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Iowa radio-television servicing firms were studied to determine the need for educational programs to train or upgrade service technicians. The first questionnaire was used to gather data on present and proposed employment from 355 firms (an 84.19 percent return), while the second questionnaire collected information on required knowledges and skills from 213 firms (an 80 percent return). The conclusions were: (1) Radio-television service technicians are relatively homogeneously grouped across areas within the state. (2) Four of the 18 areas studied needed additional training programs. (3) The majority of the technicians were found to be below 40 years of age and in need of additional training, and (4) A large portion of the applicants did not have adequate training. The study did not provide adequate data to make a satisfactory analysis of the skills and technical knowledge required by service technicians. (GR)

RADIO-TELEVISION SERVICE TECHNICIAN TRAINING NEEDS OF IOWA

by

Glenn F. Dukes

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Vocational Education Branch
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Iowa Department of Public Instruction

IOWA STATE UNIVERSITY
of Science and Technology
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This is an abstract of a dissertation submitted to Iowa State University of Science and Technology by Glenn F. Dukes in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

The study was conducted with the cooperation of the Iowa State Department of Public Instruction and the Industrial Education Department at Iowa State University.

The study was conducted under the direction of Professor Lowell L. Carver and Dr. Ray Bryan.

RADIO-TELEVISION SERVICE TECHNICIAN

TRAINING NEEDS OF IOWA

by

Glenn F Dukes

Introduction

In the development and expansion of the area vocational and technical programs in Iowa, it is hoped that all the training needs for Iowa industry will be satisfied without wasting valuable funds. To accomplish this, very extensive research projects are needed to show geographic needs of specific programs within the state. It is the intention of this study to provide this needed information for the radio-television service industry. This study is designed to determine if such an educational program is needed, and if so, in which areas.

The specific objectives of this study are as follows:

1. To describe the population surveyed by this study with respect to the number of technicians employed by each firm, the location of the firm relative to area, and the types of electronic appliances serviced.

2. To determine the additional manpower needed by firms employing radio-television service technicians due to business expansion and employment turnover at the time of the study and over the next one, two, and three year periods, as estimated by firm owners or operators.

3. To determine the sources of training completed by the radio-television service technicians presently employed in relation to the area of the state.

4. To determine the interest for in-service up-grading for technicians presently employed, as felt by the owners or operators of the responding firms.

5. To determine the interest by firm owners or operators in the development of training programs to provide service technicians specialized in repairing one appliance.

6. To determine the technical knowledge and skills felt important by the radio-television service technicians contacted.

7. To propose educational programs for training radio-television service technicians relative to the reported needs in the respective areas of Iowa.

Delimitations

The scope of this research undertaking was confined to the study of the radio-television servicing firms in the state of Iowa. It was to determine the actual or potential need for educational programs to initially train service technicians, and to develop programs to up-grade the existing radio-television service technicians.

The study was further limited to the radio-television service and repair firms in cities of 2,500 and over. It was felt by the researcher that the firms in cities of less than 2,500 population would be primarily owner-operator firms, or one-man shops, and would have very little, if any, influence on the overall predictive needs of the state.

The study was limited to firms that serviced only consumer electronic devices such as radios, televisions, and recorders. No attempt was made to include industrial firms with communicative devices that required service technicians.

Definitions

The following definitions are made to clarify the meaning of the various terms used in this study and to make possible a better understanding of the materials contained in this study.

Service occupations - Those occupations in which the workers perform some type of service for other individuals.

Technicians - Those individuals who require specialized knowledge and/or experiences to perform jobs of a technical nature.

Electronic technician - An individual whose work requires a significant degree of knowledge of electronics to complete his job requirements such as diagnosing, testing, inspecting, maintaining, etc. This person is ranked between an electrician and an electrical engineer in degree of technical proficiency.

Radio-television service technicians - Those individuals with the technical knowledge and skills necessary to service and repair the modern electronic consumer products used in today's homes.

Electronic consumer products - Those electronic devices used in the modern home for the purpose of entertainment and education. These common products are radios, televisions (both color and black and white), and hi-fi and stereo phonographs.

Radio-television servicing firms - Those firms employing service technicians for the maintenance and repair of electronic consumer products.

Specialist - Radio-television service technicians who specialize in servicing one type of consumer electronic device.

Owner-operator firm - A firm which includes only one man who is both the owner and the servicing technician.

Owner-operator - A technician who owns the firm, but may employ other technicians.

Merged areas - The sections of Iowa which have been merged together to form supporting areas for the existing 15 area vocational-technical schools and/or the area community colleges authorized by Senate File 550.

Funding

The proposal for this research project; stating objectives, method of procedure, and budget necessary for the study was submitted to the Iowa Department of Public Instruction Division of Vocational Education State Committee for Research, Demonstration and Experiments in May, 1968. The committee approved the proposal and allocated funds for the project beginning July 1, 1968, and ending July 1, 1969.

Method of Procedure

After final approval of this research project, an extensive review of literature was conducted to determine the research that had been done to determine the needs of radio-television service technicians. The review of

literature was conducted in three specific areas· the national needs and trends, the situation in Iowa, and the educational requirements needed in the field of electronics.

The population included all identified firms in Iowa which serviced consumer electronic devices. These firms were limited to cities of 2,500 population and larger.

The instruments used in the collection of data for this study consisted of two questionnaires. The first questionnaire collected information provided by the firms as to the employment at the time of the study and the expected employment needs through January 1, 1972. The second questionnaire collected information on the knowledge and skills required by radio-television service technicians. Both instruments were validated by the personal interviewing of technicians.

When returned, each questionnaire was checked to determine the completeness of the information. The data were key punched on IBM 80-column cards and processed by the computation center at Iowa State University so the data could be presented in the most useable form.

Findings

Introduction

The population participating in this study was composed of 575 radio-television servicing firms located in cities of 2,500 or larger population in Iowa. The areas correspond to the 15 area vocational-technical schools, or area community colleges, in the state. Three sections of the state have not been merged with an area school, so for the purpose of this study, these sections will be labeled Areas XVII, XVIII, and XIX. The locations of all the areas are illustrated by Figure 1 with Areas XVII, XVIII, and XIX especially indicated. Area VIII has not been designated, so this number will not appear on the map or in the tables.

The data for this study were collected by using two questionnaires. The first questionnaire requested information from the firms concerning present employment characteristics and needs and the expected employment needs over the next three year period. The second questionnaire requested information on the knowledge and skills felt to be important for radio-television service technicians.

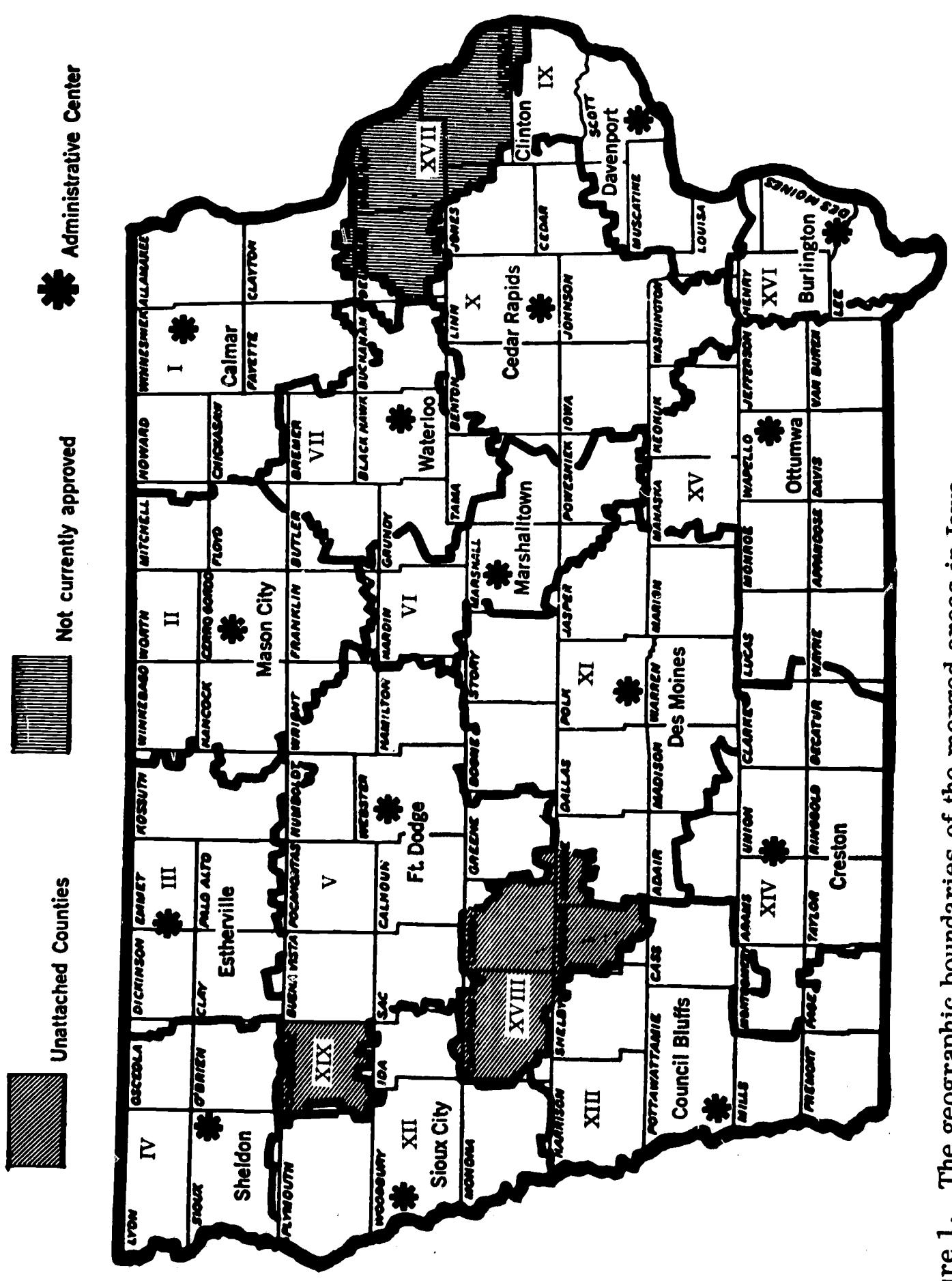

Figure 1. The geographic boundaries of the merged areas in Iowa

Five hundred seventy-five firms were contacted by the first questionnaire. A total of 484, or 84.19 percent, of the firms returned the first questionnaire. Of the 484 questionnaires returned, 355, or 73.35 percent of the questionnaires returned, were applicable to this study. Eighty-four firms were no longer in business, 41 firms contacted no longer serviced electric devices, and four firms returned the questionnaire indicating no interest in the study or that the information desired was confidential.

The population used for the second questionnaire was selected from the firms which responded to the first questionnaire. The first questionnaire asked the firms to indicate their willingness to participate further in the study. Of the 355 firms responding to the first questionnaire, 275 firms consented to supply additional information for this research project and were contacted by means of the second questionnaire.

A total of 221 questionnaires, or approximately 80 percent of the second questionnaires, were returned. Two hundred thirteen were useable questionnaires. Four firms had moved or gone out of business, and four questionnaires were received too late to be used in this study.

Description of the firms responding

The 355 firms responding in this study employ 807 radio and television service technicians. The data in Table 1 indicate the distribution of the different sized firms by areas. The owner-operator repair shop was the most prevalent of all the various size firms, and approximately 84 percent of the firms reporting employed three or fewer radio and television service technicians.

Approximately 90 percent, 319, of the reporting firms serviced all of the common home electronic devices specified in this study. Television receiving sets, both black and white and colored, were reported by eight firms as the only appliance serviced. The firms which specialized in servicing one or two electronic devices employed six or fewer employees and a majority of these firms were located in cities of 20,000 and over population.

Colored television receiving sets were the most common appliance serviced by the responding firms. Ninety-two firms, approximately 26 percent, reported that color sets were the appliance most commonly serviced, while 60 percent of the firms reported television receivers, both black and white and colored, as their primary appliance serviced.

Hi-fi and stereophonic record players were the appliances least often serviced by 217 responding firms (61 percent). Radios ranked next, with 85 percent of the firms indicating that radios, record players, or both radios and record players were the appliances least often serviced.

Table 1. Distribution of sizes of firms in each area as of January 1, 1969

Area	Firm size by number of employees					Total number of firms
	Owner-operator	1-3	4-6	7-10	11-15	
I	3	1	0	0	0	4
II	11	9	2	0	0	22
III	9	3	2	0	0	14
IV	4	5	0	0	0	9
V	14	9	1	0	0	24
VI	8	5	0	1	0	14
VII	10	9	2	2	1	24
IX	11	12	1	2	0	26
X	11	16	11	3	0	41
XI	25	22	11	2	3	63
XII	7	4	3	1	1	16
XIII	14	8	1	1	0	24
XIV	5	2	0	0	0	7
XV	14	11	2	0	0	27
XVI	9	9	2	0	0	20
XVII	10	4	0	1	0	15
XVIII	2	1	0	0	0	3
XIX	0	1	1	0	0	2
Total	167	131	39	13	5	355

Additional manpower needs of radio-television service firms

Firms employing radio-television service technicians have had difficulty employing qualified technicians. Of the 349 firms responding to this portion of the questionnaire, 282 reported difficulty in finding qualified technicians.

One hundred thirty-two of the responding firms gave as an explanation for the difficulty of finding technicians that applicants for the positions lacked the necessary qualifications. Sixty firms reported a shortage of applicants. The remaining firms gave both the lack of applicants and the lack of qualified applicants as the reason for difficulty in employing service technicians. This problem was not necessarily limited to any area of the state or any firm size.

As of January 1, 1969, 115 radio-television service technicians were needed to fill existing vacancies. Firms in Area X indicated the highest need with 31 vacancies. Firms in Area XI and Area XVI were next high with 18 and 11 vacancies reported respectively. The firms in Areas IV, XIV, and XVIII indicated no vacancies at the time the survey was conducted. The data are summarized by area in Table 2. It should be noted that 69 firms failed to respond to this portion of the questionnaire.

At the time of the study, five areas were conducting initial training programs for radio-television service technicians. These areas were Areas VI, VII, IX, XI, and XII.

It was found that there was a highly significant difference between number of vacancies reported in the areas with training programs and the number of vacancies reported in areas without training programs. The areas which contain training programs reported a smaller need than would be expected in relation to the present employment level.

Present and expected trends of the number of radio-television service technicians employed in Iowa

The firms contacted by this research project were asked to state the number of radio-television service technicians presently employed, and also to estimate the number of technicians needed over the next three year period. The researcher found the firms very reluctant to estimate future needs. Approximately 28 percent of the firms responding failed to predict needs of technicians for the years 1971 and 1972.

Two hundred fifty-three firms estimated a need of 99 additional radio-television service technicians by January 1, 1970. Firms in Areas X and XI predicted the highest need with a predicted increase of 25 and 23 technicians

Table 2. Present shortage of qualified technicians and reasons for this shortage, by area

Area	Number employed	Present vacancies	Not difficult to find qualified technicians	Difficult to find qualified technicians	Reasons for difficulty			
					Lack of applicants	Applicants lack qualifications	Both	Other
I	4	1	2	2	1			1
II	22	6	1	21	6	8	7	
III	14	1	5	8	3	4	1	1
IV	9	0	1	8	1	3	4	
V	24	4	5	18	7	7	4	1
VI	14	6		12	4	4	4	2
VII	24	9	3	21	3	9	7	2
IX	26	5	7	19	3	7	9	
X	41	31	6	35	7	18	9	1
XI	63	18	12	49	8	27	14	2
XII	16	3	6	10	1	5	4	
XIII	24	9	7	17	4	9	4	
XIV	7	0	0	7	1	5	1	
XV	27	6	6	21	5	12	4	
XVI	20	11	3	17	5	3	8	1
XVII	15	3	3	12	1	8	3	
XVIII	3	0		3		1	2	
XIX	2	2		2		2		
Total	355	115	67	282	60	132	85	11

respectively. Areas VI, XIII, and XVI each predicted a need of over five technicians by January 1, 1970.

Two hundred fifteen firms, or 60 percent of the firms answering the questionnaire, estimated an increased need of 42 radio-television service technicians by January 1, 1971, and a need of 42 technicians by January 1, 1972. Firms in Areas X and XI predicted the greatest need for both periods of time and were the only areas predicting an increase of over five radio-television service technicians. The firms estimated a minimum of 183 additional radio-television service technicians would be needed in Iowa over the period January 1, 1970, to January 1, 1972. This was approximately a 25 percent increase in employment over the number of technicians employed January 1, 1969.

Expected replacement needs

Table 3 contains data which summarize the replacement needs of the responding firms by area. Firms in Areas X, XI, and XII predicted the largest number of technicians to be replaced in each of the years presented from January 1, 1968, to January 1, 1972.

Firms employing one to three radio-television service technicians estimated the largest numerical need for replacement during the period of January 1, 1969, to January 1, 1972. These firms estimated that 73 technicians would be replaced during this period, or approximately eight percent per year of those employed at the time of the study. Firms employing four to six technicians estimated a replacement need of 60 technicians which was an 11 percent turnover per year. Firms employing over 11 technicians estimated replacing 38 technicians between January 1, 1969, and January 1, 1972, which was over 20 percent turnover per year of those technicians employed by these firms at the time of the study.

Sources of training completed by the radio-television service technicians presently employed

The 355 firms responding to this portion of the questionnaire reported employing 807 radio-television service technicians. Each technician averaged fewer than two different sources of training to obtain his present level of technical proficiency. The primary sources of training, in order of the frequency indicated, were: (1) schools sponsored by manufacturing firms, (2) vocational and trade schools, (3) correspondence courses, and (4) armed services schools. Four hundred twelve, or approximately 54 percent, of the service technicians surveyed by this study indicated some training by schools sponsored by manufacturing firms. This was prevalent through the 19 areas as shown by data in Table 4.

Table 3. Employee replacement needs from 1968 to 1972, by area

Area	Number of technicians employed	Number replaced January 1 1968-69	Expected replacement needs January 1 1969-70	1970-71	1971-72	Total replacement needs January 1, 1969 to January 1, 1972
I	5	0	0 (1)	0 (1)	0 (1)	0 (3)
II	39	3	5 (2)	2 (4)	3 (4)	10 (10)
III	23	2	1 (7)	0 (8)	0 (8)	1
IV	13	1 (1)	1 (3)	0 (4)	0 (4)	1
V	40	0	2 (7)	0 (7)	0 (7)	2
VI	29	1	1 (2)	0 (2)	1 (2)	2
VII	66	2 (3)	3 (6)	1 (8)	2 (8)	6
IX	59	7	4 (10)	4 (11)	3 (12)	11
X	124	14	9 (18)	5 (20)	5 (20)	19
XI	186	18 (1)	24 (13)	12 (19)	10 (20)	46
XII	49	11	8 (3)	6 (5)	6 (5)	20
XIII	44	8	0 (8)	0 (8)	0 (8)	0
XIV	9	1	0 (4)	0 (4)	0 (4)	0
XV	45	2 (1)	2 (12)	0 (13)	0 (13)	2
XVI	37	3	3 (3)	0 (6)	0 (6)	3
XVII	28	1	2 (3)	0 (3)	0 (4)	2
XVIII	4	0 (1)	0 (1)	0 (1)	0 (1)	0
XIX	7	0	0 (1)	0 (1)	0 (1)	0
Total	807	74 (7)	65 (104)	30 (125)	30 (128)	125

Number in parentheses indicates number of firms failing to respond to this portion of the questionnaire

Table 4. Sources of training of radio-television service technicians, by area

Area	Present technicians trained through: High school vocational courses	Vocational or trade schools	Manufacturers' training schools	Experience only	Correspondence courses	Armed service schools	College technical programs	Other means	Total	Chi square values
I	0	0	4	2	0	1	1	0	8	6.
II	11	12	19	2	8	9	6	3	70	11.727
III	1	9	10	4	7	5	4	1	41	3.499
IV	2	3	8	2	4	4	0	0	23	2.608
V	4	16	21	4	10	8	7	0	70	3.648
VI	0	7	18	4	14	4	4	0	51	11.554
VII	9	25	38	3	18	15	12	0	120	8.849
IX	13	30	35	7	12	11	3	0	111	6.557
X	21	38	62	20	35	24	11	0	211	3.800
XI	23	73	82	29	30	35	10	0	282	9.897
XII	7	17	23	2	13	10	2	0	74	4.905
XIII	7	20	27	8	6	15	5	0	88	4.649
XIV	1	2	3	3	3	2	3	0	17	6.800
XV	4	19	20	5	11	8	8	0	75	3.487
XVI	4	7	16	11	5	5	3	0	51*	15.062
XVII	0	4	19	4	11	5	0	0	43	
XVIII	2	3	2	0	2	0	1	0	10	9.984
XIX	0	4	5	2	3	1	0	0	15	
Total	109	289	412	112	192	162	80	4	1360	

*Significant

Up-grading needs of radio-television service technicians

One of the purposes of the study was to determine the up-grading needs of the technicians employed at the time of the study. The owner or manager of the firms contacted in this survey was asked to determine: (1) the number of technicians under their employment who needed up-grading night classes, (2) the number of these technicians who would be recommended to attend such night classes, and (3) the number of technicians the owner or manager thought would actually attend such classes. The data in Table 5 illustrate the responses to these questions by area. Of the 807 radio-television service technicians employed by the responding firms, 53.8 percent were thought to have need for such up-grading night classes in the opinion of the owners or managers of the firms.

The firms in Area X indicated the largest number of radio-television service technicians (51) who would attend these night classes. Firms in eight areas indicated 20 or more service technicians would attend night classes if they were made available. These areas, in descending order of the number of interested technicians, were Area X (51), Area VII (25), Area XII (22), and Areas IX, XIII, XV, and XVI all indicating 20 technicians. There was no significant difference among the areas in the number believed willing to attend up-grading classes in relation to the number of technicians presently employed in each area.

Firms employing from one to six radio-television service technicians indicated the greatest interest in night classes to up-grade the technical knowledge of their technicians. Of the technicians employed by firms employing one to three technicians, 57.8 percent were believed to be willing to attend those classes, and 49.5 percent of those employed by firms employing four to six technicians were thought to be interested in attending night classes. Only 25.9 percent of the owner-operator technicians were interested in attending night classes for up-grading purposes. Ninety-nine firms failed to respond to the final portion of this section of the questionnaire. Seventy-three were owner-operator firms.

The researcher found no significant correlation between the age of technicians and the indicated need for in-service training ($\rho = -.173$) or between the wages earned and the in-service training needs ($\rho = -.18$) across areas. The comparisons were made using the Spearman rank order correlation statistic.

Need for technicians specialized in one electronic appliance

At the time of the study, only 72 of the responding firms employed an electronic service technician to specialize in one or two of the electronic devices specified in this study. Twenty-eight firms had employed a specialist for

Table 5. Up-grading needs of radio-television service technicians presently employed, by area

Area	Number of technicians employed 1-1-69	Number of technicians firms thought needed night classes	Number of technicians firms would recommend to attend night classes	Number of technicians firms estimate would attend night classes	Percentage of technicians firms estimate would attend night classes
I	5	2	2	2	40.0
II	39	21	23	15	38.5
III	23	11	10	7	30.4
IV	13	4	4	3	23.0
V	40	23	23	19	47.5
VI	29	20	20	11	38.0
VII	66	36	38	25	37.9
IX	59	23	28	20	34.0
X	124	73	72	51	41.0
XI	186	104	99	45	24.0
XII	49	30	28	22	45.0
XIII	44	22	27	20	45.0
XIV	9	3	3	2	22.0
XV	45	26	21	20	44.0
XVI	37	19	21	20	54.0
XVII	28	10	12	8	28.6
XVIII	4	2	2	2	50.0
XIX	7	5	6	4	57.0
Total	807	434	439	296	36.7

servicing colored television sets and a total of 48 firms reported employing a technician to specialize in repairing television sets, black and white and colored, or both.

Because of the rapid technological developments in the area of consumer electronic devices, the author felt it important to determine if the need for specialists was great enough to provide special training for such technicians.

One hundred sixty-seven firms, or approximately 50 percent of the firms responding to this portion of the questionnaire, would hire a specialist at the time of the study if he were available.

A small percent of the owner-operator firms indicated a need for specialists. This implied that small firms must employ general repairmen capable of repairing all electronic appliances. Firms employing four or more radio-television service technicians indicated a greater need for a specialist than did the smaller firms. Over 80 percent of the larger firms were willing to hire a specialist if he were available at the time of the study. The size of city in which firms were located had no significant influence on the reported need for specialists.

Approximately 52 percent of the firms responding in this study specified difficulty in securing specially trained technicians to service and repair color television sets. One hundred eighty-four firms reported a willingness to hire a color television specialist if it were possible for them to hire such a specialist. Forty-five firms specified a need for specialists in television repair, both black and white and color. There was no specific need for specialists predominant to any specific area.

Rating of knowledge and skills needed by radio-television service technicians

This study attempted to determine the knowledge and skills thought important for radio-television service technicians by firm owners or operators. The questionnaire used in this portion of the research was divided into nine different areas of knowledge or skills. Three areas were the core areas of (1) English skills, (2) business practices, and (3) technical mathematics skills. Three areas directly related to electronic devices as to theory, components, and test equipment. These were (4) AC and DC circuits and machines, (5) electronic components and circuits, and (6) test equipment. The remaining three areas were skills and knowledge related to electronic devices. These areas were (7) antenna systems, (8) technical drafting, and (9) mechanical operations and skills. The questionnaire contained various items under each of these areas which were evaluated in terms of the degree of knowledge and skill needed by the radio-television service technicians. The rating was based on a five-point scale which is as follows: (1) very little importance, (2) background knowledge only, (3) desirable, (4) highly desirable, and (5) essential.

The findings of this portion of the research will be discussed in terms of the nine subject areas earlier specified.

When comparing the general groups of knowledge and skills indicated above, the areas directly related to electronics theory, components, and test equipment received the highest modal ratings. The closely related areas of technical electronics drafting skills, antenna systems, and mechanical operations and skills secured the next highest group of ratings. The core courses such as English skills, business skills, and mathematics skills as a group received the lowest rating.

Core subject areas Of the three related subject areas used in this research project, business skills received the highest rating. Six of the eight items listed in this area were rated "essential" most frequently. The three items with the most "essential" ratings were: (1) "Ability to talk with customers", (2) "Ability to make house calls", and (3) "Safety consciousness". "Knowledge of accounting procedures" and "Knowledge of marketing procedures" were rated "desirable" most frequently and their average rating was below desirable. These data are presented in Table 6.

All of the items listed under English skills received the most frequent rating of "desirable". The item, "Skill in the use of words", had the highest average rating of 3.46. The item, "Knowledge of good sentence structure", received the lowest average rating of 2.84. The data are presented in Table 7.

Any mathematic knowledge and skills beyond basic arithmetic and algebra were considered only "desirable" or "very little importance". "Arithmetic" was the only item with a modal rating of "essential". Responding firms rated "Algebra" most frequently as "highly desirable" and "Vector analysis" as "desirable". All of the other mathematical skills presented in this research had the most frequent rating of "very little importance". Table 8 presents these data.

Areas related directly to theory, components, and testing of electronic devices The items listed under electronic components and circuits received the most "essential" ratings of any area in this portion of the questionnaire. All of the items under components and circuits received the most frequent rating of "essential" except "Thin film techniques". This item received the most frequent rating of "background knowledge only". "AC and DC power supplies", "Oscillator circuits", "Audio frequency amplifiers", "Radio frequency amplifiers", and "Transistor analysis" were the five items that received the most "essential" ratings (Table 9).

Table 6. Importance of business practices to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Ability to talk with customers	3	0	16	61	133	4.51
Ability to make house calls	8	1	17	49	138	4.45
Safety consciousness	5	5	23	47	133	4.40
Ability to estimate repair costs prior to work	7	1	32	72	101	4.22
Understanding of liability responsibilities of servicemen	5	6	43	56	103	4.15
Ability to handle warranties and service policies	10	6	48	64	85	3.98
Skills in the art of salesmanship	11	13	53	77	59	3.75
Knowledge of accounting procedures	34	56	63	32	28	2.83
Knowledge of marketing procedures	47	59	56	30	21	2.62

Table 7. Importance of English skills to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Skill in use of words	12	7	94	70	30	3.46
Good penmanship	15	6	110	47	35	3.38
Good spelling skills	12	13	114	48	26	3.29
Ability to write grammatically correct reports and letters	22	29	84	42	36	3.19
Knowledge of good sentence structure	30	39	94	34	16	2.84

Table 8. Importance of technical mathematic skills to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Arithmetic	4	8	24	45	132	4.38
Algebra	29	42	53	55	34	3.11
Vector analysis	54	36	71	35	17	2.65
Trigonometry	67	54	55	23	14	2.36
Differentiation	83	47	50	19	14	2.22
Logarithmic and exponential functions	87	45	45	25	11	2.19
Analytical geometry	86	56	48	15	8	2.07
Bolean algebra	125	41	33	8	6	1.73

The items listed under AC and DC circuits and machines received an average rating of "desirable" or above except "Transient analysis", "Electric motors", and "Servo-mechanisms". These items received an average rating of "background knowledge only". All of the other items except "Multi-phase system" received the most frequent rating of "essential". The items "Series and parallel circuits", "Combination circuits", and "Ohm's law" received the largest number of "essential" ratings of all the items in this section (Table 10).

The "Oscilloscope" and the "Multimeter" were rated the most important test equipment needed by radio-television service technicians by the responding firms. The "Color bar generator" was the third highest rated test equipment. All three averaged above a 4.5 rating and were rated "essential" by over 75 percent of the responding firms. The "Ratiometer" and the "Shorting stubs and other wave guide loads" were the lowest rated equipment with a mean rating of 2.60. The remaining items are listed in Table 11 with the frequency of rating by different firms and the mean rating score.

Electronic skills related to servicing of electronic devices Skills and knowledge related to antenna systems were rated highest in this portion of the questionnaire.

Table 9. Importance of understanding electronic components and circuits to radio-television service technicians, as reported by firm operators

Topic item	Rating					
	1	2	3	4	5	Mean
AC and DC power supplies	2	2	10	27	<u>172</u>	4.71
Oscillator circuits	1	0	8	41	<u>160</u>	4.66
Audio frequency amplifiers	4	0	13	35	<u>161</u>	4.64
Radio frequency amplifiers	4	2	12	42	<u>153</u>	4.59
Transistor analysis	3	3	16	35	<u>156</u>	4.59
Semi-conductor theory and design (diodes, transistors, SCR's, uni-junction transistors, etc.)	7	3	15	33	<u>155</u>	4.53
Power supply regulation	5	3	14	46	<u>145</u>	4.52
Vacuum tubes theory and function	3	5	17	43	<u>145</u>	4.51
Video amplifiers	6	3	13	47	<u>144</u>	4.50
FM modulation	7	2	19	43	<u>142</u>	4.46
AM modulation	7	3	20	42	<u>141</u>	4.44
Vacuum tube circuit analysis	6	6	17	45	<u>139</u>	4.43
Phase modulation (color)	6	7	22	44	<u>134</u>	4.38
Integrated circuits	9	7	23	41	<u>133</u>	4.32
Switching circuit design and analysis (multi-vibrators, free running, flip-flop, etc.)	15	17	41	45	<u>95</u>	3.88
Vacuum tube circuit design	14	18	46	44	<u>91</u>	3.84
Transmission lines	17	18	51	48	<u>79</u>	3.72
Waveguides	30	37	47	44	<u>55</u>	3.27
Thin film techniques	48	<u>52</u>	50	37	26	2.72

Rating scale:

1 - very little importance
2 - background knowledge only
3 - desirable
4 - highly desirable
5 - essential

Rating most often listed is underscored.

Table 10. Importance of the understanding of AC and DC circuits and machines to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Series and parallel circuits	3	2	8	26	174	4.72
Combination circuits	2	4	12	32	163	4.64
Ohm's Law	1	4	15	31	162	4.64
Inductive reactance, capacitive reactance, resonance, etc.	7	8	28	38	132	4.31
Integrating circuits	14	10	44	55	90	3.92
Kirchoff's Law	28	22	48	37	78	3.54
Differentiating circuits	29	19	53	45	67	3.48
Thevenin's Law	44	30	43	40	56	3.16
Norton's Law	44	31	48	38	52	3.11
Multi-phase systems	40	31	64	41	37	3.02
Transient analysis	46	35	59	39	34	2.91
Electric motors	35	63	74	23	18	2.65
Servo-mechanisms	59	61	57	26	10	2.38

All items appearing in this section of the research received an average rating of "desirable" or "highly desirable" as knowledge and skills needed for radio-television service technicians. As indicated by the data in Table 12, all items in this area were rated essential by the largest number of responding firms. "VHF antenna systems" received the highest mean rating of 4.52. "Rotor mounting" was rated the least important item with a mean rating of 3.74.

The ability to read and understand "electronics symbols" was the item thought most important in the area of technical drafting skills needed by radio-television service technicians and received an average rating of 4.44 by the responding firms. "Schematic diagrams (simplified and full)", "Printed circuit layout", "Electronic circuit drawing", and "Block diagrams" all received an average rating of "highly desirable", with over 50 percent of the responding firms rating these items "essential". "Pictorial drawings", "Sketching", and "Dimensioning" skills received an average rating of "background knowledge only". These items and their ratings are presented in Table 13.

Table 11. Importance of test equipment to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Oscilloscopes	3	2	12	37	158	4.63
Multimeters	3	4	15	27	163	4.62
Color bar generator	8	0	12	33	159	4.58
Tube testers	7	4	20	28	153	4.49
Transistor testers	8	4	17	30	153	4.49
RF generators	8	5	26	47	126	4.31
Sweep/marker generator	10	4	19	62	116	4.28
Signal generators below microwave frequencies	12	8	33	43	116	4.15
Audio generators	10	7	38	47	110	4.13
Television analyst	12	8	36	54	102	4.07
Field strength meters	20	21	61	51	59	3.51
Vector oscilloscope	25	18	59	53	56	3.46
Impedance bridge	24	24	69	40	55	3.37
Function generators	33	33	51	42	53	3.23
Distortion analyzer	28	43	66	39	35	3.05
Grid dip oscillator	31	33	82	35	30	3.00
Variable frequency bandpass filter	26	45	70	45	25	2.99
Microwave signal generators	52	53	49	32	26	2.66
Spectrum analyzer	64	38	55	26	29	2.61
Ratiometer	58	43	58	32	21	2.60
Shorting stubs and other wave guide loads	45	52	69	33	12	2.60

Rating scale:

1 - very little importance
2 - background knowledge only
3 - desirable
4 - highly desirable
5 - essential

Rating most often listed is underscored.

Table 12. Importance of understanding antenna systems to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
VHF antenna systems	2	4	19	43	142	4.52
Impedance matching of antenna to line and set	7	2	39	41	121	4.27
Directional antennas	11	10	34	45	110	4.11
Distribution systems	6	7	46	56	95	4.08
Antenna elements and mounting techniques	15	11	37	47	100	3.98
UHF antenna systems	20	17	37	39	98	3.84
Rotor mountings	11	22	58	38	81	3.74

Table 13. Importance of technical drafting skills (reading and understanding) to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Electronic symbols	7	2	19	47	136	4.44
Schematic diagram, simplified	9	3	17	49	133	4.39
Printed circuit layout	9	5	21	44	132	4.35
Schematic diagram, full	11	6	15	48	131	4.34
Electronic circuit drawings	11	8	18	58	116	4.23
Block diagrams	21	11	34	41	104	3.93
Charts and graphs	29	23	65	55	39	3.25
Pictorial drawings	41	40	75	31	24	2.80
Sketching	41	58	61	35	16	2.65
Dimensioning	57	63	58	25	8	2.35

In the mechanical operations and skills area, "Soldering" skills received the most "essential" ratings by the radio-television service technicians responding. "Printed circuit techniques" and "Desoldering" skills also received an average rating above "highly desirable", and over 76 percent of the firms rated these skills "essential". "Sheet metal fabrication" and "Brazing" were the only skills that rated below "desirable" and were reported as being needed for "background knowledge only". These items are presented in Table 14.

Table 14. Importance of operations and skills to radio-television service technicians, as reported by firm operators

Topic item	Rating 1	2	3	4	5	Mean
Soldering	3	0	5	22	182	4.79
Printed circuit techniques	2	2	5	25	178	4.77
Desoldering	4	4	14	27	163	4.61
Drilling	15	29	61	41	66	3.54
Brazing	68	38	63	27	16	2.46
Sheet metal fabrication	84	48	60	15	5	2.10

Educational programs needed to train radio-television service technicians

This study attempted to determine the number of radio-television service technicians who would be needed over the period from January 1, 1969, to January 1, 1972, and to use this information to propose the areas in which programs are needed. These needs for technicians were determined from the following sources: (1) the existing vacancies as of January 1, 1969, (2) the replacement needs from January 1, 1969, to January 1, 1972, (3) the additional technicians needed for expansion from January 1, 1969, to January 1, 1972, and (4) the upgrading needs of the existing radio-television service technicians. The data summarizing these needs by area are presented in Table 15.

As of January 1, 1969, 115 radio-television service technicians were needed to fill existing vacancies.

Table 15. Summary of the expected needs for radio-television service technicians, by area

Area	Vacancies 1/1/69	Estimated replacement needs 1/1/69 to 1/1/70	1/1/70 to 1/1/71	1/1/71 to 1/1/72	Expected additional technicians needed 1/1/69 to 1/1/70	1/1/70 to 1/1/71	1/1/71 to 1/1/72
I	1 (3)	0 (3)	0 (3)	0 (3)	1 (3)	0 (3)	0 (3)
II	6 (19)	5 (20)	2 (18)	3 (18)	7 (16)	6 (15)	5 (15)
III	1 (9)	1 (7)	0 (6)	0 (6)	1 (7)	0 (5)	0 (5)
IV	0 (7)	1 (6)	0 (5)	0 (5)	1 (5)	0 (4)	0 (4)
V	4 (20)	2 (17)	0 (17)	0 (17)	3 (16)	0 (13)	2 (13)
VI	6 (14)	1 (12)	0 (12)	1 (12)	5 (13)	3 (12)	4 (12)
VII	9 (19)	3 (18)	1 (16)	2 (16)	4 (14)	4 (14)	1 (14)
IX	5 (19)	4 (16)	4 (15)	3 (14)	5 (18)	4 (14)	3 (14)
X	31 (35)	9 (23)	5 (21)	5 (21)	25 (30)	6 (23)	8 (23)
XI	18 (50)	24 (50)	12 (44)	10 (43)	23 (49)	11 (44)	10 (44)
XII	3 (13)	8 (13)	6 (11)	6 (11)	2 (11)	1 (9)	0 (9)
XIII	9 (20)	0 (16)	0 (16)	0 (16)	7 (16)	1 (14)	2 (14)
XIV	0 (4)	0 (3)	0 (3)	0 (3)	1 (4)	1 (4)	0 (4)
XV	6 (17)	2 (15)	0 (14)	0 (14)	2 (17)	2 (16)	1 (16)
XVI	11 (19)	3 (17)	0 (14)	0 (14)	8 (17)	2 (14)	3 (14)
XVII	3 (14)	2 (12)	0 (12)	0 (11)	3 (13)	1 (9)	3 (9)
XVIII	0 (2)	0 (2)	0 (2)	0 (2)	0 (2)	0 (2)	0 (2)
XIX	2	0 (1)	0 (1)	0 (1)	1 (2)	0 (0)	0 (0)
Total	115 (69)	65 (251)	30 (220)	30 (217)	99 (253)	42 (215)	42 (215)

The number in parentheses indicates the number of firms responding

Total expected need by 1/1/70	1/1/71	1/1/72	Up-grading needs of present technicians	Total number of technicians needed 1/1/69 to 1/1/72
1	0	0	2	1
12	8	8	15	28
2	0	0	7	2
2	0	0	3	2
5	0	2	19	7
6	3	5	11	14
7	5	3	25	15
9	8	6	20	23
34	11	13	51	58
47	23	20	45	90
10	7	6	22	23
7	1	2	20	10
1	1	0	2	2
4	2	1	20	7
11	2	3	20	16
5	1	3	8	9
0	0	0	2	0
1	0	0	4	1
164	72	72	296	308

By January 1, 1972, 308 new radio-television service technicians will need to be trained to fill the predicted need due to the replacement of present technicians and added technicians needed because of expansion of the business. Firms in Areas II, VII, IX, X, XII, and XVI estimated a need of 15 or more technicians to fill the estimated vacancies due to business expansion.

Approximately 53.8 percent of the 807 radio-television service technicians presently employed would be recommended to take up-grading classes by their employers if such courses were available. Only 36.7 percent, or approximately 296, of these technicians were believed to be willing to attend such classes.

At the time of the study, there were initial training programs for radio-television service technicians established in Areas VI, VII, IX, XI, and XII. These areas still rank high in initial training needs and also in the need for special programs for up-grading of the radio-television service technicians in those areas.

Using the data from the previously mentioned areas as the criterion, the author proposes programs in the following areas:

1. Area X has the second highest number of vacancies (18) and the second highest number of technicians expected to be needed due to business expansion and turnover from January 1, 1969, to January 1, 1972. The firms in this area reported the largest number of technicians who would be interested in attending in-service classes for up-grading purposes.

2. Areas II and XVI have the potential for a full-time radio-television service training program. Area II ranks third in the number of technicians needed over the next three years and tenth in the number of technicians interested in up-grading classes. Firms in Area XVI reported 11 vacancies at the time of the study and an additional need of 16 technicians over the next three year period. Also, 20 technicians in this area were reported to be willing to attend up-grading classes.

3. The firms in Areas V, XIII, and XV did not report a large enough growth indication to warrant a program to be developed in these areas. However, the firms did indicate a high interest in up-grading programs (19 and 20 technicians). The author feels that some type of rotating program should be established in these three areas to provide a workshop type training for the technicians for up-grading purposes. This may be accomplished independently, or in conjunction with other areas. The author feels the need is indicated by the data presented in Table 15.

Based on the data presented, these programs should be highly practical in nature. The courses should deal primarily with teaching electronics theory and components, emphasizing the practical application to the different electronic devices. These programs must provide the student with experience in using equipment and actually servicing electronic devices. Only basic English and mathematics skills were indicated as desirable for radio-television service technicians. Business skills were rated high and should be included in these programs.

Discussion

This research project attempted to secure information regarding the radio-television servicing occupation to aid in planning vocational programs to fit the needs of Iowa. Specific consumer electronic devices were specified for this study in an attempt to obtain more specific data. Though the study was thoroughly planned, some of the limitations and implications must be clarified.

Limitations of the study

Firms located in cities of 2,500 population or larger were selected as the population for this study. The researcher felt the information gained from these firms would be more easily obtained, and also give a more realistic estimate of the future need for trained radio-television service technicians. This was based on the assumption that most of the repair firms located in cities of less than 2,500 population would be very small firms, or owner-operator firms. Other research reviewed implied this size firm was more reluctant to participate in such projects and their expected need due to business expansion was very small and would have little, if any, effect on the overall predicted needs for Iowa. This was substantiated by the returns from this study. The owner-operator firms and the firms responding from the smaller cities were more reluctant to complete the questionnaire.

One of the major objectives of this study was to estimate the training needs of radio-television service technicians for the next three years, through January 1, 1972. The researcher used the owner, or the operator, of the servicing firms surveyed as the source for predicting future needs. To the knowledge of the author, there was no research at the time of the study that validated those individuals as predictors of future employment needs of the industry. There were several studies conducted with that assumption, but none of the studies validated this point of view. The author felt that the owner-operator, if he made a conscientious effort, could determine his individual business situation, and would make adequate predictions of his future needs. The major limitation of the reasoning was that many firm owners or operators were reluctant to predict future needs, so as a result, the predictions made by this study were conservative.

The state employment trends for Iowa were not broken down in relation to the geographic areas used in this area. For this reason, these figures could not be used for the purpose outlined in this study.

The data indicating the up-grading needs of the radio-television service technicians employed at the time of the study were estimated by the owner or operator of the responding firm. It may not have represented the true feelings of all of the radio-television service technicians because all of the technicians were not asked to respond. The author felt the data obtained were realistic within the economic limitations of this study. The quality and type of classes offered for up-grading purposes will be the primary factor determining the acceptance of these classes by the service technicians. If the courses are developed with a high degree of practical application, the estimated need for up-grading classes presented by this study may be conservative. If the classes are based on theory alone, the opposite may be true.

Implications of the study

Need for training This research study reveals a shortage of qualified service technicians. This was determined not only by the number of vacancies at the time of the study, but also by the large number of firms indicating a difficulty in employing qualified technicians (79 percent of the responding firms). This same problem was stated by other research in related occupational areas. From where can this additional technically trained labor supply come?

Perhaps new sources of labor should be explored to fill the needs in the electronics industry, specifically, the radio-television service industry. This could be supplied through the use of women, handicapped individuals, or by developing different levels of competencies needed by such repairmen and limit the repair at each level to the competency level needed.

Women are physically more agile with their hands and are better able to handle small assembly manuvers and repair skills. For this reason, they should be capable of servicing electronic devices. The author feels there are two large factors preventing women from becoming radio-television service technicians. First of all, this is not a socially accepted feminine occupation. Even though this is not as prevalent a distinction in occupation as it was 20 years ago, the author still feels it has a direct influence on the recruitment of women to this occupation. The second factor is the training involved in becoming a radio-television service technician. This training is based on a background of science and mathematics as well as mechanical manipulations. Even though women are fully capable of mastering all three equal to, or perhaps better than, men, they are classified socially as masculine skills. Thus it would be more difficult to entice women into obtaining these skills. Also, there is a physical limitation of women entering the occupation of radio-television servicing. The larger sets

are heavy and would be difficult for women to handle. This could be overcome by employing lower skilled labor to do the heavy work.

Special training of the handicapped is another possible source of labor for the consumer electronics industry. This has been accomplished successfully in other areas, and is being emphasized by the federal government in terms of the emphasis placed in the federal legislation on the training of the handicapped. Even though this is possible, and important, the author does not believe this will supply enough additional qualified labor to satisfy the existing and projected vacancies in the electronic servicing industry in Iowa.

The third source of labor previously suggested was to divide the radio-television service skills into different degrees of difficulty, and specialize in training technicians to fit each competency level. This would allow the use of a wider range of ability individuals in the industry. At the present time, this has been impractical because of the small firm size and the design of the equipment. With the present technological developments, there is no reason why this cannot develop. One individual could be trained to test and replace tubes, clean certain parts such as the tuner; or in the future, test and replace complete circuit panels such as those being used by Motorola at the present time. The individual would not need knowledge of electronic theory or mathematics. He would need to recognize the quality of the item by interpreting his test equipment. If more complicated repair were needed, the item could be sent to the technicians level of competency for further analysis and repair.

No matter which of these sources of labor used, or perhaps some other source, something must be done about the radio-television service industry to improve the public opinion of the industry to recruit more individuals into this occupation. The author feels this point is best summarized by the following statement written by one of the persons filling out the questionnaire.

> "If a man has the ability and incentive to become a competent serviceman, he will recognize the foolishness of remaining in a branch of the industry offering low pay, unpleasant encounters with certain segments of the public, and the usual lack of appreciation of his efforts by his business employer. Especially, when so many other branches of the electronics industry offer much higher rewards for so little effort. (A paragraph described his past experience in the electronics field.) In all this experience, I have not encountered a field as demanding as competent radio and television servicing, and in which the rewards, both financial and personal appreciation, were so out of proportion."

If these conditions exist, something must be done to improve them, or improve the public image of the radio-television repair industry before a

recruitment program can adequately supply the labor force needed by this industry.

Economic implications on training programs for radio-television service technicians This study implied many economic problems that were confronting the radio-television service industry. This was first implied by the large number of firms that have gone out of the service business and the number of firms that indicated they planned to go out of business in the near future. This was not necessarily a new trend, because the small businessman has had economic problems in the past few years and the number of small businesses is rapidly decreasing, especially in the smaller cities. There were some factors indicated by this study that the author felt were influential in the expansion of the radio-television service occupation.

Many firms reported being caught in a price squeeze, with the working margin being reduced to a minimum level. Labor costs have increased and the firms complained that the new technicians were not competent enough to earn this amount of income for the firm. This implies a lack of competence in our existing training programs. On the other side of the squeeze play is the increasing cost of repair parts. Not only were the repair components more expensive to purchase, but each manufacturing company uses components that are not interchangeable with other makes, so the firm must have more capital invested in stock components, or lose valuable time waiting for repairs to be sent from the factory. In both cases, the service firm loses money. If this trend continues, it may affect the total number of firms, but the author does not feel it will greatly influence the overall need for well-qualified technicians.

Another factor influencing the electronic service business today is the technological developments in the industry and the economic standards of today's society. The electronics industry has developed miniaturized, throw-away products for economically affluent society. The items are made small and difficult to repair, complicated in design, and are made economically enough that a new electronic device can be purchased easier than the old one could be repaired. Also, in the past, we have had a growing economy where money was easily obtained through high wages and easy credit. Our society has been style oriented and educated to accept planned obsolescence in our consumer products. This puts undue pressure on the electronic service industry. The customers expect the devices to be repaired as easily as is stated in the advertising and at the same old "fair price".

It is the author's opinion that the technological developments will continue to challenge the radio-television service technicians' knowledge, skill, and economic existence by providing smaller, more durable, longer lived, throw-away components. Through the miniaturization and integration of circuits and

components, the repair industry may be taken out of the technician level and be replaced by block component testers and replacers. The true technician may be needed only at the manufacturing level of the industry.

The national economy may have the greatest influence on the radio-television service industry in the next few years. In the past year, there has been an attempt by the federal government and national economists to stabilize our inflationary economy. This means that credit has and will continue to increase in cost and be more difficult to obtain. If this happens, more people will keep the electronic devices longer and have them repaired instead of purchasing new devices. This means an additional burden would be placed on the presently overworked, under-manpowered service industry. Even more qualified technicians would be necessary to handle this business than was reported in this study.

Educational implications This study indicates a definite need for training radio-television service technicians in Iowa, both from the standpoint of initial training programs, and for in-service training purposes. This study indicated a minimum of 115 vacancies at the time of the study. At the present time, there are five areas which contain radio-television service training programs, but vacancies were still reported in these areas. Our present supply of technicians is not filling the needs of the industry.

The author felt that the most important need implied by this study was the need for in-service training of the presently employed service technicians. It was estimated that over half of the technicians in Iowa needed training and over one-third would attend such classes. Other factors indicated the reason for such a demand for in-service training. Over 58 percent of the technicians reported were less than 40 years old. This is a young work force that is education conscious and easily trained. The second factor influencing this need is the increase in the rate of technological developments in the area of consumer electronics. These developments are in both the electronics devices and the test equipment used in the industry. The technicians must keep abreast of the developments or change occupations.

The in-service training concept, even though it is not new, puts a new viewpoint on the term education. These individuals need pertinent technological information that is readily applicable to their daily work. As far as our educational process, this may mean short (two-night) classes at various points within a given area so more technicians can be more conveniently reached. These classes may be conducted in cooperation with the manufacturing industries to supply more applicable information.

These classes may be conducted in non-conventional buildings or make use of existing buildings and unconventional times, so a more economic utilization of facilities could be made possible. Perhaps a completely new training

technique is needed to provide more pertinent information, knowledge, and skills in a shorter length of time.

This study attempted to determine the general content needed to train radio-television service technicians. These items were rated by the owners or operators of the firms responding to the questionnaires used in this research. The results presented in the previous chapter were very general in nature and would not be adequate to develop such a training program. The following were some of the problems encountered:

The author hoped to analyze the rating of different course items in terms of the appliance most often serviced by the firms to determine the training needed by a technician for a specific appliance. Approximately 90 percent of the responding firms serviced all of the appliances indicated in this study. Even though a firm repaired and serviced one appliance more frequently than the others, the rating was still based on all of the appliances he serviced. Firms reporting radios as the appliance most often serviced still rated the need for understanding and skill in the use of the color bar generator as highly important.

Also, a complete statistical analysis of the data resulting from the responses to the rating scale was felt to be economically not feasible, both from the standpoint of time and money. The author felt data collected would not provide valid data for statistical comparisons valuable to this study.

This study did give general implications as to the type of material that should be included in training programs discussed in this research. It is the opinion of the author that a more thorough study should be conducted on course content based on job analysis and actual job frequency comparison of skills used by the practicing radio-television service technician.

Conclusions

1. The data collected by this research indicate the radio-television service technicians are relatively homogeneously grouped across areas within the state. There is very little difference in age, wage, and interest in in-service training between the areas. This homogeneity indicates that a well-organized training program could be developed for Iowa in general, with no special limitations or additions needed for a particular area of the state.

2. At the time of the study, there were initial training programs for radio-television service technicians established in Areas VI, VII, IX, XI, and XII. Based on the data provided by this study, an additional full-time training program is needed in Area X. Consideration should be given to Areas II, XVI, and XIII. The needs in these areas may not warrant a full-time program for initial training only, but in conjunction with the in-service training

needs of these areas, the author felt it would be economically feasible to establish training facilities in these areas.

3. The radio-television technicians surveyed by the study were found to be reasonably young, the majority below 40 years of age, and in need of additional technical training. Approximately 53 percent of the technicians employed at the time of the study were thought to need up-grading. These facts indicate the need for the development of in-service training programs in conjunction with area community colleges and area vocational technical programs. Previously, this service has been very limited for this occupation, and it has been provided by the individual manufacturers. The author feels that if adequately organized, this in-service training program could better be handled by the area school system. First, they would be located closer to the service technicians' place of employment and would be more convenient to attend. Secondly, this class would be scheduled at unconventional school times and could make better utilization of present facilities and would increase the needs for additional facilities and programs indicated in the previous discussion.

4. More emphasis must be placed on the quality of training provided. The data collected by this study not only indicated a lack of applicants to fill the existing vacancies in the service industry, but it was also indicated that a large portion of the applicants did not have adequate qualifications. This implies poor training programs. Also, many of the special notes written on the questionnaires implied incompetence of new trainees, and that they were unable to repair appliances without supervision. The author feels that our present programs should be critically evaluated in terms of the type and degree of skills needed by the technicians, and the degree of competence of these skills the students obtain in the training program.

5. This study attempted to provide information on the knowledge and skill thought important by the radio-television service technicians to help in establishing better programs. Because of the general nature of this survey and the time and economic limitations of the study, the author did not feel this study provided adequate data to make satisfactory analysis of the skills and needs required by radio-television service technicians. Based on the limited data presented by this study, new programs developed to train radio-television service technicians should be highly technical in nature with strong emphasis on direct application to servicing and repairing electronic devices. The data in this research indicated that more emphasis should be placed on business practices pertaining to operating a business firm. Only limited background skills were indicated in the other core areas of English and mathematics.