel-cadmium cell.				
E. Battery.				
F. Secondary cell				
G. Lead acid cell				
H. Photo-cell				
I. Thermocouple				
J. Piezoelectric effect				
K. DC generators.				
L. AC generators (alternator) . .				
M. Static machines.				
7. Induction				
A. Symbol for inductance "L". . .				
B. Unit of inductance "henry" . .				
C. Self inductance.				
D. Mutual inductance.				
E. Coupling				
F. Magnetic shielding				
G. Neutralizing				
H. Saturation				
I. Air core inductors				
J. Iron core inductors.				
K. Impedance.				
L. Coefficient of coupling "K". .				
M. Inductive reactance.				
N. Transient response				
O. Variable inductor.				
P. Phase relationship between voltage and current.				
Q. Ampere-turns				
R. Polarity of coil (left hand rule).				

APPENDIX G (continued)

	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
7. Induction (continued)				
S. Series aiding and series opposing connections				
T. Time constant.				
8. Motor Principles				
A. DC motors.				
B. AC motors.				
C. Poly phase motors.				
D. Types of starting circuits . .				
9. Meter Principles				
A. AC ammeter				
B. DC ammeter				
C. AC voltmeter				
D. DC voltmeter				
E. Ohmmeter				
F. Wattmeter.				
G. Types of meter movements . . .				
10. Alternating Current				
A. Definition				
B. Frequency.				
C. Wave form.				
D. Peak voltage				
E. Root-mean-square				
11. Transformers				
A. Magnetic field				
B. Primary winding.				

APPENDIX G (continued)

	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
11. Transformers (continued)				
C. Secondary winding.				
D. Step up-step down.				
E. Types (air core, iron core). .				
F. Primary and secondary winding turns ratio.				
G. Transformer losses				
H. Kinds of transformers.				
I. Electromotive force.				
J. Counter electromotive force. .				
K. Phase relationship between primary and secondary windings				
12. Electric Power				
A. Watt's Law				
B. Resistance Heating				
C. Watt hour.				
D. Fuses.				
E. Circuit breakers				
13. Capacitors				
A. Types.				
B. Voltage rating				
C. Unit of capacitance-farad. . .				
D. Properties				
E. Capacitive reactance				
F. Capacitors in series				
G. Capacitors in parallel				
H. Time constant.				
I. Phase relationship of current and voltage.				

APPENDIX G (continued)

	Extent of Treatment of Subject Matter			
	Superior Treatment	Satisfactory Treatment	Weak Treatment	No Treatment
14. Industries				
A. Power generation and distribution				
B. Home appliance				
C. Component manufacture.				
15. Electrical Drawings				
A. Pictorial.				
B. Schematic.				
16. Description, function, and operation of electrical components.				
17. Test Equipment				
A. Kinds.				
B. Uses				
18. Format Content for General Electricity				
A. Accuracy of information presented.				
B. Organization and arrangement.				
C. Aids (such as index, table of contents, references) . .				
D. Illustrations.				
E. Durability				
F. Selection of paper used. . . .				

Completed by _____ _____ _____
Name Address Date

APPENDIX H

COMPLETE NAMES AND ADDRESSES OF COMPANIES PARTICIPATING IN THE STUDY

Bell and Howell Schools
Devry Industries, Inc.
3956 West Belmont Avenue
Chicago, Illinois 60618

Electronic Aids, Inc.
6101 Falls Road
Baltimore, Md. 21209

Electronic Kits Supply Co.
Dept. S-2
P.O. Box 54660 Term. Annex.
Los Angeles, Calif. 90054

Hickok Teaching Systems, Inc.
Wheeling Avenue
Woburn, Mass. 01801

Lab-Volt Educational Systems
Buck Engineering Co., Inc.
Box 686
Farmingdale, New Jersey 07727

McKnight and McKnight Publishing Co.
Bloomington, Illinois 61701

Philco-Ford
Educational and Technical Services Division
P.O. Box 10
Fort Washington, Pa. 19034

Science Electronics
Division of General Electronics Laboratories, Inc.
1085 Commonwealth Avenue
Boston, Mass. 02215

APPENDIX H (continued)

Simpson Educational Systems
853 North Dundee
Elgin, Illinois 60120

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