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THE STATUS OF APPLIED ELECTRICITY IN SELECTED COLLEGES AND SECONDARY SCHOOLS IN KANSAS

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THE STATUS OF APPLIED ELECTRICITY IN SELECTED COLLEGES AND SECONDARY SCHOOLS IN KANSAS

A Thesis Submitted to the Graduate Division in Partial Fulfillment of the Requirements for the Degree of Master of Science

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Genuine thanks is expressed to the respondents who cooperated in providing the requested information.

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ABSTRACT

History would seem to indicate that an institution, whether it be social, political, or economic, exists effectively only so long as it serves the needs of its time. So it is with industrial arts education.

This study was developed on the premise that applied electricity was a current and future need of such dimensions that it demanded more attention by educators. An attempt was made to determine the present status of teaching applied electricity in selected colleges and secondary schools in Kansas with a view to developing and/or improving programs in the area.

Objective data were obtained by surveys of secondary school administrators, industrial arts supervisors, and instructors who taught applied electricity as a separate course or as a unit in a composite general shop. Additional information and statistics were derived from books, periodicals, published catalogs from colleges and universities, and documents prepared by electrical industries.

A survey of eighty-eight high schools in the state revealed that only 17.1 per cent had a separate course or courses in applied electricity. Of this group 47 per cent indicated they desired additional courses in the area if facilities and curriculum could be adjusted.

Among the schools that did not have separate courses of applied electricity, 53.2 per cent replied that they would desire such a course.

Of the eleven teachers responding 63.6 per cent felt that their preparation as teachers of applied electricity had been inadequate.

About 70.6 per cent of the supervisors and administrators who had separate courses of applied electricity indicated that such courses should be organized under the industrial arts department rather than the physical science department.

A perusal of the catalogs of Kansas four-year colleges and universities offering industrial arts revealed that only one college actually had an adequate program, four colleges had minimum programs, two sub-minimum programs, and one offered no electricity at all.

Current literature and trends in the industrial economy would seem to indicate that in view of the skill demands of society--both present and future--school curriculum must undergo careful scrutiny and creative alteration.

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CHAPTER I

INTRODUCTION

Since Thomas A. Edison's establishment of the Pearl Street Station in New York City in 1882 an entirely new industry was born. In the short span of seventy-five years the electric industry has progressed remarkably until today it is one of the main foundation stones of modern civilization. It provides electric service to every segment of American life and plays an indispensable role in the high standard of living, the cultural advance, the prodigious industrial production, and the hopes for even greater progress in the future.

It has been suggested by many that society today stands on the threshold of the second industrial revolution in the guise of automation. Automation has as its life blood the electronics and electrical industries. The electron tube is taking over. The role of electricity in this technological era is indispensable.

What is being done in education today to keep abreast of the socio-economic and technological developments which are making themselves felt in the lives of students? This study will give some indication of the status of applied electricity as a school subject in Kansas schools and at the same time point to possible improvements.

Statement of the Problem

This is a study of the present status of teaching applied electricity in selected colleges and secondary schools in Kansas with a view toward improving and/or developing proper course offerings in applied electricity in high schools and colleges of the state.

The term, applied electricity, shall be used in this study to include the generation, transmission, effects, and uses of electricity both in theory and in practice.

Need for the Study

In an era in which there is so much concern about the scientific and technical needs of society it is well to examine conditions--past, present, and future--as to their relationship to industrial arts education.

Since industrial arts is linked primarily to the technological aspect of today's culture it must be geared to significant changes which come. The fact that applied electricity is of tremendous importance, not only to the technological changes which have come and are coming but also to the enrichment of daily living, would seem to indicate that school offerings in this area should be examined critically. Industrial arts education should be able to identify current problems and provide satisfactory solutions to them.

Purpose of the Study

The purpose of this study was to determine if existing programs of electricity in secondary schools and colleges are adequate. It was also the desire of the writer to stimulate some creative thinking and promote some positive action in the direction of curriculum planning to include courses in applied electricity in schools where they are currently non-existent.

Limitations of the Study

The study has been limited to ninety-seven public secondary schools in Kansas having a minimum enrollment of 200 students as indicated by the Kansas Educational Directory[1] and to eight four-year colleges and universities having an industrial arts curriculum.

First and second class cities were not used as a base because of the significant number of rural, community, and county high schools that would have been excluded. The minimum enrollment of 200 students, however, included most of the second class cities.

No statistical consideration has been given to whether or not the schools were city, urban, or rural, or whether they were three or four-year high schools.

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[1] Adel F. Throckmorton, Kansas Educational Directory, State Superintendent of Public Instruction, Topeka, Kansas, 1956-1957, pp. 10-77.

The writer admits a bias in favor of a much broader program offering in the area of applied electricity both in the secondary school and in the college.

Related Studies

Studies have been made by Morgan,[2] Hahn,[3] Starkey,[4] and Atteberry[5] which have a general relation to this thesis.

In Morgan's[6] study of the industrial arts program of Pittsburg High School, Pittsburg, Kansas, it was found that no radio or electronics courses and no practical electricity courses were available. The survey did reveal, however, that twenty-eight per cent of the students (which was the highest percentage of interest shown out of fourteen possible course additions in the industrial arts program) were interested in

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[2]Jack W. Morgan, "Industrial Arts in Pittsburg High School" (unpublished master's thesis, Kansas State Teachers College, Pittsburg, Kansas, 1949).

[3]Henry G. Hahn, "The Status of High School Industrial Arts in Second Class Cities in Kansas" (unpublished master's problem, Kansas State Teachers College, Pittsburg, Kansas, 1942).

[4]Harry Arthur Starkey, "A Survey of the Industrial Arts Programs of the Colleges and Junior Colleges of Kansas" (unpublished master's problem, Kansas State Teachers College, Pittsburg, Kansas, 1941).

[5]Pat Herman Atteberry, "The Status of Industrial Education in the Junior Colleges of the United States" (unpublished master's thesis, Kansas State Teachers College, Pittsburg, Kansas, 1952).

[6]Morgan, op. cit., p. 23.

a radio and electronics course. Practical electricity and welding ranked fourth out of the fourteen possible course additions with twenty-three per cent of the students showing an interest.

These findings while possibly not typical of all high school students in similar circumstances would nevertheless indicate substantial interest in applied electricity.

Sources of Information

Suggestions for improvement, change, and/or development will be based upon objective data obtained from secondary school administrators, industrial arts supervisors, and instructors who teach applied electricity as a separate course or as a unit in a composite general shop. Additional information and statistics were derived from books, periodicals, published catalogs from colleges, and documents prepared by the electrical industries.

CHAPTER II

METHODS USED IN THE STUDY

Survey of the Teachers of Applied Electricity

A questionnaire was sent to ten teachers currently teaching applied electricity as determined by the Directory of Shop Teachers in Kansas.[7] This questionnaire[8] secured information pertaining to years of experience, type and adequacy of training, nature of course taught, and reasons for not starting or expanding an area of applied electricity.

Survey of Teachers of Composite General Shop

The same questionnaire that was sent to the teachers of applied electricity was also sent to thirty-one composite general shop teachers.

Survey of Supervisors of Industrial Arts

Questionnaires[9] were sent to seventeen supervisors of industrial arts. The information secured indicated whether or not a separate course of applied electricity was offered, under what department it was organized, how long it had been offered, the extent of the offerings, grade level, and reasons for not developing or expanding a program.

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[7] Directory of Shop Teachers in Kansas, compiled by the Trade and Industrial Education Division, The Kansas State Board of Vocational Education, Topeka, Kansas, 1956.

[8] See Appendix, p. 77.

[9] See Appendix, pp. 78-79

Survey of High School Administrators

The same questionnaire that was sent to the supervisors was also sent to ninety-seven high school administrators to determine the status of teaching applied electricity in their respective schools.

Survey of College Catalogs

The catalogs of four-year Kansas colleges and universities were examined to locate those having an industrial arts curriculum. They were further scrutinized to determine the course offerings in applied electricity.

CHAPTER III

FINDINGS OF SURVEYS

Teachers of Applied Electricity

Of ten questionnaires[10] sent to electricity and/or radio instructors,[11] only four replies were received, one address was unknown, and five failed to reply even after a third mailing of the questionnaire. A return of forty per c ent cannot bear information which would be conclusive but the results have been tabulated and evaluated as follows:

Question 1. I (am, am not) teaching electricity?

All four replies were in the affirmative.

Question 2. For how many years have you taught electricity?

Shortest number of years taught	3
Longest number of years taught	15
Average number of years taught	9

(In order to give a more accurate picture of the training received and desired by teachers in this area, Questions 3 through 8 will be applied to each individual teacher separately. The teachers shall be referred to by number.)

Teacher Number 1.

Question 3. Where did you receive the major portion of your college training?

University of Minnesota, Minneapolis, Minnesota.

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[10] See Appendix, p. 77.

[11] Directory of Shop Teachers in Kansas, op. cit.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

Electricity	2 hours
Radio	2 hours

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor?

Electricity
Radio
Algebra
Trigonometry

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

Electrical projects
Alternating current
Electronics

Question 8. Was and/or is electricity a hobby with you?

Yes.

Teacher Number 2.

Question 3. Where did you receive the major portion of your college training?

Kansas State Teachers College, Pittsburg, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

A.C. and D.C. Transmission
Illumination
Electrical Machinery
Storage Batteries
Radio
Installation
Automotive Electricity
Arc Welding

(Number of hours of credit not indicated)

Question 5. Was your training adequate?

Yes.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

All of them.

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

Electronics
Television

Question 8. Was and/or is electricity a hobby with you?

No.

Teacher Number 3.

Question 3. Where did you receive the major portion of your college training?

Vocationally in the field at Topeka, Kansas. I was a service man for years.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

None.

Question 5. Was your training adequate?

Yes.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

College Physics
Mathematics minor

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

All they can get!
Also vocational experience.
Vocational experience is the most important.

Question 8. Was and/or is electricity a hobby with you?

Yes.

Teacher Number 4.

Question 3. Where did you receive the major portion of your college training?

None.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

None. I had eighteen years practical experience, two and one-half years in the army, and two government licenses.

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor?

No reply.

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

Yes.

Question 9. Please check the appropriate blanks. Column A indicates the items included in the present course of study. Column B indicates the items that would be considered desirable but which are not currently offered.

A	B	
4		Magnetism
4		Static electricity
4		Current electricity
4		Wet cells
4		Dry cells
1	2	Electroplating
4		Ohm's law
4		Measuring instruments
4		Effects of electricity
4		Heating effects
4		Lighting effects
1	1	Electric welding
4		Series and parallel wiring
2	1	Appliance wiring
2	2	Appliance maintenance
3	1	House wiring
4		Induced currents
4		Electromagnetic effects
4		Transformers
4		A.C. and D.C. generators
4		A.C. and D.C. motors
4		Alternating current
3	1	Power transmission
4		Rectifiers
4		Radio theory
3		Radio practice
1	2	Television theory
1	2	Television practice
2	1	Electronics
1	2	Consumer knowledge
4		Safety
		Others

Question 10. Please indicate the reason or reasons that might prevent your school from expanding its offerings in applied electricity. Check those that you consider most important.

No. of Times Checked	
0	Insufficient funds
0	Inadequate facilities
0	Not enough student interest
0	Lack of instructor interest
0	Very little administrative interest
0	Qualified instructors are not available
1	Not enough students to justify a separate course

1	Curriculum already overcrowded
0	Course content does not justify a separate course
0	Students receive sufficient applied electricity in a physics course
0	Students receive sufficient applied electricity in a composite general shop
0	Others

Question 11. Please list any special electrical projects, devices, or methods that you use which would be beneficial to others in the field.

Magnetic filing chart
Compass
Temporary magnet
Pith ball apparatus
Wire splicing
Bell circuits
Light switch circuits
Miniature lamp socket
Push button or switch
Simple cell
Buzzer
Telegraph key
Motor
Transformer
Crystal radio
Marking tools with acid
Electroplating

Summary. Even though there was an inadequate response--forty per cent--by the teachers of applied electricity certain facts were of some significance.

The average length of experience was eight and one-half years which might indicate that not many new teachers were going into the field. To further support this conclusion electronics and television which are relatively new school subjects were both cited as desirable courses in a teacher preparatory program.

Half of the teachers responding felt as though their training had not been adequate as indicated by Figure 1.

Mathematics and physics were cited as good background courses.

Three of the four instructors indicated that electricity was a hobby with them.

Fifty per cent of the teachers wanted to include electroplating, appliance maintenance, television theory and practice, and consumer knowledge into their courses.

An examination of the projects used would point to the need of some creative thinking to enrich and modernize the type and variety of project offerings.

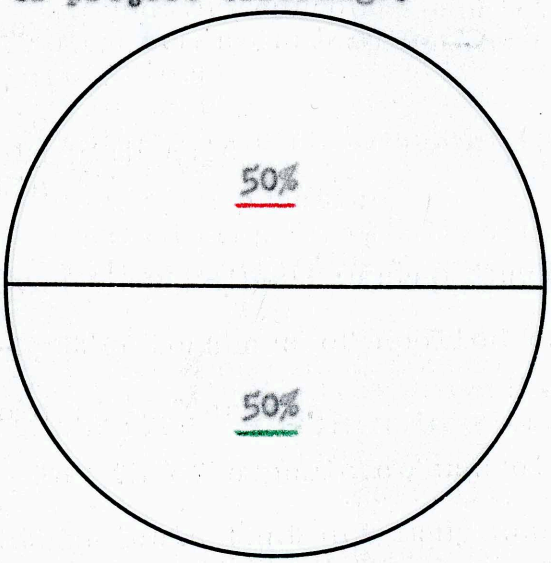

Figure 1.

A Comparison of Adequacy of Preparation
Teachers of Applied Electricity

Adequate Inadequate

Teachers of Composite General Shop

Schools having composite general shops were ascertained from the Directory of Shop Teachers in Kansas[12] and from the information received from the questionnaires[13] sent to high school administrators.

Of thirty-one questionnaires sent to teachers of composite general shops twenty-two were returned. Fifteen of them were not given consideration in the tabulation of results since they did not include electricity in their program.

The results of the survey were tabulated as follows:

Question 1. I (am, am not) teaching electricity.

Number answered yes	7	or	31.8%
Number answered no	15	or	68.2%

Question 2. For how many years have you taught electricity?

Shortest number of years taught	4
Longest number of years taught	30
Average number of years taught	12

(As in the preceding tabulation of survey results, each teacher in this group has been dealt with individually on Questions 3 through 8 to give a more accurate picture of their preparation.)

Teacher Number 1.

Question 3. Where did you receive the major portion of your college training?

Kansas State Teachers College, Emporia, Kansas.

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[12] Directory of Shop Teachers in Kansas, op. cit.

[13] See Appendix, p. 77.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

Electricity as a part of aircraft mechanics training.

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

No reply.

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

No.

Teacher Number 2.

Question 3. Where did you receive the major portion of your college training?

Kansas State Teachers College, Pittsburg, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

None.

Question 5. Was your training adequate.

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

Mathematics minor.

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

General Shop
Physics--a must
General Electricity
Mathematics
Metalwork
Radio--becomes more important each year

Question 8. Was and/or is electricity a hobby with you?

Yes.

Teacher Number 3.

Question 3. Where did you receive the major portion of your college training?

Kansas State College, Ft. Hays, Kansas.
Kansas State College, Manhattan, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

I started in electrical engineering.

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

General Mathematics
General Science
Physics
House Wiring
Motor Repair
Generators and Generating Systems
Transmission Lines

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

Yes.

Comments: I have tried to teach just general electricity--things that every boy will need in working with electricity in every day life. I find my training not enough advanced to meet the needs of a teacher of electricity. I have given courses in general radio and we enjoyed it, but in our school we do not have enough time and equipment to do a good job. I have an amateur radio station and can help the boys some. I do think every school should be able to teach enough electricity, both theory and practice, to enable a boy to go out and do the things he needs to in every day living. To become an expert it is necessary for him to spend a lot of time in special work in college to prepare him for advanced work.

Teacher Number 4.

Question 3. Where did you receive the major portion of your college training?

Kansas State Teachers College, Emporia, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

General Electricity 2 hours

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

General Electricity

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

No.

Teacher Number 5.

Question 3. Where did you receive the major portion of your college training?

Kansas State Teachers College, Emporia, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

Physics 6 hours

Question 5. Was your training adequate?

No.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

Light
Magnetism
Electricity
Electrical Theory
Trigonometry

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

No.

Comments: We have one unit, about four weeks, in a general shop set-up. The general shop is incomplete actually.

Teacher Number 6.

Question 3. Where did you receive the major part of your college training?

Kansas State Teachers College, Pittsburg, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

Electricity.

Question 5. Was your training adequate?

Yes.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instrcutor? Please list in the order of importance.

Mathematics
General Physics
General Electricity
Electricity Laboratory

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

Yes.

Teacher Number 7

Question 3. Where did you receive the major portion of your college training?

Bradley University, Peoria, Illinois.
Kansas State Teachers College, Pittsburg, Kansas.

Question 4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours of credit.

Too long ago. Have learned more since college than when in college.

Question 5. Was your training adequate?

Yes.

Question 6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance.

No reply.

Question 7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance.

No reply.

Question 8. Was and/or is electricity a hobby with you?

Yes.

Question 9. Please check the appropriate blanks. Column A indicates the items included in the present course of study. Column B indicates the items that would be considered desirable but which are not currently offered.

A	B	
7		Magnetism
3	1	Static electricity
7		Current electricity
7		Wet cells
7		Dry cells
2	3	Electroplating
6	1	Ohm's law
6		Measuring instruments
6		Effects of current electricity
7		Heating effects
7		Lighting effects
4	1	Electric welding
7		Series and parallel wiring
5	1	Appliance wiring
5	2	Appliance maintenance
3	3	House wiring
5	2	Induced currents
5	2	Electromagnetic induction
6	1	Transformers
1	4	A.C. and D.C. generators
2	4	A.C. and D.C. motors
6	1	Alternating current
1	4	Power transmission
1	5	Rectifiers
2	4	Radio theory
2	4	Radio practice
1	4	Television theory
1	4	Television practice
1	4	Electronics
3	3	Consumer knowledge
6	1	Safety
		Others

There would seem to be a desire on the part of composite general shop instructors to enlarge their offerings in the

field of electricity. The items desired in the order of importance would seem to be rectifiers in first place with electronics, radio, television, power transmission, and A.C. - D.C. generators and motors in second place followed by house wiring, electroplating, and consumer knowledge.

Question 10. Please indicate the reason or reasons that might prevent your school from expanding its offerings in applied electricity.

No. of Times Checked	
2	Insufficient funds
4	Inadequate facilities
2	Not enough student interest
2	Lack of instructor interest
0	Very little administrative interest
3	Qualified instructors are not available
0	Not enough students to justify a separate course
4	Curriculum already overcrowded
1	Course content does not justify a separate course
0	Students receive sufficient applied electricity in a physics course
0	Students receive sufficient applied electricity in a composite general shop
0	Others

Significant results here would seem to indicate that an overcrowded curriculum schedule and inadequate facilities were the main deterrents to expanding offerings in applied electricity with the lack of qualified instructors holding a strategic position.

Question 11. Please list any special electrical projects, devices, or methods that you use which would be beneficial to others in the field.

Local electrical codes
Home electric repair
Scout merit badge
Test lamp

Summary. Five of the seven teachers indicated that their preparation in applied electricity had been inadequate as shown by Figure 2. If an expanded applied electricity course were to be offered, more college training would be needed.

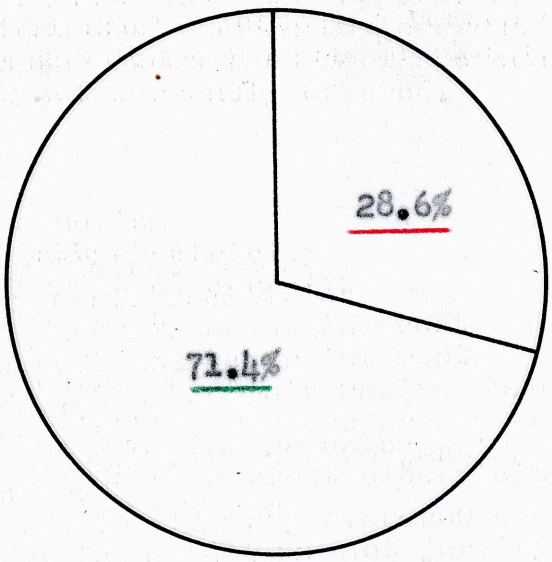

Figure 2.

A Comparison of Adequacy of Preparation
Teachers of Composite General Shop

Adequate Inadequate

Of the teachers responding all received the major portion of their training in one of the four state colleges with Emporia and Pittsburg contributing the greatest number.

Mathematics and physics were again suggested as desirable for more adequate preparation.

Four of the seven commented that electricity was a hobby with them.

There was a desire to enrich the area of applied electricity by including information about electronics, radio, television, power transmission, and A.C.-D.C. generators and motors. House wiring, electroplating, and consumer knowledge were also regarded as desirable additions. The items mentioned as desirable additions indicated that the applied electricity offered was of a rather meager nature.

Reasons for not expanding or developing the program were listed in order of importance as inadequate facilities, curriculum already overcrowded, and a lack of qualified instructors.

Supervisors of Industrial Arts

The names of the supervisors were obtained from the Trade and Industrial Education Directory[14] and from the questionnaires sent to high school administrators.

Of seventeen questionnaires[15] sent to supervisors of industrial arts all seventeen were returned. The results were divided into two groups--those having separate courses in applied electricity and those not having separate courses.

Schools Having Separate Courses. There were six schools that had a separate course or courses in applied electricity. The results of the survey were as follows:

Question 1. For how many years has your school offered separate courses in applied electricity?

Shortest number of years offered	16
Longest number of years offered	30
Average number of years offered	23

Question 2. Are the courses organized under the industrial arts department?

Number answered yes	5	or	83.3%
Number answered no	1	or	16.7%

Question 3. Are the courses organized under the physical science department?

Number answered yes	1	or	16.7%
Number answered no	5	or	83.3%

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[14] Trade and Industrial Education Directory, Kansas State Board for Vocational Education, Topeka, Kansas, 1956-57.

[15] See Appendix, pp. 78-79.

Question 4. Should the applied electricity courses be organized under the industrial arts department?

Number answered yes	5	or	83.3%
Number answered no	1	or	16.7%

Question 5. In your opinion should the applied electricity courses be organized under the physical science department?

Number answered yes	1	or	16.7%
Number answered no	5	or	83.3%

Question 6. During what year, or years, is the applied electricity course offered?

The majority of replies indicated that it was offered during all three years of high school. Some offered it only during sophomore and junior years.

Question 7. What prerequisites are there for the course?

None of the respondents indicated any prerequisites.

Question 8. How many semesters of work in the area of applied electricity are available to the student?

Shortest number of semesters	1
Longest number of semesters	6
Average number of semesters	4

Question 9. What is the average class size?

Smallest class	20
Largest class	28
Average class	27

Question 10. Is the applied electricity course open to girls?

Number answered yes	5	or	83.3%
Number answered no	1	or	16.7%

The comment was made that no girls ever enrolled even though the course was open to them.

Question 11. Do you think that it should be open to the girls?

Number answered yes	4	or	66.6%
Number answered no	1	or	16.7%
Number made no comment	1	or	16.7%

Question 12. Do you have an instructor who teaches only electricity?

Number answered yes	3	or	50.0%
Number answered no	3	or	50.0%

Question 13. If the instructor teaches other subjects, please indicate the subjects.

Two indicated radio as another class taught. Other classes taught ranged through mathematics, mechanics, physics, general science, printing, woodwork, and general metals without any particular pattern.

Question 14. Do you have a composite general shop?

None of the six schools had a composite general shop.

(Questions 15 through 18 do not apply since there was no composite general shop program in any of the schools.)

Question 19. Would you like to see more emphasis placed upon applied electricity in your school?

Number answered yes	2	or	33.3%
Number made no comment	4	or	66.7%

Question 20. Please indicate the reason or reasons that might prevent you from expanding your offerings in applied electricity. Check those that you consider most significant.

No. of Times Checked	
1	Insufficient funds
1	Inadequate facilities
3	Not enough student interest
0	Lack of instructor interest
0	Very little administrative interest
0	Qualified instructors are not available
1	Not enough students to justify a separate course
1	Curriculum already overcrowded

- Course content does not justify a separate course
- Students receive sufficient applied electricity in a physics course
- Students receive sufficient applied electricity in a composite general shop
- Others

Summary. Five of the six schools having a separate course had it organized under the industrial arts department and felt that that was the proper place for it as indicated by Figure 3.

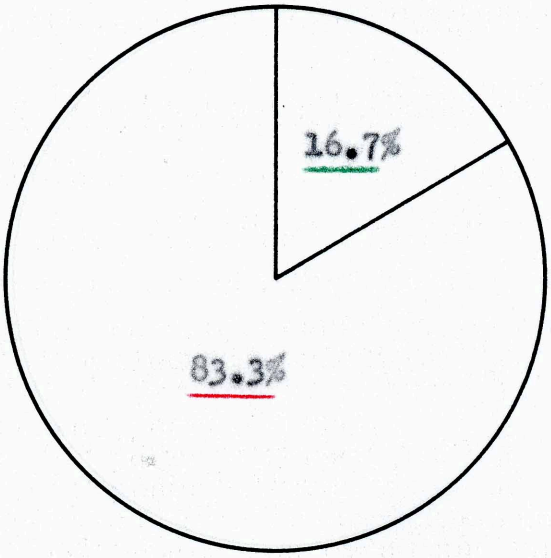

Figure 3.

Organizational Location of Applied Electricity As Indicated by Industrial Arts Supervisors

Industrial Arts Physical Science

The average length of time that applied electricity had been offered was sixteen years which would seem to indicate that the program is comparatively young.

The majority of the replies revealed that the course was offered during any of the last three years of high

school with an average of four semesters available to the student. No prerequisites were required.

Five of the supervisors indicated that the course was open to girls but that girls never enrolled.

The main reason for not expanding the offerings was a lack of student interest.

Two supervisors replied that they would like to see more emphasis placed upon applied electricity and four made no comment as Figure 4 indicates.

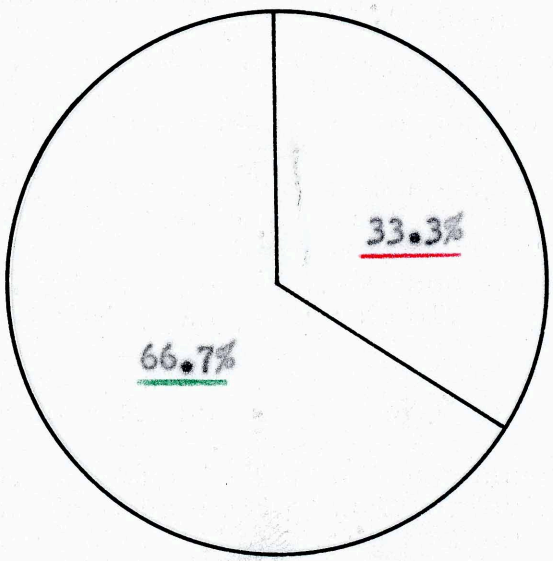

Figure 4.

A Comparison of Attitudes Toward
Enlarging the Electricity Program-Supervisors

Enlarged Program No Comment

Schools Not Having Separate Courses. There were eleven schools that did not have a separate course of applied electricity. The results of the survey were as follows:

Question 21. Has your school ever offered a separate course or courses in applied electricity?

Number answered yes	2	or	18.2%
Number answered no	9	or	81.8%

Question 22. For how many years was it offered?

Both schools offered it for three years during the war.

Question 23. Do you have a composite general shop?

Number answered yes	5	or	45.5%
Number answered no	6	or	54.5%

Question 24. Do you have an area of electricity in your composite general shop?

Number answered yes	2	or	40.0%
Number answered no	3	or	60.0%

Question 25. For how many years has the area of electricity been offered?

Both schools had offered it for four years.

Question 26. Is the composite general shop open to the girls?

Number answered yes	1	or	20.0%
Number answered no	4	or	80.0%

Question 27. Do you think that it should be open to the girls?

Number answered yes	2	or	40.0%
Number answered no	2	or	40.0%
Number made no comment	1	or	20.0%

Question 28. Would you desire a separate course or courses in applied electricity in your school?

Number answered yes	7	or	63.6%
Number answered no	3	or	27.4%
Number made no comment	1	or	9.0%

Question 29. Please indicate the reason or reasons why you offer no separate courses in applied electricity. Check those that you consider most significant.

No. of Times Checked	
5	Insufficient funds
7	Inadequate facilities
2	Not enough student interest
2	Lack of instructor interest
3	Very little administrative interest
4	Qualified instructors are not available
2	Not enough students to justify a separate course
6	Curriculum already overcrowded
0	Course content does not justify a separate course
1	Students receive sufficient applied electricity in a physics course
1	Students receive sufficient applied electricity in a composite general shop
0	Others

Comments:

If we could get time in our physics sections we would have ample teaching. We do as much as our three semesters will allow us to do in two semesters work.

I might add--we do not have a composite general shop. However, our industrial arts department has work in wood and sheet metal. Then too, we have Vocational Agriculture. Between these two, combined with physics, we are evidently supplying the desire so far. I do think a separate course should be set up as it would develop a lot more interest.

We do not now have a course in applied electricity, but we did have at one time several years ago. Interest in the course was very good and students visiting school after their graduation expressed much appreciation of the course. We dropped the course at the time when we moved into a new shop building and had to use the teacher of electricity in other fields of work. We hope to return to offering an electricity course when school financial problems permit.

Summary. Nine of the eleven schools indicated that they had never offered a separate course of applied electricity.

Of the five schools indicating general shops only two had areas of applied electricity.

Inadequate facilities was listed as the major obstacle to offering a course of applied electricity with overcrowded curriculum, insufficient funds, and a lack of qualified instructors next in importance.

Seven of the supervisors replied that they would desire a separate course of applied electricity, three indicated no, and one made no comment as is shown in Figure 5.

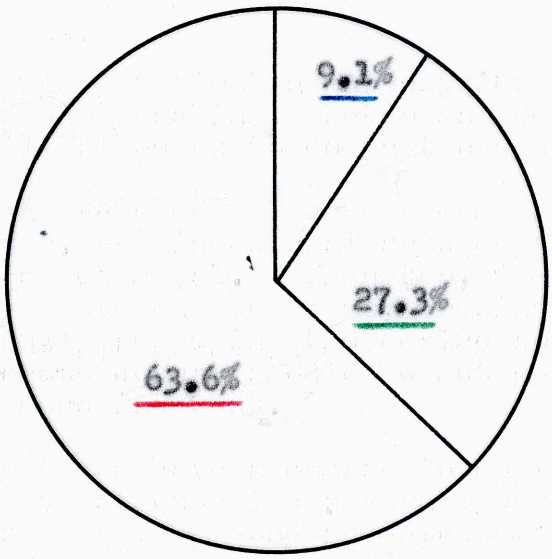

Figure 5.

Attitudes of Supervisors Regarding a Separate Course of Applied Electricity

Desire Course Desire No Course No Comment

High School Administrators

The names of high school administrators were obtained from the Kansas Educational Directory.[16]

Ninety-seven questionnaire[17] were sent out and seventy-three replies were received. Only sixty-four were usable for the following tabulations since nine administrators merely indicated 'no course' without providing the requested data. The results were divided into two groups--those having separate courses in applied electricity and those not having separate courses.

Schools Having Separate Courses. There were eleven schools that had a separate course or courses in applied electricity. The results of the survey were as follows:

Question 1. For how many years has your school offered separate courses in applied electricity?

Shortest number of years offered	4
Longest number of years offered	30
Average number of years offered	16

Question 2. Are the courses organized under the industrial arts department?

Number answered yes	10	or	90.9%
Number answered no	1	or	9.1%

Question 3. Are the courses organized under the physical science department?

Number answered yes	1	or	9.1%
Number answered no	10	or	90.9%

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[16] Throckmorton, op. cit.

[17] See Appendix, pp. 79-79.

Question 4. Should the applied electricity courses be organized under the industrial arts department?

Number answered yes	7	or	63.6%
Number answered immaterial	4	or	36.4%

Question 5. In your opinion should the applied electricity courses be organized under the physical science department?

Number answered no	7	or	63.6%
Number answered immaterial	4	or	36.4%

Question 6. During what year, or years, is the applied electricity course offered?

The majority of replies indicated that the course was offered during the last three years of high school. The sophomore year was the most favored year with junior and senior years next in order.

Question 7. What prerequisites are there for the course?

The major portion of the replies indicated that there were no prerequisites. Mathematics and general shop were given as prerequisites in two of the schools.

Question 8. How many semesters of work in the area of applied electricity are available to the student?

Shortest number of semesters	1
Longest number of semesters	6
Average number of semesters	4

Question 9. What is the average class size?

Smallest class	12
Largest class	30
Average class	21

Question 10. Is the applied electricity course open to girls?

Number answered yes	5	or	45.4%
Number answered no	6	or	54.6%

Question 11. Do you think that it should be open to the girls?

Number answered yes	7	or	63.6%
Number answered no	4	or	36.4%

Question 12. Do you have an instructor who teaches only electricity?

Number answered yes	4	or	36.4%
Number answered no	7	or	63.6%

Question 13. If the instructor teaches other subjects, please indicate the subjects.

The administrators gave industrial arts as the major subject area with radio, chemistry, and physics being mentioned.

Question 14. Do you have a composite general shop?

Number answered yes	4	or	36.4%
Number answered no	7	or	63.6%

Question 15. Do you have an area of electricity in your composite general shop?

Only one of the schools indicated an area of electricity.

Question 16. For how many years has the area of electricity been offered?

The area had been offered for fifteen years.

Question 17. Is the composite general shop course open to the girls?

The course was not open to the girls.

Question 18. Do you think that it should be open to the girls?

The respondent thought that it should be open to girls.

Question 19. Would you like to see more emphasis placed upon applied electricity in your school?

Number answered yes	6	or	54.6%
Number answered no	4	or	36.3%
Number answered no comment	1	or	9.1%

Question 20. Please indicate the reason or reasons that might prevent you from expanding your offerings in applied electricity. Check those that you consider most significant.

No. of Times Checked	
1	Insufficient funds
2	Inadequate facilities
5	Not enough student interest
1	Lack of instructor interest
0	Very little administrative interest
2	Qualified instructors are not available
0	Not enough students to justify a separate course
3	Curriculum already overcrowded
0	Course content does not justify a separate course
0	Students receive sufficient applied electricity in a physics course
0	Students receive sufficient applied electricity in a composite general shop
0	Others

Comments:

Our courses have been largely an elementary course in electricity. It is being revised under a new teacher and called basic electricity and electronics.

We are going to expand next year and introduce electronics.

I am glad to see you making this study. Electricity is not enough. We also need electronics. We are now passing from the "Industrial Revolution" into the "Electronic Revolution." I believe all industrial arts teachers should get all the electricity and electronics that they can and that the colleges should offer all of this work possible.

Summary. The average length of time a course in applied electricity was offered was sixteen years.

Ten of the administrators thought that an applied electricity course should be organized under the industrial arts department. One thought that it should be under the physical science department as indicated by Figure 6, page 37.

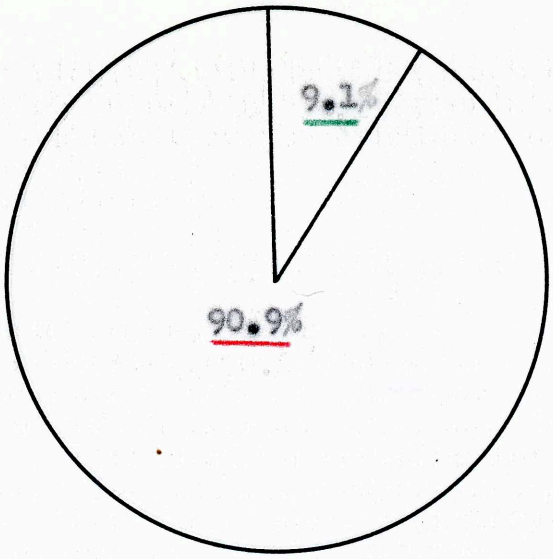

Figure 6.

Organizational Location of Applied Electricity
As Indicated by Administrators

Industrial Arts Physical Science

The course was available to students in the last three years of high school. The majority of schools had no prerequisites. Schools having prerequisites mentioned mathematics and/or general shop. The average number of semesters available was four with an average class size of twenty-one.

Girls were not eligible for the applied electricity courses in many of the schools but most administrators thought that they should be.

Six of the administrators replied that they would like more emphasis placed upon applied electricity. Four indicated they would not desire additional courses while one made no comment as shown in Figure 7. page 38.

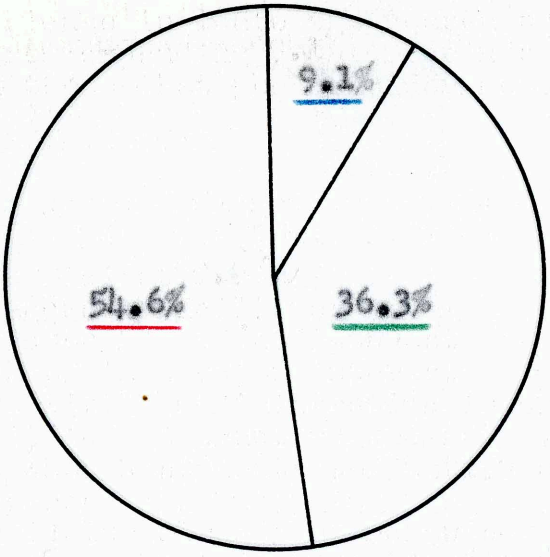

Figure 7.

A Comparison of Attitudes Toward
Enlarging the Electricity Program-Administrators

Enlarged Program No Change No Comment

Four schools indicated they had a teacher who taught only electricity while seven schools indicated that the teacher had other classes.

It was of some significance that the administrators having a course felt that the major reason for no expanding the program was not funds or facilities but rather a lack of student interest and an overcrowded curriculum. The lack of qualified instructors and inadequate facilities ranked the same.

Schools Not Having Separate Courses. There were fifty-three schools that did not have a separate course of applied

electricity. The results of the survey follow:

Question 21. Has your school ever offered a separate course or courses in applied electricity?

Number answered yes	5	or	9.4%
Number answered no	48	or	90.6%

Question 22. For how many years was it offered?

Shortest number of years	2
Longest number of years	10
Average number of years	5

Question 23. Do you have a composite general shop?

Number answered yes	27	or	50.9%
Number answered no	24	or	45.3%
Number made no comment	2	or	3.8%

Question 24. Do you have an area of electricity in your composite general shop?

Number answered yes	17	or	63.0%
Number answered no	9	or	33.3%
Number made no comment	1	or	3.7%

Question 25. For how many years has the area of electricity been offered?

Shortest number of years	1
Longest number of years	31
Average number of years	9

Question 26. Is the composite general shop open to the girls?

Number answered yes	3	or	11.1%
Number answered no	23	or	85.2%
Number made no comment	1	or	3.7%

Question 27. Do you think that it should be open to the girls?

Number answered yes	13	or	48.2%
Number answered no	11	or	40.7%
Number made no comment	3	or	11.1%

Question 28. Would you desire a separate course or courses in applied electricity in your school?

Number answered yes	27	or	50.90%
Number answered no	13	or	24.55%
Number made no comment	13	or	24.55%

Question 29. Please indicate the reason or reasons why you offer no separate courses in applied electricity. Check those that you consider most significant.

No. of Times Checked	
17	Insufficient funds
30	Inadequate facilities
10	Not enough student interest
5	Lack of instructor interest
2	Very little administrative interest
9	Qualified instructors not available
17	Not enough students to justify a separate course
16	Curriculum already overcrowded
4	Course content does not justify a separate course
7	Students receive sufficient applied electricity in a physics course
4	Students receive sufficient applied electricity in a composite general shop
1	Covered in general science and vocational agriculture
1	Haven't gotten around to it yet

Comments:

As the need develops and space is available, and equipment, we may offer electricity as a separate course.

We are considering the addition of a course in this area. The addition will depend on allotment of time for the course. With the present staff an hour or two would have to be taken from some other course offering.

Some work is done in Vocational Agriculture classes. We don't have the staff to offer any more industrial arts classes.

It was planned to include a unit of applied electricity in our General Shop course when it was organized two years ago. Experience has shown so far that time does not permit a unit of electricity to be included. We have five other areas including welding, sheetmetal, forging, foundry, and machine tools. These units take up the full time and although we would like to include electricity in the course, it is not seen justified at present.

The subject would be of interest. There are many separate courses that can be placed in the schedule of studies. It depends on the objectives of an education

in the particular school. I question the ability of many students to even secure the fundamentals, reading, writing, and arithmetic. Only the better students or those with special aptitudes should take the course.

Our physics course, open to juniors and seniors, gets several units on electricity, however, our best applied course comes from sophomore and junior years in vocational agriculture. Our instructor gets an illustrated panel displaying wiring, resistance, etc. from a nearby REA office which he uses to teach electricity.

Beginning next fall we will be offering a general shop program which will contain a unit on electricity.

I am a firm believer in General Education!

Summary. Twenty-seven schools revealed that they had a composite general shop but only seventeen of them had an area of applied electricity. The average length of time the area had been offered was nine years.

Only four of the twenty-seven schools having composite general shops made them available to the girls.

Twenty-seven schools replied that they would like a separate course in applied electricity. Thirteen were not interested in such a course and thirteen made no comment as revealed in Figure 8, page 42.

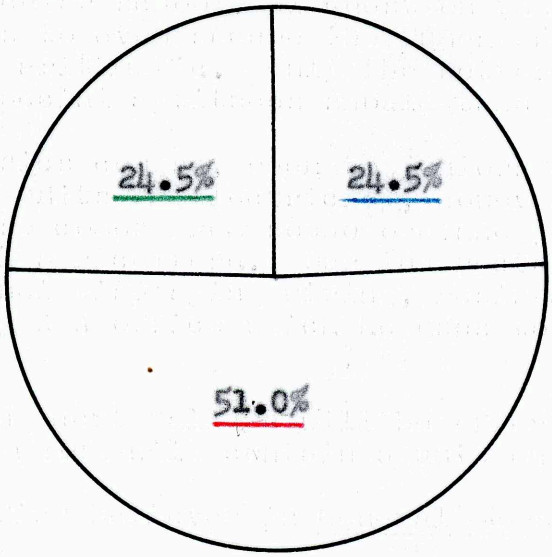

Figure 8

Attitudes of Administrators Regarding a Separate Course of Applied Electricity

Desire Course Desire No Course No Comment

Of fifty-three schools not having a separate course of applied electricity only five indicated they had ever had such a course and in those schools it was mainly offered only during the crisis of World War II.

The major reason given for not developing a program was inadequate facilities with the following significant reasons next in order: insufficient funds; not enough students to justify a separate course; curriculum overcrowded; not enough student interest; and students received sufficient applied electricity in a physics course.

College Catalogs

A perusal of the catalogs of the eight four-year colleges or universities having an industrial arts curriculum served as a basis for the information concerning course offerings in applied electricity for the respective schools.

Kansas State Teachers College of Pittsburg. Kansas State Teachers College of Pittsburg had the broadest offering in the area of applied electricity. The courses offered were as follows:[18]

Electricity	10 hours
Elements of Radio	5 hours
Basic Radio	5 hours
Advanced Applied Electricity	3 hours
Total	23 hours

There was, however, a big drawback to the organization of the courses in that they were all taught by the physical science department. Pittsburg was the only school operating in this manner. It would appear to the writer that much better correlation and integration could be had by organizing the applied electricity courses under the industrial arts department. The survey of administrators and supervisors of industrial arts bear out the writer's opinion.

Kansas State Teachers College of Emporia. Kansas State Teachers College of Emporia had the following courses listed:[19]

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[18]Kansas State Teachers College of Pittsburg, Bulletin, LIII, No. 2 (December, 1956), 191.

[19]Kansas State Teachers College of Emporia, Bulletin of Information, XXXV, No. 9 (September, 1955), 131-35.

Introduction to Electrical Construction	2 hours
Projects in Electricity	3 hours
Automotive Electricity and Fuel Systems	3 hours
Welding and Foundry	3 hours
Total	11 hours

There would be very little electrical theory in a Welding and Foundry course as described by the catalog and only part of the time would be devoted to electricity in the Automotive Electricity and Fuel Systems course. Actually, they offer about five hours of electricity which is the minimum state requirement.[20]

Bethel College of Newton. Bethel College listed the following courses:[21]

Practical Electricity	3 hours
Welding I	3 hours
Advanced Welding	4 hours
Total	10 hours

It was interesting to note that seven of the ten hours offered was in welding. This could scarcely be termed an adequate program to prepare teachers of applied electricity.

Kansas State College of Manhattan. Kansas State College of Manhattan offered:[22]

Appliance Servicing	4 hours
Welding	1 hour
Total	5 hours

They offered just enough to meet state requirements.

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[20] Certificate Handbook, State of Kansas, Adel F. Throckmorton, State Superintendent of Public Instruction, Topeka, Kansas, March, 1955, p. 43.

[21] Bethel College of Newton, Bulletin, XLIV, No. 2 (February, 1957), 80-81.

[22] Kansas State College of Manhattan, General Catalog, XXXIX, No. 8 (August, 1955), 226.

Kansas State College of Ft. Hays. The following courses were offered by Kansas State College of Ft. Hays:[23]

Practical Electricity	2 hours
Welding	3 hours
Total	5 hours

They offered just enough to meet state requirements.

University of Wichita. The University of Wichita offered:[24]

Practical Electricity	5 hours

While this course was apparently designed to meet certification requirements it appeared to be a better background in electricity than any of the other college offerings with the exception of Pittsburg.

Friends University of Wichita. Friends University had the following courses:[25]

General Shop Electricity	2 hours
Arc Welding	1 hour
Total	3 hours

Southwest College of Winfield. Southwest College of Winfield offered no courses in applied electricity.[26]

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[23] Kansas State College of Ft. Hays, Catalog, XLV, No. 1 (July, 1955), 113.

[24] University of Wichita, Bulletin, XXXII, No. 2 (May, 1957), 186.

[25] Friends University of Wichita, Bulletin, LIV, No. 5 (February, 1957), 126.

[26] Southwest College of Winfield, Bulletin, No. 2 (1956-57).

Summary. The survey of college offerings in applied electricity would seem to indicate that they were inadequate.

One college offered no courses in applied electricity. One school offered only three hours of applied electricity, one of which was welding. Another college offered ten hours in the area with seven of the hours being devoted to welding. Four of the state colleges offered only a minimum program in applied electricity. Pittsburg State Teachers College offered an adequate program but it was not too desirable from the standpoint that it was organized under another department.

Since it is the responsibility of the college to train applied electricity teachers, perhaps the place and need for technical skill in the current socio-economic and educational structure should be examined. Further, present and future curriculums should be evaluated in terms of existing and expected demands.

CHAPTER IV

THE PLACE OF TECHNICAL SKILL

An important fact of national life in this decade is that the shortage of educated, skilled manpower exists in all areas requiring special talent and training.[27]

Recently, Dr. A. V. Austin, Director of National Bureau of Standards, speaking at a congressional hearing regarding technical changes taking place in the economy said, "I think the critical area is the high school and it is primarily high school teachers."[28]

At the same hearing Chairman Putman said:

> The most disturbing thing which has come to the subcommittee's attention was the near unanimous conclusion of the witnesses that the nation is faced with a threatened shortage of scientists, technicians, and skilled labor.[29]

In view of present developments it seems certain that the demand will be on the increase for many years, and the shortage will become more critical. The lack of persons scientifically, mathematically, and technically qualified for positions in this country in industry, government, and teaching at the college and pre-college levels has brought about considerable alarm.

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[27] John R. Mayer, "High School Science and Manpower Needs," The High School Journal, XL (February, 1957), 178.

[28] B. P. Brodinsky, "Automation," The Nation's Schools, LVIII (August, 1956), 38.

[29] Ibid., 37.

Seymour L. Wolfbein, Chief of the Division of Manpower and Employment Statistics, Bureau of Labor Statistics, had the following to say in a speech delivered at the Four-State Conference in Pittsburg, Kansas, October 14, 1956:

> There are today basic industrial, economic, and social changes which are playing a vital role in shaping the educational problems we face. The population changes, the changing industrial structure, and the increasing skill demands of a rapidly advancing technology all point to the importance of continuous flexibility and leadership on the part of members of our profession and in our curriculums.
>
> Are we at the forefront of this trend or are we lagging behind? There will unquestionably be a continued increase in the trend toward more education and training. Are we prepared in terms of curriculum, personnel, and facilities?[30]

The word, automation, has hit the American scene and captured the imagination of the people, and well it should. Automation is a force that school administrators must reckon with because it is affecting the economic, social, and industrial life of the country. Administrators today, if they will keep step with the era of automation are challenged to keep pushing up the budget, to enrich and revise the curriculum, and school services.[31]

The high school is confronted with a great challenge--a challenge to improve its offerings in mathematics and science; to strengthen its guidance services; to re-assess its trade and industry and its business education courses.[32]

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[30] From a speech on the "Challenge of Automation" by Seymour L. Wolfbein, delivered at the Four-State Conference, Pittsburg, Kansas, October 14, 1956.

[31] Brodinsky, op. cit., p. 36.

[32] Ibid.

For about the last one hundred years advances in the practical arts have been to an ever-increasing degree closely linked with the advances in pure science. The consequences of this change in regard to the educational system have been very great, but not great enough in terms of the need. For just as there is no shading discernible today between pure science and large areas of advance in the practical arts, so there is no discontinuity in the skills and talents that are required to make the advances.[33]

In this same connection the Harvard Committee Report of 1945 had the following comments:

> We shall say something about the importance of shop training in General Education. For those who intend to go into scientific or technological work, it has special relevance. The manipulation of objects, the use of tools, and the construction of simple apparatus, all are required for entry into the field of experimentation. Even the pure mathematician is greatly aided by shop experience.... The lack of shop training is at present a most serious deterrent to entry into all types of technological work and to college and post graduate training in science, medicine, and engineering.[34]

To narrow the discussion to the chosen field of applied electricity it might be well to mention a few significant facts.

In 1939 electronics, for example, was a tiny industry. Today, it is worth almost ten billion dollars. Dan G.

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[33] James B. Conant, "Science in War and Peace," Ferment in Education (University of Illinois Press, Urbana, Illinois, 1948), p. 184.

[34] Charles Quinlan, "Industrial Arts is NOT Just an Extra," The School Executive, LXXVI (November, 1956), 59.

Mitchell, president of Sylvania, says that the industry will double again in size during the next ten years and will bring new marvels to the home and to the automation process itself.

Space will be taken to mention only one example, the electronic computer, and two of the hundreds of applications. In the banking business it may appear as a twenty-five ton bank clerk named Erma. Erma is a brain and nerve system made up of 17,000 radio tubes. She can handle the bookkeeping details of 50,000 checking accounts every day. In engineering, the electronic computer takes only fifteen minutes to do a calculation which would require three years of error-free hand and brain work.[35]

At the present time our technological economy appears to require a rather definite ratio of five technicians to one engineer. Foremost in the shortage are electronics technicians, with second place going to electrical technicians.[36] Both stem from the same common stock of knowledge and skill; both base their calculations on the behavior of the electron and Ohm's law.

Today, there seems to be a tacit, but not clearly expressed, assumption that the purpose of the present day society favors one which gives the greatest good to the greatest number. American society has seized upon technology as an

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[35]Brodinsky, op. cit., p. 37.

[36]Harry Wilson, "Our Future Technicians," School Shop, XVI (October, 1956), 22.

applicable means to this end, so far as gratifying material wants is concerned. It might be assumed that society as a matter of enlightened self-interest would pay particular attention to the education and training of an adequate supply of what they refer to as technicians. This has not been the case. If the humanist chooses science as the basis for a technology designed to advance the standard of living of mankind then it becomes incumbent on him so to fashion an educational system.[37]

Throughout history human societies have seemed to be very wasteful of human talent. In this day and age society can no longer afford this waste. Among the historic changes which have marked this age, this may well prove to be one of the most profound.

The present demand for talent is not a mere by-product of prosperity. It is rather the nature of a society that has built up the appetite of demand which is fed by technical innovation. Inevitably, social complexities accompany change. John W. Gardener says:

> We must turn out men whose technical skills are matched by their breadth of comprehension, by their grasp of their own heritage, by largeness and liberality of mind.[38]

Of what significance is all this to industrial arts education? It would seem to be of the greatest significance. Industrial arts programs in college, pre-college, or pre-technical

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[37] Lawrence R. Hafstad, "Science, Technology, and Society," American Scientist, XLV (March, 1957), 158-59.

[38] John W. Gardener, "The Great Hunt for Talent," Harper's Magazine (January, 1957), p. 53.

courses must provide those experiences which will discover potential talent and interest and develop a broad base of principles involved. Youth should be prepared to meet changing consitions of the society and economy in which they will be living and working.

The needs of youth in terms of a curriculum can only be determined by a continuous examination of the conditions prevailing and then taking constructive and adequate steps to make the curriculum meaningful.

The writer does not desire to promote the teaching of applied electricity at the expense of other subject matter but rather a possible change in emphasis of subject matter within the field of industrial arts education as well as within the framework of general education.

It is the opinion of the writer, based upon the material presented, that applied electricity should be at the forefront of a positive and effective industrial arts program. If industrial arts people do not rise to the challenge and the need of applied electricity as a prominent part of any program, large or small, then other areas will have to assume the responsibility of providing a technological base and foundation in this area. R. Lee Hornbake sized up the situation well he said:

> Industrial arts may well become a therapeutic digression from the on-going educational enterprise, an activity located in a shop where pupils can go to make gadgets, twist Western Union splices, and learn to replace washers in

> faucets. This would indeed be a sad ending for a subject area that has its origins in one of the wonders of the world, American Industry, and which has 'learning by doing' as its professional birthright.[39]

If these changes in emphasis in the field of industrial arts education are to take place, then teacher training institutions are going to have to revise their programs to keep step with the needs of youth. It must be remembered that it is the colleges who prepare teachers who in turn prepare youth for life. College curriculum and emphasis must change before high school programs can have a rebirth.

Only as creative individuals dare to promote positive and adequate changes can education stay abreast of the needs of society.

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[39] R. Lee Hornbake, "Time for Progress," School Shop, XV (June, 1956), 16.

CHAPTER V

THE IMPORTANCE OF CURRICULAR REEVALUATION

The great contemporary English historian, Arnold J. Toynbee, has brought to light some data from his study of history which provides criteria by which not only modern economists and sociologists might be guided but also modern educators and curriculum planners. Of twenty-six civilizations identified by Toynbee, "sixteen are dead and nine of the remaining ten--all, in fact, except our own--are shown to have already broken down."[40] One of the three major reasons cited for the breakdown was "a failure of creative power in a creative minority, which henceforth becomes a merely dominant minority."[41]

While the germ of industrial arts education has been present since the creation of man, it was not until after the Great Emancipation that it made its appearance as manual training in the American high school. This appearance was not without its birth pangs. It took such men as Calvin Woodward, John Dewey, Frederick G. Bonser, Charles R. Richards, and others--a creative minority--to make significant contributions to the industrial arts program.

Today, industrial arts has become, in general, an accepted part of the public secondary school program. Through the use

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[40] Arnold Joseph Toynbee, A Study of History, abridgement by D. C. Somervell (Oxford University Press, New York, 1947), p. 578.

[41] Ibid.

of composite general shops, limited general shops, and unit shops the idea of greater pupil participation in the planning of work and in the operation and function of the shop has evolved. Again, it has been the creative minority that has instigated these changes, often against the fierce opposition of classical education entrenched behind traditional concepts of what education should or should not be.

In examining the characteristics of far too many present day industrial arts programs, it is found that there is a dearth of creative thinking and a lethargy of action. Woodworking, metalworking, and mechanical drawing stand as the main content of many programs. This hangover is probably due to the nature of the society in which industrial arts education had its beginnings in 1880. Since the turn of the century this country has been and is continuing to undergo a technological revolution. All indications seem to point to an increasing rapidity of evolution. The characteristics of this change are seen in the extensive use of electrical energy and the development of a multiplicity of electrical appliances and electronic equipment of all kinds. For example just since 1930 the number of electrical household appliances have increased by over 300 percent.[42] In 1920 when the United States had a population of approximately 106,500,000 people there was a total of 540 kilowatt hours of electricity

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[42] The ABC of Home Wiring, Kennecott Copper Corporation, New York, p. 2.

available per person. In 1955 when the population had grown to a little more than 164,000,000, or an increase of 55 per cent, the electricity available per person had risen to 3,828 kilowatt hours, or an increase of more than 600 per cent.[43]

It is further estimated that the population of the United States will reach 228,000,000 by 1976 causing electric energy sales alone to quadruple in the next twenty years. In other words the actual average annual residential use will rise from 2,969 kilowatt hours to 11,000 kilowatt hours and the present industrial average of 6,000 kilowatt hours per worker will rise over 21,000 kilowatt hours.[44]

The advent of the internal combustion engine and its many applications and implications, the variety of new metals, the new techniques in the graphic arts and ceramics, the industrial giant, atomic power, and the mandatory automated processes have brought, and will bring about, radical changes not only in the socio-economic fiber of the country but also in the educational institutions.

What is the significance of all this to the industrial arts education program? Struck says:

> Industrial arts education which aims to give an appreciative understanding of contemporary life through a study of representative tools, materials, processes, and life habits of people concerned with doing the world's work in productive industries and manufacture, is rich in life centered learning opportunities.[45]

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[43] Statistical Bulletin for the Year 1955, Edison Electric Institute (New York, May, 1956), p. 13.

[44] "Electrical Business Outlook," Electric World (April, 1957), p. 119.

[45] F. Theodore Struck, Creative Teaching (John Wiley and Sons, Inc., New York, 1938), p. 593.

Is industrial arts education accomplishing these aims without greater emphasis upon applied electricity?

Selvidge and Fryklund have the following to say:

> In the field of industrial arts an attempt is made to give youth the information and experiences which will stimulate interest in industrial life and enable them to do effectively the things that most youth are called upon to do regardless of their vocation. The important thing is not that the student make the identical thing that he will later be called upon to make but rather that he gain experiences capable of wide application, and develop in him a habit of orderly procedure and systematic work which will be of value to him in any line of endeavor.[46]

Are industrial arts programs providing these requirements without more emphasis upon applied electricity?

Another list of objectives set forth by Lawson follows:

1. To give pre-vocational exploratory experience and understanding of the major requirements, opportunities, skills, and needs in business and industry.

2. To equip individuals with essential, practical skills for life use, vocational and non-vocational.

3. To develop appreciation for the better ideals, functions, and service of business and industry.

4. To develop in every child an appreciation of the importance and dignity of work as the natural heritage of citizens in a democratic society.

5. To give additional training in specific skills and knowledge to those students whose aptitudes and interest suggest possible advanced work in these areas through attending college or technical institutes.

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[46] R. W. Selvidge and Verne C. Fryklund, Principles of Trade and Industrial Teaching (Charles A. Bennett Company, Inc., Publishers, Peoria, Illinois, 1946), pp. 35-36.

6. To equip vocationally those students who may use these skills in business or industry upon completion of grade or high school education.[47]

In 1940 the Educational Policies Commission of the National Education Association made a study of the relationship of education to the economic well-being of the country. The following objectives received much emphasis:

1. Social intelligence on social problems.
2. Understanding of industrial relationships.
3. Scientific competence.
4. Consumer education.
5. Job training.
6. General mechanical competence.[48]

Again in a summary of objectives of education set forth by the National Council of Professors of Education and Administration the following were given:

Section B

Item 14. We believe that school programs must increasingly educate for the intelligent consumption--not only of goods and services--but equally of science, research findings, and the arts....

Item 15. We believe that in order for school programs to keep pace in an age, symbolized by automation, critical and continuous evaluation of 'book learning' and current methodology is compelled.[49]

The aforementioned definitions of industrial arts education and selected educational objectives from studies conducted would seem to indicate the needs of present and future programs. The whole idea of curriculum planning needs to be

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[47]Douglas E. Lawson, School Administration Procedures and Policies (Odyssey Press, New York, 1953), pp. 351-52.

[48]Educational Policies Commission, Education and Economic Well-Being in American Democracy (Washington, D.C., 1940) p. 43.

[49]"What theNational Council of Professors of Education and Administration Believes," The School Executive (December, 1956), p. 71.

geared to the best means of achieving established objectives. The comments of Douglas E. Lawson are timely. He says:

> A wholesome trend in recent years is the growing tendency to think of curriculum revision as a continuous process of evaluation and adaptation.... Among the better schools today, many programs of continuous curriculum study and revision are in operation.[50]

He goes on to say:

> For the past decade, and particularly as a result of the recent war, the schools have been casting a critical eye upon their existing programs in technical and semi-technical subjects.[51]

It would appear in view of established objectives and present and future needs that a reorganization of curriculum and facilities at all levels of the educational process is long overdue a nd probably inevitable--both to meet demands of a changing society and to meet the needs of increased enrollments. More money, increased efficiency, new ideas and teaching methods, and a drastic reorganization of the curriculum are needed.[52]

If the public school is going to make a maximum contribution as a dynamic, positive, social force, there will have to be considerable rethinking concerning points of view and practice. Too often tradition and an accumulation of procedures surround curriculum issues. In many cases there is

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[50] Lawson, op. cit., p. 329.

[51] Ibid., p. 350.

[52] Rowl Beardsley, "Teaching Salaries--Then and Now," The Education Digest, XXI (February, 1956), 5.

no clear cut identification of underlying principles and implications.[53]

Of course back of all curriculum issues lies the problem of relating two basic ideas; the child--his nature, needs, and the way in which he learns; and the society of which he is an integral part--its goals, values, and the kind of citizens it needs.

Most educators recognize the need for school experiences which will develop individuals able to take a responsible place in society, however, not many agree completely on the way in which the experience should be gained.

There is an ever increasing demand for such courses as driver education, technical education, etc., which all result in additional courses. Further, as the amount of knowledge increases, the more man knows, the more he can know. Yet curricular changes come slowly. The problem of selecting what should be taught becomes increasingly difficult as public demands and human knowledge both increase. A firm body of principles derived from a consistent philosophy of education and accepted widely by the lay public, is surely needed as the only lasting solution to the problem of a good curriculum.[54]

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[53] Florence B. Stratemeyer, et al, Developing a Curriculum For Modern Living (Bureau of Publications, Columbia University, New York, 1947), pp. 3-4.

[54] Willard B. Spalding, "Problems Facing Education in the United States," Education, LXXVI (February, 1956), 339.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Of ninety-seven high school administrators survey seventy-three replies were received. An additional fifteen schools were heard from either through the supervisor of industrial arts or the applied electricity instructor. The nine remaining schools were not heard from in any way. So of the ninety-seven high schools having an enrollment of 200 or more students eighty-eight were represented to give 90.3 per cent coverage.

Fifteen of the responding schools, or 17.1 per cent as shown in Figure 9, had at least one separate course of applied electricity while fourteen schools indicated they had had a

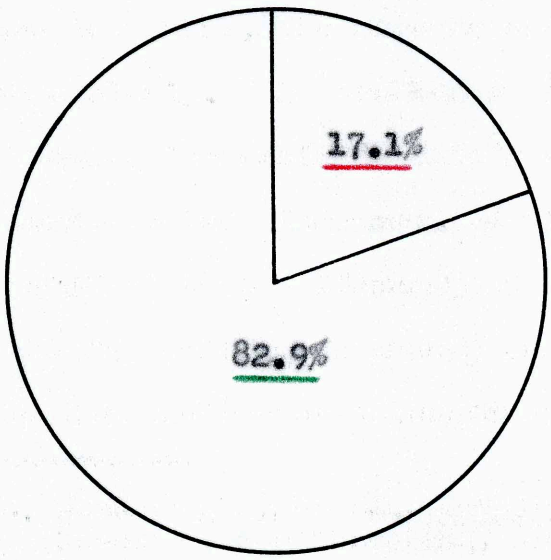

Figure 9.

A Comparison of Schools Having and Not Having Separate Courses of Applied Electricity

Having Not Having

separate course at one time--the majority of them being offered during the crisis of World War II.

Questionnaires were sent to thirty-one composite general shop teachers with twenty-two responding. Only seven, or 31.8 per cent, replied that they had an area of applied electricity.

Exclusive of what applied electricity might be included in vocational agriculture classes and auto mechanics classes, twenty-two schools, or 25 per cent of the schools studied had some form of applied electricity in their curriculum.

Inadequacy of preparation to teach applied electricity was cited by seven of the eleven teachers surveyed or 63.6 per cent as revealed in Figure 10.

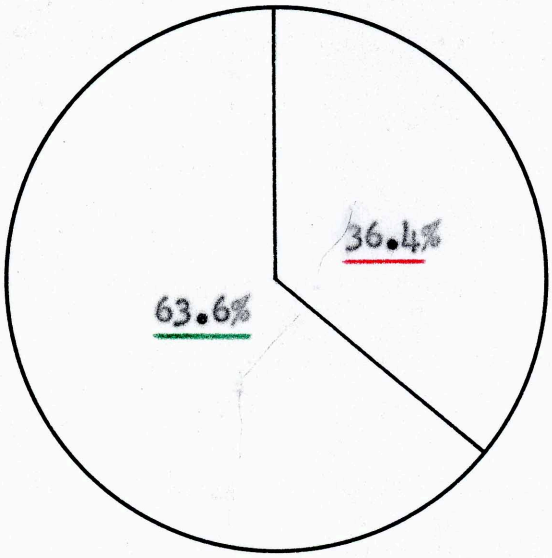

Figure 10

A Comparison of Adequacy of Preparation

Adequate Inadequate

Among the sixty-four supervisors and administrators not having a separate course of applied electricity the majority of them indicated they would like a separate course as shown in Figure 11.

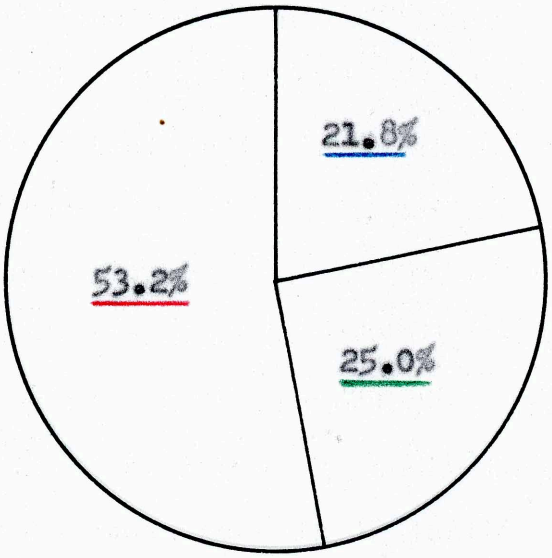

Figure 11.

Attitudes of Respondents Regarding a Separate Course of Applied Electricity

Desire Course Desire No Course No Comment

Very few schools indicated any prerequisites for the applied electricity course. The average number of semesters available to the students were four--the courses being offered mainly during the sophomore and junior years. The average class size reported was twenty-four.

Figure 12 indicates that of the seventeen supervisors and administrators who reported separate courses almost half, or 47 per cent, of them desired more emphasis upon applied electricity.

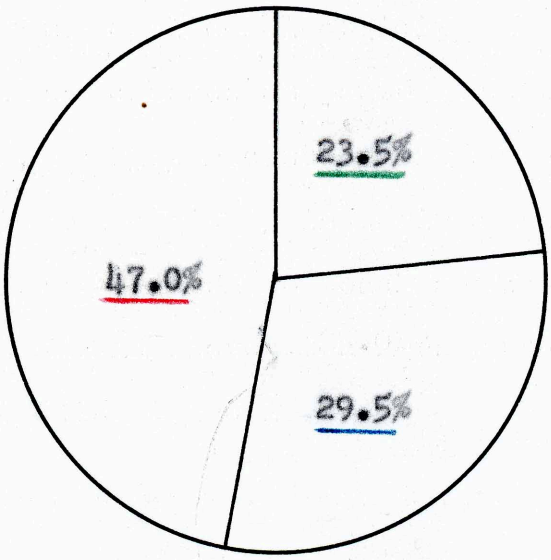

Figure 12.

A Comparison of Attitudes Toward Enlarging The Electricity Program

Enlarged Program No Change No Comment

About 70.6 per cent of the seventeen supervisors and administrators felt as though the applied electricity course should be organized under the industrial arts department as illustrated by Figure 13, page 65.

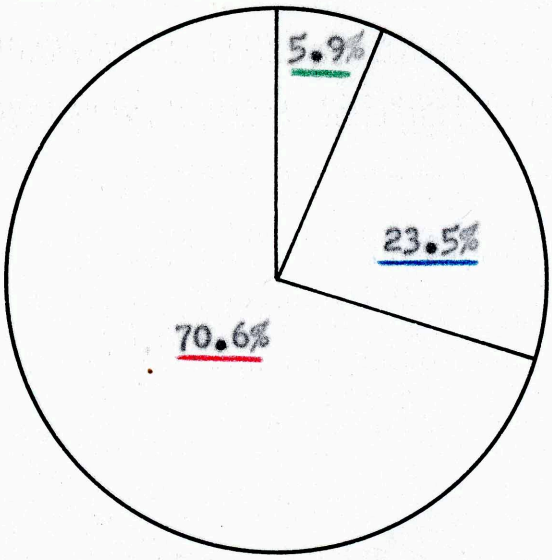

Figure 13.

Organizational Location of Applied Electricity
As Indicated by the Respondents

Industrial Arts Physical Science Immaterial

The major portion of the respondents replied that the applied electricity course should be open to the girls if they were interested in taking it.

The main reasons that seemed to prevent schools from developing and/or expanding a program in applied electricity were incorporated into Table I, page 66.

TABLE I

REASONS GIVEN FOR NOT DEVELOPING AND/OR EXPANDING COURSES IN APPLIED ELECTRICITY

Reason	Number
Inadequate facilities	44
Curriculum overcrowded	31
Insufficient funds	26
Not enough student interest	23
Not enough students	20
Lack of qualified instructors	18
Lack of instructor interest	10
Physics classes offer sufficient applied electricity	8
Composite general shop offers adequate applied electricity	5
Very little administrative interest	5
Course content does not justify a separate course	5
Others	4

The survey would appear to indicate the following conclusions:

1. Only a fourth of the responding schools had any applied electricity.

2. Almost two-thirds of the teachers revealed that their training had been inadequate.

3. Over half of the supervisors and administrators not currently having a separate course of applied electricity desired such a course.

4. Of the supervisors and administrators having a separate course of applied electricity almost half of them desired more emphasis in the area.

5. Over seventy per cent of the supervisors and administrators indicated that an applied electricity course should be organized under the industrial arts department.

6. The six major reasons given for not developing and/or expanding the program were:

a. Inadequate facilities
b. Curriculum already overcrowded
c. Insufficient funds
d. Not enough student interest
e. Not enough students
f. Qualified instructors not available.

Since the problems of facilities and funds are almost always major problems in education it is not especially surprising that they are among the top three listed.

Curriculum revision is an item, however, that needs to be met and dealt with in terms of current and future needs of youth. It seems that educators must shoulder their responsibility in this respect and harness some creative thinking with some constructive, positive action.

Moffat and Rich have stated well the course of action that must be taken. Institutional programs must undergo readjustment in line with existing and future demands. There is a challenge to construct a program in which teachers will always be alert to add desirable material and discard that which has ceased to be serviceable. It does not matter how "time-honored any item of a subject may be, it must be judged by its possibility of being serviceable--and either rejected or retained on that basis alone."[55]

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[55] Maurice P. Moffat and Stephen G. Rich, "The Future Challenges Secondary Education," The Journal of Educational Sociology, XXX (December, 1956), 13.

A survey of the eight colleges would seem to indicate that only one school offered an adequate program in applied electricity while one school offered no courses in applied electricity. Two other schools offered sub-minimum courses. The four remaining schools provided courses apparently designed to meet the minimum requirements for certification purposes.

A perusal of contemporary literature would lend substantial support of the need of curriculum revision to include courses of a technical nature to meet the socio-economic demands of society.

CHAPTER VII

RECOMMENDATIONS

In view of the results of the survey, assuming it bears evidence of a substantial nature, and in view of the information gleaned from current literature and college catalogs, the following recommendations are suggested:

1. Critical examination of existing curriculum structure and proper revision to include applied electricity on both the secondary and college level.

2. Much broader teacher preparation in applied electricity in college.

3. More industrial arts teachers should be guided into an adequate background in electricity.

4. Mathematics and physics should be included in the college curriculum for teachers of applied electricity.

5. Applied electricity courses should be organized under the industrial arts department.

6. Increase certification standards.

7. Strong administrative and teacher interest in developing a program of applied electricity.

8. A study of the comparative costs of setting up a desirable applied electricity curriculum in comparison with other industrial shops on both the secondary and college level.

9. A minimum of four semesters available to the high school student.

10. Mathematics and a composite general shop course would be desirable prerequisites for high school students.

11. A maximum class size of twenty students.

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BIBLIOGRAPHY

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APPENDIX

February 22, 1957

Dear

Applied electricity seems to be of increasing importance in the Industrial Arts programs of our secondary schools. I am making a study of the status of teaching applied electricity in Kansas, and should like some assistance from you in securing the data called for on the attached questionnaire.

The express purpose of the study is to be able to make some positive recommendations to teacher training institutions for the development or the improvement of their program offerings in this area. The help you give by preparing the attached form will be appreciated.

A stamped, self-addressed envelope is enclosed for your convenience.

Sincerely yours,

Karl Cunningham
College Unit #54
Pittsburg, Kansas

Approved by the Industrial Education and Art Department of Kansas State Teachers College of Pittsburg.

FOR THE ELECTRICITY INSTRUCTOR OR THE COMPOSITE GENERAL SHOP INSTRUCTOR

Your Name _____.
Your Position: ___Electricity Instructor; ___Composite General Shop Instructor.

Please provide the following information. If necessary, use back side of paper.

1. I (am, am not) teaching electricity.
2. For how many years have you taught electricity? ___Years
3. Where did you receive the major portion of your college training? Name of college _____. Location _____.
4. What courses in electricity did you have in college? Please indicate the courses and the number of semester hours credit. _____
_____
_____
5. Was your training adequate? ___Yes ___No
6. What courses in electricity and/or math and physics were most beneficial to you as an instructor? Please list in the order of importance on the back.
7. What additional courses, if any, would you suggest for the preparation of instructors of applied electricity? Please list in the order of importance on the back of this sheet.
8. Was and/or is electricity a hobby with you? ___Yes ___No
9. Please check the appropriate blanks. Column A indicates the items included in the present course of study. Column B indicates the items that would be considered desirable but which are not currently offered.

A	B		A	B	
___	___	Magnetism	___	___	Induced currents
___	___	Static electricity	___	___	Electromagnetic induction
___	___	Current electricity	___	___	Transformers
___	___	Wet cells	___	___	Generators, A.C. & D.C.
___	___	Dry cells	___	___	Motors, A.C. & D.C.
___	___	Electroplating	___	___	Alternating current
___	___	Ohm's law	___	___	Power transmission
___	___	Measuring instruments	___	___	Rectifiers
___	___	Effects of current electricity	___	___	Radio theory
___	___	Heating effects	___	___	Radio practice
___	___	Lighting effects	___	___	Television theory
___	___	Electric welding	___	___	Television practice
___	___	Series and parallel wiring	___	___	Electronics
___	___	Appliance wiring	___	___	Consumer knowledge
___	___	Appliance maintenance	___	___	Safety
___	___	House wiring	___	___	Others _____

10. Please indicate the reason or reasons that might prevent your school from expanding its offerings in applied electricity. Check those that you consider most significant.

___ Insufficient funds
___ Inadequate facilities
___ Not enough student interest
___ Curriculum already overcrowded
___ Not enough students to justify a separate course
___ Course content does not justify a separate course
___ Students receive sufficient applied electricity in a physics course
___ Students receive sufficient applied electricity in a General Shop
___ Others _____
___ Lack of instructor interest
___ Very little administrative interest
___ Qualified instructors not available

11. Please list any special electrical projects, devices or methods that you use which would be beneficial to others in the field.

The Status of Teaching Applied Electricity in Selected Secondary Schools in Kansas.

It is hoped that this questionnaire will serve as the basis for some positive recommendations to teacher training institutions for the improvement of their program. Any comments or suggestions which in your opinion would contribute to a better program in the area of applied electricity would be gladly received.

Applied electricity shall be understood to mean a combination of theory and practice in the construction and maintenance of such devices as household appliances, motors, transformers, house wiring, simple circuits, and electronic equipment.

FOR THE ADMINISTRATOR OR THE SUPERVISOR

Your Name _____.
Your Position ___Administrator; ___Supervisor.
Type of Secondary School ___3 year; ___4 year high school.

IMPORTANT - The following questions are to be answered by those HAVING a separate course or courses in applied electricity.

Please provide the following information:

1. For how many years has your school offered separate courses in applied electricity? ___Years.
2. Are the courses organized under the Industrial Arts Department? ___Yes ___No
3. Are the courses organized under the Physical Science Department? ___Yes ___No
4. Should the applied electricity courses be organized, in your estimation, under the Industrial Arts Department? ___Yes ___No
5. In your opinion should the applied electricity courses be organized under the Physical Science Department? ___Yes ___No
6. During what year, or years, is the applied electricity course offered? Freshman___; Sophomore___; Junior___; Senior___.
7. What prerequisites are there for the course? _____
_____
8. How many semesters of work in the area of applied electricity are available to the student? ___
9. What is the average class size? ___
10. Is the applied electricity course open to girls? ___Yes ___No
11. Do you think that it should be open to the girls? ___Yes ___No
12. Do you have an instructor who teaches only electricity? ___Yes ___No
13. If the instructor teaches other subjects, please indicate the subjects.
_____
_____
14. Do you have a Composite General Shop? ___Yes ___No
15. Do you have an area of electricity in your Composite General Shop? ___Yes ___No
16. For how many years has the area of electricity been offered? ___Years
17. Is the Composite General Shop course open to the girls? ___Yes ___No
18. Do you think that it should be open to the girls? ___Yes ___No
19. Would you like to see more emphasis placed upon applied electricity in your school? ___Yes ___No

20. Please indicate the reason or reasons that might prevent you from expanding your offerings in applied electricity. Check those that you consider most significant.

___ Insufficient funds
___ Inadequate facilities
___ Not enough student interest
___ Lack of instructor interest
___ Very little administrative interest
___ Qualified instructors are not available
___ Not enough students to justify a separate course
___ Curriculum already overcrowded
___ Course content does not justify a separate course
___ Students receive sufficient applied electricity in a physics course
___ Students receive sufficient applied electricity in a Composite General Shop
___ Others _____
___ _____

IMPORTANT - The following questions are to be answered by those NOT HAVING a separate course or courses in applied electricity.

21. Has your school ever offered a separate course or courses in applied electricity? ___Yes ___No
22. For how many years was it offered? ___Years
23. Do you have a Composite General Shop? ___Yes ___No
24. Do you have an area of electricity in your Composite General Shop? ___Yes ___No
25. For how many years has the area of electricity been offered? ___Years
26. Is the Composite General Shop open to the girls? ___Yes ___No
27. Do you think that it should be open to the girls? ___Yes ___No
28. Would you desire a separate course or courses in applied electricity in your school? ___Yes ___No
29. Please indicate the reason or reasons why you offer no separate courses in applied electricity. Check those that you consider most significant.

___ Insufficient funds
___ Inadequate facilities
___ Not enough student interest
___ Lack of instructor interest
___ Very little administrative interest
___ Qualified instructors are not available
___ Not enough students to justify a separate course
___ Curriculum already overcrowded
___ Course content does not justify a separate course
___ Students receive sufficient applied electricity in a physics course
___ Students receive sufficient applied electricity in a Composite General Shop
___ Others _____
___ _____

If you have any additional comments that you would care to make, please feel free to use the back of the sheet.