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Mukiri wa Githendu

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An evaluation of perceptions of total quality management (TQM) livestock practices of Iowa 4-H’ers who received new instructional materials

by

Mukiri wa Githendu

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Department: Agricultural Education and Studies Major: Agricultural Education

Approved:

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For the Graduate College

Iowa State University
Ames, Iowa
1996

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TABLE OF CONTENTS

LIST OF TABLES vi

CHAPTER I. INTRODUCTION 1

Background 1

Instructional materials for youth with livestock projects 2
The 4-H program 3
Total quality management (TQM) 5

Statement of the Problem 7
Purpose of the Study 9
Objectives 9
Need for the Study 9
Implications and Educational Significance of the Study 13

Implications 13
Importance 13

Assumptions 14
Limitations 14
Operational Definitions 14
Summary 16

CHAPTER II. REVIEW OF LITERATURE 18

Introduction 18

Total Quality Management Theory 19

Definition 19
Historical background 19
Deming’s fourteen points 19
Six key elements of TQM 23

Quality 25
What is quality? 25
Customer-defined quality 25
The challenge of determining an organization’s customers 26
Understanding and controlling variation 27
Determining the major processes 28
Quality circles 29
Quality teams 30

Quality in Education 32
Educational effectiveness 32
Team problem-solving and tools training 35

Curriculum 36
Definition 36
Curriculum approaches 36
4-H curriculum 38

Teaching Methods 40
Introduction 40
Instructional materials 41
Choice of method 42
Programmed instruction and learning 42
Lecture method 44
Discussion method 45
Teacher-directed small groups 45
Tutoring 45
Games and simulations 46
Computer-assisted instruction (CAI) 46
Video-assisted instruction 47
Effect of multimedia instruction on science achievement 48

Using TQM to Improve Food Safety in Livestock Production 51
Introduction 51
Safety and consumer issues 51
TQM in commodities production 55
Livestock production factors and projects 56

Program Evaluation 60
Definition 60
Evaluation models 61
Meta-evaluation 63
Collecting, summarizing, and reporting evidence 63
Evaluating instructional materials 64
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical Framework for the Study</td>
<td>64</td>
</tr>
<tr>
<td>Summary</td>
<td>65</td>
</tr>
<tr>
<td>CHAPTER III: METHODS AND PROCEDURES</td>
<td>68</td>
</tr>
<tr>
<td>Introduction</td>
<td>68</td>
</tr>
<tr>
<td>Population and Sample</td>
<td>69</td>
</tr>
<tr>
<td>Development of Instruments</td>
<td>69</td>
</tr>
<tr>
<td>Pre-test Data Collection</td>
<td>73</td>
</tr>
<tr>
<td>Non-respondents</td>
<td>73</td>
</tr>
<tr>
<td>Data Coding</td>
<td>74</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>75</td>
</tr>
<tr>
<td>Preliminary Factor Analysis</td>
<td>75</td>
</tr>
<tr>
<td>Post-test Data Collection</td>
<td>78</td>
</tr>
<tr>
<td>Questionnaire Reliability</td>
<td>79</td>
</tr>
<tr>
<td>CHAPTER IV: FINDINGS</td>
<td>81</td>
</tr>
<tr>
<td>Introduction</td>
<td>81</td>
</tr>
<tr>
<td>Objective 1: Demographic Identification of 4-H’ers</td>
<td>81</td>
</tr>
<tr>
<td>Objective 2: Perception Identification of 4-H’ers</td>
<td>84</td>
</tr>
<tr>
<td>Regarding TQM Implementation</td>
<td></td>
</tr>
<tr>
<td>Objective 3: Effect of TQM Instructional Materials</td>
<td>93</td>
</tr>
<tr>
<td>Objective 4: Relationships Between Demographics and TQM practices</td>
<td>99</td>
</tr>
<tr>
<td>Objective 5: Skill Areas Identification</td>
<td>102</td>
</tr>
<tr>
<td>Factor Analysis</td>
<td>102</td>
</tr>
<tr>
<td>CHAPTER V: DISCUSSION</td>
<td>106</td>
</tr>
<tr>
<td>Demographics of 4-H’ers</td>
<td>106</td>
</tr>
<tr>
<td>Perceptions of Youth Regarding Their Implementation of TQM</td>
<td>108</td>
</tr>
<tr>
<td>Livestock Practices for Enhancing Food Safety</td>
<td></td>
</tr>
</tbody>
</table>
Effect of TQM Materials on Young Producers’ Perceptions of Their Roles in Producing Safe Food

The Relationship Between the Demographics and Total Quality Management (TQM) Practices

Skill Areas Needing Most Help

CHAPTER VI: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Purpose and Objectives of the Study

Methods and Procedures

Findings

Demographics of 4-H’ers
Identification of the perceptions of the youth regarding their implementation of TQM practices
Assessment of the impact of TQM instructional materials on 4-H’ers perceptions
Determination of the relationships between demographics and perceptions of TQM
Identification of skill areas where the youth need most help

Summary of Conclusions

Summary of Recommendations

Recommendations for Further Study

Implications for Agricultural Education

BIBLIOGRAPHY

ACKNOWLEDGMENTS

APPENDIX A: A LETTER OF HUMAN SUBJECTS APPROVAL

APPENDIX B: QUESTIONNAIRE

APPENDIX C: QUESTIONNAIRE COVER LETTERS AND TQM CURRICULUM TOPICS

APPENDIX D: T-TESTS BETWEEN EARLY, LATE, AND PHONE RESPONDENTS
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1.</td>
<td>Essential characteristics of successful quality teams</td>
<td>31</td>
</tr>
<tr>
<td>Table 2.</td>
<td>Cronbach alpha reliability (internal consistency) of the TQM instrument</td>
<td>80</td>
</tr>
<tr>
<td>Table 3.</td>
<td>Percentages and frequencies of respondents by age</td>
<td>82</td>
</tr>
<tr>
<td>Table 4.</td>
<td>Percentages and frequencies of respondents by enrollment in 4-H</td>
<td>83</td>
</tr>
<tr>
<td>Table 5.</td>
<td>Percentages and frequencies of 4-H respondents enrolled in FFA</td>
<td>83</td>
</tr>
<tr>
<td>Table 6.</td>
<td>Percentage and frequencies of respondents by gender</td>
<td>84</td>
</tr>
<tr>
<td>Table 7.</td>
<td>Percentages and frequencies of pre-test respondents by animal species</td>
<td>84</td>
</tr>
<tr>
<td>Table 8.</td>
<td>Percentages and frequencies of pre-test respondents' ratings of TQM practices</td>
<td>85</td>
</tr>
<tr>
<td>Table 9.</td>
<td>Pre-test means and standard deviations of Total Quality Management (TQM) practices</td>
<td>89</td>
</tr>
<tr>
<td>Table 10.</td>
<td>Percentages and frequencies of post-test respondents' ratings of TQM practices</td>
<td>91</td>
</tr>
<tr>
<td>Table 11.</td>
<td>Means and standard deviations of post-test respondents’ ratings of TQM practices</td>
<td>94</td>
</tr>
<tr>
<td>Table 12.</td>
<td>Multivariate analysis of variance of pre-test respondents’ ratings of TQM practices by gender, age group, animal species and years in 4-H</td>
<td>95</td>
</tr>
<tr>
<td>Table 13.</td>
<td>Means and standard deviations of the sources of significant variation in pre-test respondents’ ratings of TQM practices</td>
<td>97</td>
</tr>
<tr>
<td>Table 14.</td>
<td>Multivariate analysis of variance of pre-test respondents’ ratings of TQM practices by gender, age group, animal species, and years in 4-H</td>
<td>99</td>
</tr>
<tr>
<td>Table 15.</td>
<td>Paired t-tests between post-test and post-test ratings of TQM practices by 4-H’ers</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 16. Comparison of the pre-test/post-test percentages of ratings of all the TQM practices 101
Table 17. Factor analysis of individual TQM practices using pre-test data 104
Table 18. Final factor analysis of individual TQM items using pre-test and post-test data 106
CHAPTER I. INTRODUCTION

Background

Instructional materials have been an important part of teaching youth engaged in livestock production (TQM, 1993). Appropriate instructional materials can help youth become active learners who will use the information in their livestock projects to enhance food safety. Lee and Thomas (1995) noted that a large number of traditional agricultural education programs remain in the United States. These programs focus on production agriculture, with many serving important needs in areas where crops and livestock are important. According to Lee and Thomas, more production agricultural education programs will enhance the instruction in the future by expanding the educational base in agriscience. Since food production continues to be a top priority human endeavor, instruction in production agriculture will continue in many ways. Lee and Thomas (1995) further observed that:

As we approach the twenty-first century, national emphasis on raising expectations will shift instructional approaches so that students have greater responsibility in the learning process. Accordingly, instruction focus will be sharper, more in-depth, and with less fragmentation. To this end, students will use instructional materials to internalize the content. Systematically-designed texts, activity manuals, and computer-based materials will expand. Less use will be made of brochures, pamphlets, non-systematic job sheets and government bulletins. (p. 11)

Martin (1995) observed that technology is advancing at an accelerating pace and quickly around the world. He noted that new technology can change the type of people and organizations needed as well as the education needed to make effective use of the technology. Miller (1994) noted that education in the United States is rapidly changing. Newspapers and magazines carry numerous stories on how education is either succeeding or failing to serve the citizenry. According to Miller, the federal government and the states are responding to criticisms with new and innovative approaches to improve the quality of education.
Youth who produce livestock assume an obligation to produce quality, wholesome, products. They need to adopt practices and procedures that will lead to safe food for the consumer. Skills in producing safe food and a background in Total Quality Management principles will be of value to youth as they assume future careers in the livestock industry. As emerging technologies create changes in production systems, the skills of critical thinking and decision-making will help youth continue to use Total Quality Management concepts with their livestock projects (TQM, 1994).

There are three principles of Total Quality Management important to livestock production by youth (TQM, 1994). The first principle is a concentration on consumer wants and needs, and an understanding of how production practices can impact the quality of the final product. The second principle is the importance of utilizing resources effectively and efficiently, keeping in mind environmental concerns and human resources. A third principle is improving problem-solving skills, which will enable continuous improvement.

Instructional materials for youth with livestock projects

As a way of helping young livestock producers learn how to produce high quality and safe food, Iowa State University extension specialists in conjunction with the University of Nebraska extension specialists developed the *Total Quality Management for Youth Producers* animal science curriculum (TQM, 1993). This curriculum is aimed at enabling young people to apply TQM principles (prominently practiced in business, education, and industry) to food production.

Among the teaching materials that comprise the TQM program are seven videotapes with twenty segments and seventeen learning activities. The materials focus on a variety of commodities including sheep, beef, dairy cattle, swine, poultry, and fish. Each videotape segment is less than ten minutes in length and features a professional and a young producer. These two persons team up to provide information on the TQM approach to raising animals for
food. The videotapes cover topics such as providing a quality environment, handling livestock safely, giving injections, and focusing on the quality of products. Each learning activity in the program suggests a follow-up activity that the youth can do independently. The activities provide young people with the opportunity to put their new knowledge into action immediately.

The teaching materials were introduced via a nationwide satellite down-link program in the autumn of 1993 (see Appendix C). Baseline data for use in the evaluation of these materials were collected before the satellite program by a pre-test of 4-H'ers with livestock projects. These baseline data were collected by the Department of Agricultural Education and Studies at Iowa State University as a part of their external evaluation of the project, and the results were subsequently compared to post-test data.

The 4-H program

The number of young people who are producers of livestock is substantial. Statistical 4-H records have indicated that in 1992, there were 165,134 4-H'ers in Iowa. Out of these, 10,189 were enrolled in beef projects, 9,724 were in swine projects, 6,343 were in sheep projects and 2,652 were in poultry (ISU Extension, 1993b). It is important to remember that most of these 4-H'ers participated in more than one livestock project.

The 4-H youth program is one of the oldest and largest non-traditional educational efforts in public education in the United States. For over 80 years, 4-H has existed to help young people become mature, competent adults (Weatherford & Weatherford, 1983). Over the years, efforts to assess the effectiveness of the 4-H program have been limited. As noted by Ladewig and Thomas (1987), most efforts have focused on the program's ability to reach increasing numbers of participants. In today's environment of complex problems, budget constraints, and expensive program alternatives, evidence is needed concerning "who benefited, by how much, and what difference does it make that individuals participated in 4-H" (Ladewig & Thomas, 1987, p. 3).
4-H strives to accomplish its goals through the four “Hs,” which stand for head, heart, hands, and health, and represent the well rounded development of young people. The 4-H program developed as an informal youth education movement around the philosophy of “learning by doing.” Wessel and Wessel (1982) reported that educational leaders working to revitalize rural schools were a major impetus behind this principle of applied education. Their early goal was to use agricultural sciences as a mechanism to tie formal education to rural experiences of students. Educators found also that successful youth projects could be used to demonstrate the value of recommended farm practices to adult farmers.

Since this initial effort by public school officials to utilize the natural environment as a classroom, 4-H has grown in size, membership, and complexity. The 4-H program is part of the Cooperative Extension System of the United States Department of Agriculture (USDA). It is administered at the state level by the extension component of the state land-grant institution. Both cooperate at the county level with local governments to bring the 4-H program to youth, primarily between 9-19 years of age. The 4-H program relies on the active involvement of parents, volunteer leaders, and other adults who organize and conduct educational subject/project experiences in community and family settings. These “learning by doing” experiences are supported by research and extension functions of the land-grant universities. Additional support is provided by contributions from the private sector at all levels, county, state, and national (Wessel & Wessel, 1982).

One of the current issues in the 4-H program is the question of leadership development. Leadership in addressing the issues confronting the livestock industry is needed. In this regard, the 4-H beef program is an important educational program that can provide future leaders for the beef industry (Iowa Business Council, 1990). When young people are learning the skills of livestock production, they are also learning “life skills” that go beyond their projects. An Oregon Extension Survey (Rasmussen, 1989) of 5,000 4-H’ers carrying out animal science projects found that a majority of the young people identified “life skills” as the most important
skills learned from their projects. According to ISU Extension (1989), the seven key life skills emphasized in the Iowa 4-H program are: developing positive self esteem, communications skills, decision-making skills, learning how to learn, ability to cope with change, citizenship skills, and leadership skills.

Seevers and Dormody (1994) found participation in 4-H leadership activities predicted 13% of the variance of leadership life skills development among senior 4-H members in Arizona, Colorado, and New Mexico. They recommended that 4-H professionals and volunteer leaders should not only continue to encourage participation in leadership activities at the club/county levels but should also provide opportunities and support for involvement at higher levels. One of the current approaches in improving leadership skills is Total Quality Management (TQM).

**Total quality management (TQM)**

TQM focuses on consumer satisfaction, effective use of resources, and continual improvement (Melan, 1993). TQM has been defined as “the application of quantitative or qualitative methods and human resources to improve the materials and services supplied to an organization, all the processes within an organization, and the degree to which the needs of the customer are met, now and in the future” (Mossard, 1991, p. 223). The reference to both quantitative methods and human resources in this definition is reflective of TQM's attempt to integrate the analytical perspective of scientific management with the human relations focus on organizations, groups, and employees (Kronenberg & Loeffler, 1991).

Scientific management, sometimes referred to as Taylorism (Taylor, 1919), sought ways to increase productivity by applying the scientific method to study workers' jobs. Taylor and his disciples advocated detailed planning and analysis of work processes to find the best ways to perform job functions (Lerner & Wanat, 1992, p. 65). Some contemporary critics suggest that scientific management sought to fit the employee to the job. However, according to
Drucker (1991), scientific management has suffered a "bad rap" over the years. What scientific management actually attempted to do, according to Drucker, was teach employees how to work smarter rather than harder. Today, working smarter, not harder, is considered the essence of productivity improvement (Brinkerhott & Dressler, 1990, p. 20). As a management doctrine, scientific management had several drawbacks, including the lack of employees' involvement in decision-making about their jobs. Because employees were treated as cogs on a wheel, scientific management was rightly criticized as being depersonalizing and dehumanizing.

At the opposite end of the spectrum from scientific management is the human relations school of thought (Bernard, 1938; Mayo, 1945; Maslow, 1962). The focus of human relations is on people. Proponents of human relations teams, groups, and organizations are concerned with such issues as organizational culture, formal and informal group structure and communication, and attempt to make the nature of work more compatible with the human condition (Kronenberg & Loeffler, 1991). In short, human relations has predominated over the past fifty years, while scientific management has generally been dismissed as a passé managerial doctrine.

TQM attempts to blend the analytical and working smarter aspects of scientific management with the organizational, group, and employee focus of human relations. Until recently such an effort would have been scorned. But, TQM has succeeded in demonstrating the feasibility of melding the positive aspects of these two diverse management doctrines, while mitigating the negative aspects of scientific management. For example, a basic tenet of TQM is that only through systematic analysis can a real understanding of quality problems be achieved (Gitlow, Gitlow, Oppenheim & Oppenheim, 1989; Gabor, 1990). This analytical perspective is reflective of the scientific management tradition. A concept frequently associated with TQM is the notion of zero-defects (Crosby, 1980). Zero defects is the idea that the ultimate goal of a TQM system should be the reduction of variation in the production of products and services to absolute zero. Zero-defects is the modern day system's equivalent to the old scientific
management objective of trying to find the best way to perform job functions so as to minimize errors.

Statement of the Problem

Swan (1992) observed that American consumers have been increasingly vigilant about the safety of their food supply. Swan further noted that agricultural education programs should provide information that youth and the public can use to make better decisions about producing and purchasing food. As reported in the press (Beware, 1994; EPA, 1994), food safety is a current concern of both consumers and producers. It is important for society, and particularly youth, to understand its obligations to produce a quality product that is safe for human consumption. Today's consumers are concerned about cholesterol, drug residuals in food production, pesticide use on produce, and other food safety issues, and every producer plays an important role in sustaining consumer demand for food products (Beware, 1994; EPA, 1994).

Today's consumers are increasingly more health-conscious. Surveys (McNutt, Powers, & Sloan, 1986; Jolly, Schutz, Diaz-Knauf, & Johal, 1989; Shin, Kliebenstein, Hayes, & Shogren, 1992) of public opinion have indicated that most consumers express some degree of concern over the safety of their food. Moreover, food-borne illnesses cause large social and economic costs annually (Roberts & Van Ravenswaay, 1989). Therefore, consumers are willing to pay for safer food products, as the health risks associated with poor quality are more important to them than the extra money needed to purchase safe food. It was reported by Shin et al. (1992) that consumers were willing to pay more for a safer food product than the typical food product.

Pariza (1990) noted that other concerns of consumers are nutritional imbalance, and the so-called "emotionally-charged" issues of environmental contamination, pesticide residues, and food additives. As the general level of concern with food safety increased, consumers appeared to express more concern with chemical issues, health issues, and spoilage issues (Brewer,
Sprouls, & Russon, 1994). Brewer et al. noted that chemical issues included hormones in meat, poultry, and milk, food additives, preservatives, irradiation, pesticide residues, artificial colors, natural toxins, plastic packaging, and nitrates. According to Brewer et al., examples of health issues were fat, cholesterol, calories, sugar, and vitamin content. Spoilage issues included food preparation, refrigerated, pasteurized, and shelf-table foods, microbial contamination, and restaurant sanitation.

It has been suggested (Ferris, 1988) that livestock producers are no longer just production oriented, they tend to be more responsible to serving consumers. Ferris (1988, p. 37) observed, “The problem is that the production orientation diverts attention from agriculture’s most important role of serving consumers, and it can jeopardize an industry’s future.” He also noted that in order to survive and prosper in this consumer-driven industry and to sustain consumer demand for food products, livestock producers must take every step possible to ensure that the products they supply remain high in quality, wholesome, and safe.

Harlander (1990) observed that the food chain begins with the planted seed and ends with the consumption of products. The food processing industry serves as a vital link between the farmer and the supermarket, as the food processor transforms perishable raw agricultural products into shelf-stable, convenient, and palatable foods and beverages. To maintain the public’s trust and alleviate consumer’s concerns about food safety, livestock producers should be obligated to incorporate every possible approach to identifying weak links in the food chain and providing consumers with safe food from farm to table (Jensen, 1994). Food chain links include proper handling, planning, and managing of animals, proper selection of chemicals, vaccinations and medications for animals, cautious implanting and sanitation of animals, proper knowledge of animal genetics and breeding, and concerns about the demands of consumers. These links intertwine with each other through the entire process of safe food production. Misuse of drugs, vaccinations, pesticides, and various other medications can cause serious residue problems in the finished animal (Pariza, 1990).
Federal and state governments in the United States now set product standards, regulate the available product information, encourage consumer education, help consumers obtain redress, take antitrust action, and ensure consumer representation in government. Federal standards delineate the rules against which product composition, performance, and safety can be judged. The Food and Drug Administration, for example, establishes the ingredients that must be in a product before it can be called macaroni (Eiler, 1984).

**Purpose of the Study**

The primary purpose of this study was to assess the perceptions of 4-H youth regarding the total quality management of their livestock projects for the enhancement of safe food. A secondary purpose was to assess the effect of the new *Total Quality Management (TQM)* Curriculum for Youth Producers (TQM, 1993).

**Objectives**

Specific objectives of the project were:

1. to identify the demographics of the 4-H’ers,
2. to identify the perceptions of the youth regarding their implementation of TQM livestock practices for enhancing food safety,
3. to assess the effect of the TQM instructional materials on young producers’ perceptions of their roles in producing safe food,
4. to determine relationships between demographics and total quality management (TQM) practices, and
5. to identify skill areas of animal care where youth needed the most help.

**Need for the Study**

Russell (1993) noted that a strong commitment to youth development as a priority area in colleges of agriculture would be a significant step toward redirecting needed attention and commitment of resources required to meet significant goals of the colleges and the U.S.
agricultural industry. He further observed that colleges of agriculture have a growing vested interest in the expansion and quality of 4-H, high school agriculture, and emerging agricultural literacy programs such as Agriculture-in-the-Classroom programs. The degree to which colleges of agriculture respond to this priority has major implications not only for the future well-being of the colleges, but for the U.S. agricultural industry as it moves into the next century.

Gregory (1989) observed that the food service industry was the fourth largest in the United States, comprising more than a half million establishments that employed about 8 million people. He noted that training this many people was a mammoth undertaking; however, the need is one of the most pressing in the nation. According to Gregory, more people were eating out and were becoming more conscious about food safety. Extension has found that few Iowans suffer acute poisons from pesticide use today (ISU Extension, 1995a). This good safety record is possible because people are learning more about ways to minimize exposure to harmful chemicals.

Ritchie, Benson, and Rust (1994) observed that there are rapid technological changes in animal production enterprises, which put constant changing pressures on young livestock producers. Due to these changes, young producers are obliged to re-examine the knowledge and skills about what they produce, how they do it, and whether they effectively utilize human, animal, and environmental resources in the process of production. In order to utilize these resources, young producers must consider how they handle, plan, and manage their animals; how they select chemicals, vaccinations, and medications for their animals; what they know about implanting, sanitation, and genetics of their animals, and how they feel about producing a quality product. All these factors can directly or indirectly influence the production of quality products that are wholesome and safe. Young livestock producers are required to enhance their ability to make and implement responsible decisions in the production of safe food products for
human consumption. It is, ultimately, the attitudes of these youth, along with the skills they develop in managing their animal projects, that influence what they produce and how they do it.

Educators need to understand how young producers manage their animals and to what extent these young producers are concerned about producing quality food products that are wholesome and safe. The need to introduce principles of quality management as a way of preparing youth for adult roles in the livestock industry cannot be overemphasized. Although quality management is a current topic and many books have been written on it, the concept is still not very clearly understood. Reynolds (1994) recently observed:

> In many cases our understanding of Total Quality Management (TQM) is probably like a person who is learning about an elephant from three blind peoples' descriptions. The first blind person has hold of the elephant's tail and describes the elephant as a rope. The second blind person feels its leg and describes the elephant as a trunk. The third blind person touches the trunk and describes the elephant as a snake. Each one is right, yet none has described the whole. (p. 4)

Much of the material published about TQM centers on manufacturing and provides examples based on production of physical products. However, managing a service organization, such as a youth educational program, requires a different approach, because the attributes of services are different from those of products. For example, a product can be counted and put into an inventory, but there is usually no equivalent process for service delivery. Through mass production, a quality product can be delivered inexpensively, but services are expected to be tailored to the customer. There is, therefore, a need for agricultural educators to take the ideas of quality management to youth and undertake research on how best to apply the principles in the agricultural sector. There is little documentation of the principles of TQM in agricultural education research.

One of the most important contemporary challenges facing schools, colleges, and universities is how to manage for quality. TQM is a means of assuring quality and standards in education. It provides a philosophy as well as a set of tools for improving quality. It is
achieved by putting a simple but central idea into operation. The principal idea behind TQM is that consumers and their interests should come first: an easily understood idea, but whose implementation demands a high degree of commitment. There is no single specification for TQM. Different organizations pursue TQM in their own way. Fortunately, TQM is very flexible and can be adopted to meet the particular needs and circumstances of all institutions, large or small. However, no educator can tell an institution how to achieve total quality management for itself—only customers can tell that! This study raises the issues and hopes to give guidance on the main questions raised for youth agricultural programs that decide to travel the TQM route.

The need for more information on TQM in education was highlighted by the response to the National Quality Survey (Sallis, 1991, 1993) carried out in the autumn of 1990. While this was a survey of some colleges, it demonstrated the degree of interest nationally in TQM and quality issues in general. In the last couple of years, awareness has increased. People from all sectors of education are expressing an interest. Many institutions, regardless of size, are beginning to put the philosophy of TQM into practice. This growth of interest has stimulated a demand for research and publications that address the issues the subject raises for education.

Quality is perplexing to define and difficult to measure. While its presence is often taken for granted, its absence is all too obvious. In education, it represents the difference between the excellent and the ordinary—ultimately, the difference between success and failure. As all sectors of education face the full rigors of a new educational marketplace, the pursuit of quality and the ability to change become especially important. TQM is a philosophy and a methodology that assists institutions to manage change and to set their agendas for dealing with the new external pressures. It does not work overnight; transforming institutional culture is a slow process. What it does is provide frameworks and guidelines for transition, per the Chinese proverb, “a journey of one thousand miles begins with one step.”
Implications and Educational Significance of the Study

Implications

1) According to Deming (1993), TQM entails a new theory of management for improvement of quality, productivity, and competitive position. This is important because today's youth will be the farmers of tomorrow, and the animals they keep will be processed into food products. This study focuses on 4-H’ers’ adoption of TQM livestock practices.

2) It has been pointed out (Murgatroyd & Morgan, 1993) that if the goal of improved teaching materials is to improve the product of education, namely learning, attention must also be given to the processes whereby the product is made. For the classroom this principle, as Tribus (1992) said, translates to:

   If you want to improve the students’ achievements, put your attention on the teaching/learning process and not on the achievements in examinations. (p. 9)

3) This study indicated to what extent 4-H’ers are aware of their role in producing quality food for the consumers.

Importance

1) The study is important because youth are the producers of the future.

2) There is a need to assess the utility of instructional materials.

3) Environmental and food safety concerns are of high priority in modern society.

Therefore, this study is important because it evaluates the customers’ (in this case, 4-H’ers’) perceptions with a view to using these perceptions in the improvement of the teaching materials and approaches. This study provided some indication of the value of the instructional materials.
Assumptions

The following assumptions were made in this study:

1) 4-H livestock projects are expected to be experiences that provide 4-H’ers with skills they can use in their future careers.

2) The data reflect the true opinions of the respondents.

Limitations

The following limitations were made in this study:

1) Results were limited to the population being studied.

2) Results were obtained from a set of responses to a structured questionnaire.

Operational Definitions

The study was guided by the following operational definitions:

**Total quality management (TQM):** Flood (1993) defined TQM as “continuous improvement; it involves all operations at all levels, undertakes performance measurements, focuses on leadership and employee participation and motivation, and takes a whole system perspective,” (p. 10). It is a philosophy of continuous improvement, which can provide any educational institution with a set of practical tools for meeting and exceeding present and future customer needs, wants, and expectations (Sallis, 1993). The 4-H’ers’ overall performance in animal management and safety practices was for the purpose of this study referred to as Total Quality Management (TQM).

**Perception:** Perception is defined by Chamber’s 20th Century dictionary as the act or power of perceiving; discernment; apprehension of any modification of consciousness; the combining of sensations into recognition of an object; direct recognition; a percept; reception of a stimulus.

**Young livestock producers:** Youth who are currently engaged in raising livestock, poultry, and fish, or who are interested in raising them in the future.
Food production project: A production project is a business venture for experience and profit involving the production of a crop or some type of livestock. It is owned in full or in part, and managed by the students, and it provides an opportunity to determine how efficiently a unit of animals or crops can be produced, and how much profit can be made from the undertaking (Phipps & Osborne, 1988).

4-H: 4-H is the youth education program of the Cooperative Extension Service. This informal educational program is conducted by the U.S. Department of Agriculture, state land-grant universities, and county governments and combines the work of federal, state and local Extension staff and volunteer leaders (Wessel & Wessel, 1982). According to Wessel and Wessel, participation in the 4-H program is open to all interested youth, regardless of race, creed, national origin, or handicap. They further noted that participants are primarily between the ages of 9 and 19 and reside in every demographic area; farm, city, and in-between.

Agricultural education: Agricultural education is the scientific study of the principles and methods of teaching and learning as they pertain to agriculture (Love, 1978).

Consumer protection: Consumer protection comprises all the activities of government, business, and consumer organizations designed to ensure consumers’ rights in the marketplace. The following are generally considered consumers’ rights: (1) the right to safety from product-related hazards; (2) the right to information about products, including the facts consumers need in order to protect themselves from fraud and misleading product claims; (3) the right to redress, that is, the right to reject unsatisfactory products and services and to obtain satisfaction when the complaint is justified; (4) the right to choose among a variety of products in a marketplace free from control by one or a few sellers; (5) the right to be heard in governmental decision-making that affects consumers, including representation in governmental policy-making on such matters as import quotas and tariffs, and representation in regulatory decisions involving such issues as airline fares and food-safety regulations.
Food safety: Food safety is a system of precautions and regulations that ensure that foodstuffs are free of toxic substances.

Instructional materials: Materials related to educational instruction; tools such as video, guides, and manuals, which facilitate teaching and learning.

Curriculum: A curriculum is a plan for what is to be learned in a formal setting such as in a school or an informal program. Curriculum studies is a field of inquiry into how programs are developed, implemented, and evaluated.

Life skill: A life skill is a skill developed early in life and used through the life cycle; transferred from one experience to another. Some life skills emphasized in Iowa 4-H program are: positive self-esteem, decision-making skills, learning how to learn, ability to cope with change, citizenship skills, and leadership skills. Boyd, Herring, and Briers (1992) observed that the 4-H program is an experiential education (learning by doing) program whose mission is to help youth become self-directing, productive, and contributing members of society. This mission is accomplished by involving youth in innovative educational programs that contribute to the development of skills useful for everyday living. Such skills are called leadership life skills and include the ability to work with and get along with others, to communicate, to make responsible decisions, and to have an understanding of themselves (Hoopfer, 1981).

Summary

The job of educators is to provide youth with the knowledge to ask the right questions, whether as producers, processors, or consumers. Youth need to understand food safety and how it relates to them as workers and as educated consumers. They must understand the total aspects of the industry and how the practices they use affect the quality of the food purchased by the consumer. This understanding will improve communication between consumers, industry, and education (Sutter, 1992).
Since food safety is one of the most important current issues and young producers are among those who provide food products today, it is imperative for educators to develop an appropriate program to help young people who are livestock producers understand the obligations they should have in developing a wholesome and safe food product for human consumption. Total Quality Management (TQM) focuses on the consumer's wants and needs. It involves critical thinking and strategic planning designed to improve each individual production system.

A set of instructional materials, *Total Quality Management Curriculum for Youth Producers* (1993), was developed to enhance a young producer's ability to make and implement responsible decisions in the production of quality food products that are wholesome for human consumption. This study was a pre-test and post-test evaluation of the TQM curriculum for 4-H'ers with livestock projects. It was designed to assess their perceptions towards the use of TQM in their livestock production and provide data for educators about how 4-H producers manage their animals and to what extent they were concerned about producing a quality product.
CHAPTER II. REVIEW OF LITERATURE

Introduction

The purpose of this study was to evaluate the impact of a new set of instructional materials and to assess the perceptions of 4-H’ers regarding the total quality management of their livestock projects and the production of safe food. The study was a pre-test and post-test descriptive survey of the effect of new teaching materials, *Total Quality Management (TQM) Curriculum for Youth Producers* (TQM, 1993), on the perceptions of 4-H’ers with livestock projects.

Descriptive studies have greatly increased our knowledge about what happens in education, and some descriptive research is intended to produce statistical information about aspects of education that interest policy-makers and educators. This chapter will give an account of Total Quality Management (TQM), which is the basic theoretical framework of this study. It will show how TQM affects education, curriculum, teaching methods and livestock projects. The chapter will also highlight the various approaches used in evaluation of educational programs and, in particular, the evaluation of instructional materials.

First, this chapter will look at the TQM theory and attempt to define TQM. A history of TQM and the development of its key elements will be given. A close examination of quality and its components will be given. This will be tied with quality in education. The chapter will also examine teaching methods, curriculum development, and the use of TQM in improvement of food safety in livestock production and development, and will finally look at the principles of program evaluation.
Total Quality Management Theory

Definition

Total Quality Management (TQM) is both a philosophy and a set of guiding principles and practices that represent the foundation of continuously improving organizations (Mansir & Schacht, 1989). It applies human resources and quantitative methods to improve the material and services supplied to an organization, all the processes within an organization, and the degree to which the needs of the consumer are met now and in the future.

Historical background

TQM is based on the ideas and writings of four principal individuals: Deming (1982, 1986, 1990), Crosby (1980, 1985, 1992), Juran (1988, 1989) and Feigenbaum (1983a, 1983b). Deming and Juran have been speaking and writing about quality for about fifty years. W. Edwards Deming has influenced quality management in both Japan and the United States, and studies demonstrate that the majority of TQM programs are based, at least in part, on Deming's approach to quality management (Krone, 1991).

The idea of quality management caught on and flourished in Japan and is considered to be part of the explanation for Japan's economic prowess today. "Kaizen," the Japanese term for quality management, is based to a great extent on Deming's ideas (Imai, 1986). The highest Japanese award for quality is called the "Deming Prize" in his honor. Deming and the concept of quality management came to prominence in the United States in the early 1980s.

Deming's fourteen points

Deming's fourteen points of quality management evolved over many years, and it was not until late in his life that they found their full expression. In his major work, Out of the Crisis (1986), Deming set down his philosophy of quality management in what has become known as his "14 points" (pp. 23-24) as follows:
1) Create consistency of purpose toward improvement of product and service.
2) Awake to the challenges of the new economic age and adopt a new philosophy.
3) Cease dependency on inspection to achieve quality.
4) Stop awarding business on the basis of price.
5) Constantly improve the system of production and service.
6) Institute training on the job.
7) Institute leadership.
8) Drive out fear.
9) Break down barriers between departments.
10) Eliminate slogans, exhortations, and targets aimed at zero-defects and new levels of productivity.
11) Eliminate quotas on the factory floor.
12) Remove barriers that rob people of their right of workmanship.
13) Institute a vigorous program of education and self-improvement.
14) Put everybody in the company to work on accomplishing the transformation.

At the opposite pole from Deming, the TQM philosopher, is Crosby. The TQM teachings of Crosby are concerned with the tools of TQM.

Crosby received his quality management start at the International Telephone and Telegraph Company (ITT). He left ITT after the success of his book, *Quality is Free* (Crosby, 1980). Crosby attempted to distill the philosophy and concepts of quality management down to simple ideas and tools that working managers in the public and private sectors can apply. Crosby, like Deming, reduced his quality management approach to 14 points which, when compared with those of Deming, demonstrated Crosby's more technician orientation. Crosby's 14 points are as follows (pp. 112-119):

1) Management commitment.
2) Quality improvement teams.
3) Measurement.
4) Cost of quality.
5) Quality awareness.
6) Corrective action.
7) Zero-defects planning.
8) Employee education.
9) Zero-defect day.
10) Goal-setting.
11) Error cause removal.
12) Recognition.
13) Quality councils.
14) Do it all over again.

Crosby's 14 points are a how-to TQM implementation strategy that begins with management commitment to quality (Point 1) and ends with "do it all over again" (Point 14), which was Crosby's way of saying that the pursuit of quality is never ending (Martin, 1993).

Juran (1989) taught the importance of top management commitment to quality if a TQM program is to prove successful. Juran emphasized the important role of quality councils in proving organizational focus and direction to TQM efforts.

Feigenbaum (1983) taught about the "cost of quality" and why it is cheaper in the long run to build quality into our products and services than to correct errors later. Feigenbaum is generally credited with being the first person to talk about the cost of quality (Dobyns & Crawford-Mason, 1991).

Deming (1986) was adamant that TQM is applicable to all services organizations, public sector as well as the private sector. This sentiment was shared by both Juran (1989) and Crosby (1980). Juran referred to the application of TQM to manufacturing and production-
focused organizations, including services that he called "big Q" (Juran, 1989). Researchers studying service organizations pointed out that services possess certain characteristics that set them distinctly apart from products (Murdick, Render, & Russell, 1990). Empirically, TQM has been successfully applied in a number of public and private service organizations (Milakovich, 1990) and a limited number in the human services (Osbom & Gaebler, 1992).

The decade of the 1980s in the United States was called a period of consciousness-raising regarding quality (Albrecht, 1992). The 1990s are projected to be the decade of TQM implementation (Quality, 1991). Such diverse American corporations as Corning, Ford, General Motors, Hospital Corporation of America, Motorola, Westinghouse, Xerox, and others have initiated TQM programs (FQI, 1991; Gabor, 1990; Walton, 1990). In 1989 about 3,000 American companies had active TQM programs in place (Milakovich, 1990).

TQM was also expanding rapidly to the public sector. At the federal level, by 1990 some 235 quality programs were in operation in such diverse federal departments and agencies as the Department of Defense, the Environmental Protection Agency, the Internal Revenue Service, NASA, and the Office of Personnel Management (Carr & Littman, 1990; Cohen & Brand, 1990; Milakovich, 1990; Mossard, 1991). The level of quality management activity in the federal government became so significant that a Federal Quality Institute (FQI) emerged to provide leadership and coordinate the various programs (FQI, 1991). In 1989, the federal government created the President's Award for Quality. Modeled after the Baldrige Award, this award recognized federal agencies and departments that demonstrated "exemplary quality improvements" (FQI, 1991, p. 25). The TQM wave was also being felt at the state and local government levels. The states of Arkansas, Florida, Wisconsin, and Vermont all launched notable statewide TQM programs, while the states of Arizona, California, Michigan, and Pennsylvania, among others, experimented with TQM on a department-by-department basis (Management, 1992; Carr & Littman, 1990; Milakovich, 1990; Osborn & Gaebler, 1992; Strong & Ford, 1992). At the local government level, a recent survey reported that some 40
major county and municipal governments nationwide were actively engaged in implementing TQM programs (Carr & Littman, 1990).

A particularly attractive feature of quality management program is that quality is free. A substantial body of research now exists demonstrating that the costs of implementing quality management programs are recouped by greater productivity and lower total product and service costs (Crosby, 1980; Dobyns & Crawford-Mason, 1991; Feigenbaum, 1983; Zeithaml, Parasuraman, & Berry, 1990). Put another way, the cost of producing high-quality products and services is zero, while the cost of producing low-quality products and services is equal to the cost of making things right and dealing with disgruntled customers. The notion that quality actually improves productivity is somewhat revolutionary and runs counter to long-held American notions about productivity and productivity improvements. The traditional American conception of productivity is the ratio of inputs to outputs (Martin, 1993).

A unique advantage of quality management is its basic compatibility with human services and social work values. Any managerial system that does not preach the maximization of efficiency should be inherently appealing to most human service professionals. The human services have long objected to the primacy generally afforded efficiency by most management systems (Pruger & Miller, 1991a, 1991b).

**Six key elements of TQM**

Deming, Crosby, Juran, and Feigenbaum disagreed with each other—frequently with considerable vigor—over exactly what TQM meant as a philosophy of management. Despite their areas of disagreement, however, several key areas of general agreement existed. These areas of common ground also provide useful insights into TQM as a philosophy of management.

Martin (1993) performed a content analysis of the writings of the top four American quality experts. The purpose was to identify those common trends that dealt with TQM as a
philosophy of management. Additionally, a content analysis was performed on seven recent works that were attempts to synthesize the major philosophical tenets of TQM (Swiss, 1992; Watson & Hopp, 1992; Dobyns & Crawford-Manson, 1991; Kronenberg & Loeffler, 1991; Carr & Littman, 1990; Gabor, 1990; Milakovich, 1990).

From Martin’s (1993) content analysis, six key elements of general agreement were identified that appeared to be central to an understanding of TQM as a philosophy of management. These six key elements are (a) quality as a primary organizational goal, (b) quality as determined by an organization's customers, (c) customer satisfaction as the fuel that drives organizations, (d) the study and reduction of variation in the processes, (e) change as continuous and accomplished by teams and teamwork, and (f) top management commitment to promoting a culture of quality employee empowerment, and long-term perspective. As can be seen, these six key elements constitute the basic underlying philosophy of TQM.

Deming was the most forceful of the major quality experts in advocating the position of inclusion of contractors in TQM programs. Deming's rationale was the realization that organizations that are heavily reliant on contractors cannot control the quality of their products and services without the involvement and commitment of their contractors to TQM principles. The Department of Defense found Deming's contention to be particularly true in its own efforts to implement TQM (Carr & Littman, 1990). Likewise, the General Accounting Office identified contractor involvement as a key element in successful private sector TQM programs (Watson & Hopp, 1992). Contractor involvement was also mentioned as a sub-category, albeit a minor one, of the Baldrige Award criteria. Due to the significant amount of purchase of service contracting purchasing occurring today (Saidel, 1991; Salamon, 1987; Terrell, 1987), many human service organizations are heavily dependent on contractors for the quality of the products and services they provide. Consequently, the success of TQM in such organizations is dependent on the active participation of contractors.
What is quality?

No universally accepted definition of the term quality exists; this is because quality consists of several distinct dimensions. When quality is defined by people, they are often simply demonstrating preferences for differing quality dimensions. The Federal Quality Institute (FQI) identified a primary dimension of quality (performance) and general secondary dimensions: reliability, durability, conformance, availability, and timeliness (FQI, 1991). Still other quality dimensions are recognized as particularly important in human services, including accessibility, timeliness, consistency, humanness, and results or outcomes (Patti, 1987; Pruger & Miller, 1991a). Some of these quality dimensions refer to characteristics of products and services, and still others refer to the facilities and equipment used in product production and service provision.

The research of Zeithaml et al. (1990) provides some guidance on dealing with the many dimensions of quality. Specifically, these researchers have attempted to reduce the many dimensions of quality to a manageable number. Zeithaml et al. conducted extensive focus group interviews with nearly 2,000 customers representing a broad cross-section of service organizations. They were interested in determining the various dimensions of quality from the customer's perspective. The data derived from the focus group interviews were analyzed using various statistical techniques. The researchers reported they were able to reduce the various dimensions of quality to five major factors—reliability, responsiveness, assurance, empathy, and tangibles.

Customer-defined quality

One of the areas of general agreement among the big four quality experts is that customers determine the relative importance of various quality dimensions. For example, Feigenbaum (1983 a, p. 7) stated that quality means products and services that "meet the
expectations of customers.” Crosby (1985, p. 60) defined quality as “conformance to requirements.” Since customers determine the requirements, according to Crosby, this was just another way of saying that customers define quality. Juran (1989) stated that quality is fitness for use. As the customer determines whether a product or service is fit to use, this again was simply another way of saying that customers define quality.

The challenge of determining an organization's customers

When administrators of human service organizations are asked to identify who their customers are, the answer usually given is “our clients” (Martin, 1993). Clients, however, represent only one of several classes of customers, according to TQM theory. TQM theory suggest that all organizations have at least two classes of customers, while some—such as human services organizations—may have several. In TQM, the concept of customer takes on a slightly different meaning—the beneficiaries of work (Koons, 1991). TQM recognizes two major classes of customers, internal and external. An internal customer is any department, or unit, of an organization that receives products or services from another (Milakovich, 1990). In applying the TQM notion of internal customers to a child welfare agency, for example, staff functions such as personnel and finance would be viewed as providing products as services to such programs (internal customers) as adoptions, residential treatment, day treatment, and the like.

Another major challenge in customer-defined quality is the collection and use of customer quality data. The most common data collection technique is the customer satisfaction survey. Other customer quality data techniques such as citizen or community surveys, focus groups, customer complaints, suggestion boxes, panel and test marketing (Osborn & Gaebler, 1992, pp. 177-179; Zeithaml et al., 1990, p. 55) are used less frequently and are often employed as supplements to customer satisfaction surveys.
Understanding and controlling variation

According to the majority of American TQM experts, variation is naturally present in all processes. Variation, they suggest, can be controlled and reduced but never totally eliminated. A dissenting voice was Crosby (1980), who believed that variation in processes can be totally eliminated, as suggested by his slogan “zero-defects.” Setting aside the debate over whether variation can be reduced to absolute zero, all the major American quality experts do agree that variation in processes must be understood and reduced.

In the language of TQM, variation has two primary causes, common and special (Carr & Littman, 1990, pp. 73-74; Gitlow et al., 1989, p. 163; Provost & Norman, 1990, p. 42). “Common causes” of variation are small random sources that are always present in any process or system; “special causes” of variation are non-random and are caused by sources outside the system or process.

Examples of common causes of variation are when a machine or vehicle breaks down, or when the air-conditioning in an office goes out, or when one shows up late for an appointment because it rained that day and the car got stuck in traffic. Common causes, or systems problems, are said to account for 85% of the variation in most processes. This is the 85/15 rule. Two major TQM axioms are derived from the 85/15 rule: (a) Individual employee appraisal is destructive, TQM argues against the individual approach to evaluation, motivation, and rewards because it is predicated on the false notion that employees have control over variation in their work environments. If 85% of variation in processes is due to common causes, and if common causes are due to system’s problems, then only 15% of the variation in processes can be attributed to employees. In other words, TQM theory suggests that individual workers have little control over their jobs. They are simply working within systems created by management. If this argument is true, and TQM theory states that it is, individually-focused evaluations place an organization's employees in the position of being held accountable for factors beyond their control (Martin, 1993).
The implication of the 85/15 rule for motivation and performance appraisal in organizations is that team and group approaches are preferred over individual approaches. While still a somewhat novel idea, team and group performance appraisal and reward systems can be designed and successfully implemented (Motorola, 1992; Osborn & Gaebler, 1992; Lawler, 1990; Zeithaml et al., 1990; Peters & Austin, 1985).

The second TQM axiom that flows from the 85/15 rule is that most variation occurs because the system is not properly managed. According to TQM theory, an organization must be viewed as a totality, in other words, as a system. The primary job of management is to manage the system.

One of the tenets that distinguishes TQM from traditional American management is the notion that “unattended systems tend to run down.” One implication of this tenet is that the stature of major systems processes must be constantly monitored and fine-tuned. According to Martin (1993, p. 56), human service administrators working in TQM environments should be able to answer at all times two fundamental questions: Are the major processes involved in the production of my products and provision of my services under control? And, is the quality of my products and services getting better, worse, or staying the same?

**Determining the major processes**

Once a system is defined, the next activity involves identifying the system's major processes. Brinkerhoff and Dressler (1990) observed that in TQM, a system's major processes are: (a) the ones with the greatest potential for variation and instability, and (b) those most visible to consumers. By focusing on a system's major processes, TQM attempts to avoid the problem of sub optimization, which occurs when resources are expended to improve non-critical processes while other more critical processes go unattended (p. 49).
As an aid in identifying a system's major processes, Sheer (1991) suggested asking the following questions: What processes generate the most customer complaints? What processes contain bottlenecks where product or service flow slows down, creating queues and backlogs?

Another method of identifying a system's major processes is called "blueprinting" (Albrecht, 1992; George & Gibson, 1991). Blueprinting refers to the analysis of a system to identify those processes visible to customers. Customer visible processes are denoted in blue, or set above a blue line, on a system flow chart, hence the term "blueprinting." Customer visible processes are considered to have more impact on customer quality perceptions than non-visible processes. Albrecht (1992) considered customer visible processes so important that he referred to them as "quality critical process."

Still another way to identify a system's most important processes is to relate variation in customer satisfaction levels to variation in system processes. Through statistical analysis using correlation, regression, and other routines, the most important processes can be determined in terms of their effect on overall customer satisfaction levels (Martin, 1993).

Quality circles

The managerial wave known as "quality circles" burst on the American scene in the late 1970s. American management consultants and educators visiting Japan during the earlier parts of the decade observed that Japanese business firms did everything through teams. Concluding this team orientation was the critical variable in the success of the Japanese business firms, these same management consultants and educators returned to the U.S. and introduced quality circles to American business, government, and the nonprofit sector (Martin, 1993).

For the most part, quality circles have not worked well in the U.S. (Drucker, 1992). The reason most frequently given for the poor showing of quality circles in the U.S. is they were introduced as stand-alone programs and not as a part of large TQM programs, as is the case in Japan (Dobyns & Crawford-Mason, 1991; Juran, 1989; Koons, 1991). Employees
working in American quality circle programs must identify their own priorities and their own projects. The lack of management direction has tended to result in many quality circles focusing on improving the quality of the workplace, rather than on improving the quality of systems and major processes (Koons, 1991, pp. 37-38). Too many American quality circle programs wound up becoming employee driven rather than customer driven.

**Quality teams**

A quality team is a group of employees, numbering anywhere from 3 to 12 people (Feigenbaum, 1983; Glenn, 1991). Quality teams meet at regularly scheduled times, usually a minimum of once a week for at least an hour to work on agreed-upon (with management) problems designed to improve the quality of systems and major processes (Hutchins, 1985). Time spent working on a quality team is considered part of an employee's regular work time. Consequently, most quality teams meet during regularly scheduled working hours. As a general rule, employees are encouraged, but not compelled, to participate on quality teams (Juran, 1989).

The membership of a quality team in a human service organization is largely determined by the nature of the system or process to be improved. For example, if a process is completely internal to one department, then membership on a quality team may comprise only employees from that department. However, if a whole system (i.e., program or service) is to be improved, or if a major process has constituent parts that constitute outputs for some departments and inputs for others, then a quality team will probably be composed of both upstream and downstream members (Martin, 1993).

A suggestion, totally in keeping with the customer driven focus of TQM, but one that has received little attention in the literature, is to include external customers (clients, funding sources, or both) on quality teams (Albrecht, 1992). The inclusion of external customers on quality teams should help ensure that the customer perspective is constantly considered in team
quality teams should help ensure that the customer perspective is constantly considered in team discussions and decision-making. Where contractors play an important role in a system or a major process, a quality team would probably also benefit from their participation.

The role of human service managers in quality teams is not to lead, but to be supportive and to ensure that teams stay focused and on-task. Leadership, ideas, and solutions come from team members—those most familiar with a system or major process and its problems—and not from management. When working with quality teams, managers take on the role of coaches. Some essential characteristics of successful quality teams have been identified by Martin (1993). These are summarized in Table 1.

Ensuring that quality teams demonstrate these characteristics is the responsibility of management. TQM does not require that every employee in a human service organization be a

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<th>Table 1. Essential characteristics of successful quality teams (Adapted from Carr and Littman, 1990, p. 106)</th>
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<tr>
<td>• Have focus</td>
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<tr>
<td>Systems and processes are selected jointly by management and employees. Quality teams stay on task.</td>
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<tr>
<td>• Have the right members</td>
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<tr>
<td>Team members represent the systems and processes involved and the skills needed to improve them.</td>
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<td>• Have time to work</td>
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<tr>
<td>Sufficient time is provided to study the process or system, to determine the nature of quality problems and to implement the most probable solution(s).</td>
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<tr>
<td>• Have teamwork as a priority</td>
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<tr>
<td>Members of quality teams are committed to working as a team and not as individuals.</td>
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<tr>
<td>• Have excellent communication</td>
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<td>Quality teams promote good communication between themselves and management.</td>
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member of a quality team, or that quality teams be working simultaneously to improve all the organization's systems and major processes. Generally, a human service organization that has 10% of its employees working on quality teams at any one time is off to a good start. And, any human service organization that has more than 60% of its employees working on quality teams at any time is doing well (Glenn, 1991).

Quality in Education

Educational effectiveness

In both the United States and in Britain, studies such as those by Coleman (1966), Jencks (1971) and the British Plowder Report of the Central Advisory Council for Education (CAC, 1967) concluded that schools bring little independent influence to bear upon the development of their pupils. This period has been gradually followed in both societies by the emergence of a wide range of effective schools, school effectiveness, or school effect studies. These studies argue for the importance of school influence, beginning in the United States with various qualitative case studies and moving on to a wide range of quantitative studies and beginning in Britain with the works by Power (1967); Gath (1977); Reynolds (1976, 1982); Reynolds, Sullivan, and Murgatroyd (1987); Rutter, Manghan, Mortimore, and Ouston (1979); Galloway (1985); and Gray, Jesson, and Sime (1990). Subsequent studies have been made by Mortimore and his colleagues (1988) in primary schools and by Smith and Tomlinson (1989) in multi-cultural secondary schools. Work in these two societies has been recently joined by that from the Netherlands, Australia, and Canada, and a recent resurgence of studies done in and about Third World societies (Ribbins & Burrige, 1994). From these works, it is clear that schools do have substantial effects upon pupils and there are processes that work across schools to maximize their outcomes (Rutter et al., 1979).

While the effective head teacher of the 1980s got his or her school moving in the absence of any external pressure for change, the effective head teacher of the 1990s has
somehow to broker the external change agenda to his or her staff, a very different and much more complex task. The 1990s head teacher must relate to the parents, be a public relations person, cope with uncertainty, motivate staff in the absence of substantial instrumental rewards to offer them, be a financial manager, have a robust grasp of psychology, be entrepreneurial, and be able to cope with rapid changes (Ribbins & Burridge, 1994). The types of head teachers who stand out in the old school effectiveness literature are unlikely to be those that really work in the 1990s (Reynolds, 1992).

The urgent need to improve the standards of educational practice within schools, however, and the need for educational systems of most societies to change their schools to avoid the likely imposition of potentially destructive changes from the political system outside schools (as analyzed in Hargreaves & Reynolds, 1989) necessitates the growth of links between the two, now rival, paradigms. School effectiveness has the potential to inform us about what makes good schools (allowing for variation between and within countries as to what that good is), and the school improvement movement has the power to make schools good as they begin to grow and develop and as they incorporate, and yet still critique, school effectiveness knowledge (Reynolds, 1993).

Where such links are made between the two formerly rather separate traditions, there is the beginning of evidence that a fruitful synergy may exist between them, leading to the development of a knowledge base about practice, policy, and research that is neither effectiveness nor improvement oriented, but that is both at the same time. These examples seem particularly illustrative of this (Reynolds, Hopkins, & Stoll, 1993).

It is clear from the review of literature that much has been achieved in the separate disciplines of specialties of school effectiveness and school improvement. From school effectiveness we have an emerging sense of the factors associated with the effective schooling, and from school improvement we have a set of delivery mechanisms that may be useful in implanting this knowledge into school programs.
School effectiveness researchers need to develop new contemporary outcome measures and to focus upon new areas of school functioning that may have been brought into prominence by the educational reforms and changing educational climate of the past decade. School improvement practitioners and researchers also need to change, perhaps by adopting an outcome perspective and testing the actual effects of educational improvement strategies for whether or not they generate improved student learning (Ribbins & Burridge, 1994).

Traditionally, classrooms have been viewed as islands of professional autonomy with the processes of teaching and learning too esoteric and complex to be the subject of management scrutiny or teaching analysis to any extent. As a consequence, there is a disposition for the professionals in the schools to concede to the possibility of improving administration and other organizational processes such as cafeteria arrangements or rules of behavior and discipline, for example, but to exempt the activities within the classroom. When such views of professional autonomy and “sanctity” of the classroom are allied with a traditional management perspective, then the school is viewed as a collection of separate, highly specialized, individual performers and units, linked administratively within a functional hierarchy by lateral connections made by the mediating roles of senior managers and heads of departments.

In contrast, the TQM perspective, with its focus on the consumer and on process improvement, insists on applying these equally to the classroom as well as the context, and from this foundation revises the whole concept of management in the school. Tribus (1992) has defined quality in education as that which makes learning a joy and a pleasure to the students. However, he adds:

...joy is ever changing. What is thrilling at one age is infantile at another. Teachers must, therefore, be ever alert to engage the students in the discussion of what constitutes a quality experience. The negotiations and discussions are never done. (p. 10)
Students learn within these systems and processes of the classroom and can give their views of these systems. Teachers can study the systems and processes they use for consistency of performance and effectiveness, with the primary aim of improving the quality of learning. With such customer and process perspectives as these, the job of the teacher re-focusses onto the learning systems to continuously improve them with the students’ help. Similarly, the job of the principal and senior managers changes from the traditional bias of the enactment of established rules and procedures where staff are the customers of the “book,” that is essentially defined by position hierarchy, and become, instead, leaders and facilitators who work on the school systems and processes within which the teachers work, to improve them with their help (Morgan & Murgatroyd, 1994).

Team problem-solving and tools training

People learn best by doing. Therefore, effective team training incorporates lecture, discussion, and activities, and provides participants with several opportunities to practice the quality tools and model facilitation skills. Emphasis on experiential learning through use of a case study teaches team problem-solving. A workshop limited to 15-25 participants allows for effective instructor/participant interaction. Participants can work in teams of five to seven, giving individuals the opportunity to interact with others. The audience includes employees who will lead or facilitate a TQM team. The desired outcome is the ability to help teams critically analyze processes, generate creative ideas, and evaluate potential improvements (Howard, 1993).

Logistical considerations related to training require thought and attention. Training workshops serve as a model for organizational commitment to the philosophy of TQM. Training requires the commitment of time and monetary resources. When participants attend training during regular work hours, employees receive a consistent message that TQM is important to the organization. It is vital to communicate the consistent message that quality
improvement is everyone's job and that management seriously supports the initiative. Another way to model the philosophy of TQM is to use participation feedback to evaluate and improve training (Howard, 1993).

At Iowa State University, academic units, including the extension service, business college, the college of education, and college of engineering have begun TQM efforts. Other departments and individual faculty have developed projects that use TQM philosophies and tools. It is believed that these efforts will eventually come together voluntarily in a campus-wide TQM effort (Pickett, 1994).

**Curriculum**

**Definition**

A curriculum is a plan for what is to be taught in schools. Curriculum studies is a field of inquiry into how school programs are developed, implemented, and evaluated. Using methods from diverse fields, curriculum scholars investigate such questions as what should be studied in schools, what is likely to be learned as the result of the activities provided by a particular school, how to develop a practical curriculum, and what forces affect what is taught in school.

**Curriculum approaches**

Opinion varies widely about the field of curriculum studies. Some educators are oriented toward outcome, viewing curriculum as a structured series of intended learning goals. This achievement-oriented approach is evident in national educational planning. For example, the USSR's advancement in science and technology in the late 1950s prompted the adoption of more school courses in those fields in the United States. Other educators include in a curriculum all the opportunities for learning. This approach addresses both intended and unintended outcomes but pays greater attention to the activities of schooling than to particular achievements. Curricula in more liberal schools can include courses such as film studies that
are generally considered extracurricular in more conservative institutions. Some theorists
distinguish between curriculum and instruction; others believe that dichotomy is a false one
because the way a course is taught has a great influence on what is learned (Clandinin &
Connelly, 1988).

Ever since schools were established, curricula have been discussed, debated, and
changed. The curriculum of Plato's Academy in ancient Greece revolved around gymnastics,
literature, music, mathematics, and, eventually, philosophy. Ancient Roman education took on
aspects of Greek education and eventually came to be the basis of European education in the
Middle Ages. Liberal arts curricula in medieval universities consisted of the trillium (grammar,
logic, and rhetoric), and the quadrivium (arithmetic, astronomy, geometry, and music).
Today, a liberal arts curriculum encompassing the humanities, social sciences, and physical
and biological sciences, and mathematics forms the basis of a general education (Tanner,
1990).

Some educators have argued for curriculum goals related to subject matter, some for
goals related to society, and still others for goals related to the student. Examples of U.S.
colleges with divergent approaches to learning based on the needs of their students and of
society include the California Institute of Technology, whose curriculum is devoted almost
exclusively to science and technology, and St. John's College in Annapolis, Maryland and
Santa Fe, New Mexico, whose curriculum has as its core the Great Books Program.
Progressive education emphasizes a student's interests, experiences, and abilities and de-
emphasizes any binding, predefined, curriculum (Boscaljon, 1995; McNeil, 1990).

Controversies about curriculum often arise from different conceptions of what schools
are supposed to do. When the curriculum stresses academic disciplines, critics frequently
complain that it neglects personal growth or fails to prepare youth for jobs; a personal-growth
emphasis also provokes criticism. Some U.S. educators have criticized cultural bias—
"Eurocentrism"—in grade school through high school (Kaufman; 1990).
Control over curriculum varies from country to country. In many countries the central government controls the curriculum. This is true in Eastern Europe, where education and curriculum are ultimately overseen by the central government, although each republic is responsible for its schools' curricula. In Britain, before 1988, local education authorities could make extensive choices about the curriculum; the Education Reform Act of that year established a core national curriculum. As a result of reactions against a rigid and often archaic education system and curriculum, French state universities were reformed and refounded in 1970 and given academic autonomy and independence under the Ministry of Education. In the United States, many subjects in public schools on all levels are mandated by local and state governments. What is taught is strongly influenced by textbooks and other materials commercially available. The federal government plays a role in curriculum change and emphasis at all education levels by enabling federal agencies such as the National Science Foundation to provide funds for curriculum development and change (Eisner, 1994).

4-H curriculum

Although 4-H is not a school function, the importance of a relevant or up-to-date curriculum for 4-H cannot be overemphasized. Wessel and Wessel (1982) noted that 4-H also devoted considerable time to updating traditional projects so they would be more relevant to contemporary society. The only problem with this philosophy was that relevance remained a slippery commodity. What was relevant to teenagers in 1982 may have been nonrelevant to the same age group by 1995. The times, young people, and educational needs changed rapidly and 4-H, like most other youth organizations, ran at top speed just to keep up.

According to Steele, Miller, and Kalyani (1993), 4-H had a tendency to concentrate on attempting to serve teens as continuing 4-H members. It is very clear that while this is attractive and beneficial to some young people, 4-H and other programs like them do not reach the majority of the early teens. Teens find time for the programs that interest them. Individual
project-focused learning within a highly structured, adult-dominated program has little appeal to youngsters who feel a need for greater social interaction and the need to test their own independent wings (Steele et al., 1993).

If 4-H really wants to help teens at a point in life where youngsters may be most like at risk regardless of farming background, it must be creative in the kind of programs that it develops. For example, more attention needs to be given to short-term common goals seen as valuable to others as well as enjoyable and valuable to themselves. If an adult works with them, that adult must be "laid back" and supportive rather than directive, a facilitator rather than a controller (Rogers, 1983). There are several examples within the 4-H program of such activities that have appealed to teens, for example, one-act plays or getting a combo ready for a music festival, a task force in charge of cleaning up a cemetery, trying to get a road sign put in place, taking part in or coaching a judging team, or organizing and being in charge of some county-wide activity like foods review or demonstration day. Many clubs routinely carry on community service activities. Some engage in advocacy projects. However, in most counties, in order to take part in such activities, most teens must go along with other 4-H offerings and requirements so they have access to activities they prefer (Steele et al., 1993).

Miller (1976, p. 2) defined youth leadership life skills development as self-assessed and organization specific "development of life-skills necessary to perform leadership functions in real life." Severs and Dormody (1993) found participation in 4-H leadership activities to be the greatest predictor of youth leadership life-skills development among senior 4-H members in New Mexico, Arizona, and Colorado. Mueller (1989) found a positive relationship between participation in 4-H leadership activities and youth leadership development. A Michigan study (C.E.S., 1976) found leadership skills were learned through participation in 4-H activities and projects that provided youth the opportunity to participate in trial leadership roles. The curriculum should provide youth with an environment for learning experiences that will cause behavior changes (Hankel, 1990). Binkley and Tulloch (1981) stated that learning may result in
a change in “doing” behavior and “knowing” behavior, in the psychomotor, cognitive, or affective domain.

Ellis and Henderson (1993) noted that expanding 4-H programs to reach a larger population of potential members may require changes and improvements in the overall structure of program staffing and delivery. They further noted that 4-H agents should consider developing innovative programs for members to improve their economic status. For example, projects that teach members how to become entrepreneurs or how to develop marketable skills for employment should be examined as a technique to attract a larger youth audience.

The primary purpose of this study is to assess perceptions of 4-H'ers. Rogers (1983) noted that the target audience’s perceptions and the delivery methods are very important in determining the effectiveness of communication and the learning process. Per the definition of instructional materials given earlier in the dissertation, instructional materials are tools that facilitate teaching and learning. Therefore, it was important to look at some selected conventional teaching methods to have a perspective of how the TQM (1993) curriculum materials and program compared with other teaching approaches. As teaching methods were examined, the question at the back of the mind was: could teaching methods and tools affect the perceptions of 4-H’ers to TQM?

Teaching Methods

Introduction

Teaching methods are the ways in which information to be learned is presented and its effects on students evaluated. Methods vary in the medium of delivery (teacher, books, film, television, videotapes), in the explicitness of the program (structured or open), in how the teacher operates (lecture, discussion, tutor), in the ways in which student progress is monitored (immediate questions, delayed quizzes, appraisal of products), and in the organization of instructional time and space (groupings, structure, amount of choice) (Bennett, 1976). Until
recently, most reviews of teaching methods concluded that as long as the relevant content was covered, one method was as good as another. In the 1980s, however, a number of studies showed that some methods were superior, especially for teaching basic skills to less-able students (Evertson, 1994). When student performance in reading and arithmetic on normative tests was used as the criterion, better gains were found for elementary-level students when the teacher was an active planner and leader of instructional activities, chose the materials, paced the instruction rapidly, required frequent student responses, and used teacher-directed, rather than individual or self-directed, activities (Evertson, 1994).

**Instructional materials**

The development of instructional materials to meet the changing needs of students and society is a continuing process. There is a need for extensive evaluation of instructional materials to guarantee that the actual learning experiences provided are precisely those outlined in the learning units (Tyler, 1949). To design instructional materials to meet the rapidity of change in our daily lives and our increased dependence on modern technology is one of the greatest challenges facing agriculture instructors today (Scofield & Kahler, 1993).

McCamey (1987) advocated shifting education from a labor-intensive emphasis to a capital-intensive emphasis. He indicated this shift could best be accomplished by utilizing technologies such as computers and video cassette recorders for instructional purposes. Others have suggested the use of instructional technologies should support and empower the learner. Mihalevich (1990) suggested the appropriate use of instructional technologies is one of the most important considerations educators would face in the 1990s. Rozenfield (1986) noted that keeping up with technology was like chasing a moving target and identified problems in adjusting programs and obtaining needed equipment. He further noted that, in 1984, legislation was enacted that:

... explicitly addressed and responded to the impacts of technological change. Technology was no longer treated as an
unseen force acting on labor market demand but as a force with known dimensions that should be faceted into vocational instructional policies. (p. 13)

**Choice of method**

Hyman (1974) noted that several questions should be asked before selecting a teaching method.

1. Does the method permit adjustment for the abilities of different students?
2. Does it encourage the student to become continually involved in learning activities?
3. Does it permit adequate coverage of the content to be learned for all students?
4. Does it permit adequate monitoring of student progress by the teacher?
5. Does it provide adequate assistance for students who do not learn from the initial procedure?
6. Does it provide adequate practice to permit consolidation and integration of skills? (p. 20)

Choice of teaching methods is constrained in public schools by economic reality. Reducing class size, for example, is extremely costly, and the teacher must use those methods and available resources best suited to the students. The lecture method may at times be appropriate to communicate with an entire class. Small-group instruction may be the best way to teach reading skills. With more advanced students a variety of printed materials may be best. Some students may need a tutor (Hyman, 1974).

**Programmed instruction and learning**

Cutting across various teaching methods are variations in the degree to which the material is programmed. Programmed instruction can reinforce a lecture sequence or a discussion. It can be a teacher-directed, computer-directed, book-directed, or tutor-directed activity. In programmed instruction, teaching objectives are formulated and analyzed for the component skills and concepts needed to meet the objectives. This analysis leads to the design of teaching sequences, which are then tested for effectiveness and revised as necessary.
In the late 1970s the field of programmed instruction was still struggling to find ways of identifying and teaching principles that could govern good program design. The development of task analysis and the better understanding of knowledge structure were steps in the right direction. Further refinements in the field awaited a more fully developed technology of instruction (Evertson, 1994).

Programmed learning, or programmed instruction, refers to a process of education that permits self-instruction by means of Algorithms, Teaching Machines, instructional textbooks, radio, television, or computer. The purpose of testing and revision is to assure that an instructional program will enable students of a certain age, background, and ability to achieve measurable learning objectives. The process of developing such materials has been called "programming," but has also been termed "instructional systems development." Programmed texts or simple teaching machines that use a linear sequence of presentations (frames) involving questions and feedback to check the student's answers are only one of several methods of programmed learning. Audio and videotapes, and disks, interactive lessons on computers, instructional games and simulations, and a wide variety of printed materials have also been developed (Bullock, 1978).

Behavioral psychologist B. F. Skinner was the major impetus behind the development of programmed learning in the 1950s. He believed the best way to teach was to break complex tasks or behaviors down into their component parts. Skinner's work in this area embraced three major principles: (1) active response on the part of the students; (2) a minimal error rate so students' efforts would be rewarded by their correct answers almost every step of the way; and (3) immediate knowledge of results to enable self-checking every step of the way. Skinnerian programs are linear; that is, one segment of the program must be mastered before the next is presented, and the order of segments never varies.

During the period of programmed learning's greatest dissemination—the 1950s through the 1970s—thousands of learning programs were developed for hundreds of subjects. Most of
the programs dealt with well-structured subjects such as mathematics, electronics, and data processing, but all subject areas were represented. Programmed learning was widely used in industry and the military (Bullock, 1978).

Programmed learning lost favor somewhat during the late 1970s. Empirical research failed to uphold its early promise; its contributions to education proved less dramatic than originally hoped. Educators felt that many of the programs did not provide enough variables to meet the needs of individual students. However, one type of program that is well adapted to individual students is the "branching" program. This type of program allows for the presentation of different materials depending upon responses to earlier material. A branching program adjusts the difficulty of material presented according to the skill level of the user. This technique is especially useful in computer-assisted instruction (Mager, 1984).

**Lecture method**

The lecture method has been the most common method of instruction in higher education for centuries. In its early forms, the lecture method was a practiced art form, a form of theatrical performance designed to hold the student's attention. Until the advent of low-cost books, the lecture method was the most economical method of transmitting knowledge. The major drawback of this method is that it does not necessarily hold the student's attention nor does it permit active participation in learning. Also, because modern teachers are usually not trained in nor selected for their lecturing skills, the method is, not surprisingly, under frequent attack (Flournoy, 1972).

Even with these problems, research shows that the lecture method, when supported by various texts and references, can be effective at the college level. Lectures can be made more effective by focusing on issues or problems, by avoiding conclusions, by the use of questions for students to answer, and by providing periodic summaries. Although the lecture method is
particularly effective for transmitting information, studies have shown that the discussion method may be more effective in encouraging reflective thinking (Evertson, 1994).

**Discussion method**

Discussion methods are used mainly in secondary and postsecondary classrooms. In secondary schools they tend to be favored in the social sciences rather than in mathematics or the physical sciences. Discussions usually follow reading assignments. Research supports the use of discussion to teach information, to develop thinking processes, to promote attitude change, and to develop interpersonal skills. Discussion is not conducive to the learning of basic skills (Evertson, 1994).

Although discussion-group size may readily range from two to twenty participants, a group size of about five appears to be the most congenial and effective. Other methods of fostering group interactions include forming groups whose members differ in skills and attitudes, providing seating arrangements to encourage contact, and using democratic leadership techniques so that students feel comfortable in participation (Flournoy, 1972).

**Teacher-directed small groups**

The teacher-directed small-group method has traditionally been the most common and most effective approach to teaching reading and mathematics. In this method the teacher follows a detailed program of instructions and examples. The five to eight students in the group are asked to respond to the teacher's questions in unison or individually. Teacher-directed small-group instruction is showing success especially with the harder-to-teach students, although the method is also effective with faster-learning students (Gage, 1976).

**Tutoring**

Tutoring is one-on-one instruction by someone who is more often than not a specialist or technician rather than a professional. It is used mainly to remedy academic deficiencies. Many evaluation studies have shown that the effects of tutoring are not necessarily superior to
regular classroom methods. Recent studies, however, show promising effects for tutoring by nonprofessionals when adequate training and supervision is provided and when the tutor is told exactly what must be taught. Tutoring by classmates has also been demonstrated to be effective and to help the teacher in giving basic instruction to individuals (Hyman, 1974). The need for tutoring usually arises when other teaching methods have failed to some degree. Although the current large-group methods are economical, they produce a percentage of failures that requires other methods to provide a remedy (Gage, 1976).

Games and simulations

Because games are fun, educators have sought to use them to foster learning. Many card and board games are available to encourage basic skills in reading and arithmetic. Simulation games attempt to teach the principles of complex systems such as economics, international relations, or group power struggles. They may focus on current social issues or be placed in historical settings. The complexity of the game rules can be controlled to permit use at almost any level of instruction (Hyman, 1974).

Simulation games have the potential to teach problem-solving and decision-making strategies as well as the many facts and principles that define the game. Many games are designed to teach students to deal with representations of real-life conflicts and problems. Although simulation games are increasingly designed for student-computer interactions, computers are not essential (Evertson, 1994).

Computer-assisted instruction (CAI)

In CAI, the student typically uses a keyboard that gives access to a computer program that responds through displays on a televisionlike screen (monitor) through typewriter printouts and in audio tape presentations. True speech input-output systems (needed to teach beginning language and reading skills) are currently being developed (Evertson, 1994). As a teacher the
computer has many virtues: it is patient, can be positive, does not forget, and, through its record-keeping programs, knows about each student's current level of skill.

The 1990s should show a dramatic increase in CAI based on microcomputers supported by new systems for information storage and retrieval. The major factor likely to slow future development is the difficulty of designing instructional programs to place on the computers (Evertson, 1994).

Teaching methods continue to evolve with the aid of modern technology. What has not changed is the need for the teacher, who must decide which method to use. While many aspects of instructional technology were destined to be directly applicable to agriculture classrooms, Marrison and Frick (1993) suggested that the primary thrust would be the computer. Gamon, Thatch, Sammons, and Khatib (1995b) recommended that future instructional materials should be designed to accept the types of computers now in use in agriculture classrooms.

**Video-assisted instruction**

The use of the videotapes in distance education is extensive and growing as a result of their relatively low cost and ease of use (Miller & Honeyman, 1993). Miller (1995) noted the development of the method and process for technology-mediated instruction is needed to advance distance education in agriculture.

Video technology has become a part of America, but a more precise reason for the adoption and adaptation of the technology is the acceptance and attention it receives from students (Botterbusch, 1991). However, those who have the responsibility for planning educational programs have little data available concerning classroom use of instructional technology (Birkenholz & Stewart, 1991). The possibilities for the use of the videotape in education and teaching are still being studied (Ault, Emery, & Agee, 1988).

Israel and Ingram (1991) observed that extension professionals increased the likelihood of participation in self-study educational programs using videotapes and workbooks. Israel and
Ingram noted that learn-by-mail programs have been used for years, but what is new was using videotapes and workbooks to deliver an educational program. Their study showed that access to a VCR dramatically increased the probability of participation as a whole, and particularly for "expanding part-timers" and "sun-downers."

Barkman (1991) noted that videos are becoming commonplace as a way to supplement curriculum. However, according to Barkman, many extension videos still mimic televised instruction—simply recording a live demonstration on tape. As the use of video increases, Extension professionals need to investigate ways of designing video programs that actively stimulate and encourage learning. The study by Barkman (1991) showed that questions with feedback can be used in instructional video programs, as they have in print media, to guide 4-H'ers' processing activities and to affect learning. Learning during a program can be increased when the program requires meaningful processing of information.

Effect of multimedia instruction on science achievement

Since the late 1800s, with the invention of the motion picture, technology has become a part of the classroom (Henk & Rickelman, 1989). As new advances were made, educators tried to utilize them to improve instruction. Throughout the 1900s, educational radio, Skinner teaching machines, language laboratories, and videotape players were all integrated into classroom instruction (Henk & Rickelman, 1989). Now "the heart of education's technological transformation is the computer" (Lewis, 1991, p. 6). Throughout the last ten years, computers have become commonplace within the classroom. In the beginning, computer education consisted mainly of word and data processing and other business applications at the secondary level (Gould, 1991) and for drill and practice to improve math and reading skills at the elementary level.

As technology keeps evolving, educators continue to think of ways to use new advances, such as telecommunications and e-mail, CD-ROMs, virtual reality, and laser discs (Lewis,
1991). The question arises as to who is going to pay for these expensive educational tools and whether or not their use is an effective way to increase academic achievement (Hill, 1993; Lewis, 1991). One area in which technology is taking an ever increasing instructional role is science education (Duhrkopf & Kramer, 1991; Hill, 1993; Tally & Wilson, 1991).

Multimedia education is defined as using “the combination of computer data, graphics, sound, and video” as methods of instruction (Lewis, 1991, p. 7). Interactive video is defined as the combination of computers and graphics to create an active learning environment in which the students respond to solve a problem or create a product.

Although computers are standard in most classrooms, they can now be supplemented by other media. Some educators and administrators are hailing multimedia education as the wave of the future. At Indian Creek Elementary in Indiana, a science and technology magnet school, multimedia materials are integrated into all parts of the curriculum. Even first graders are able to produce their own multimedia presentations using a program called LinkWay. Students' test scores in math and the language arts are in the upper quartile because of multimedia instruction and the high use of technology throughout the curriculum (Gould, 1991).

An ongoing study of the effects of multimedia composing to improve writing skills in fourth and fifth graders, who have previously experienced writing difficulties, has shown promising preliminary results. The students had to create a “computerized book” that contained four scanner generated pictures and two digitized sounds and then caption their reactions to these items. The students' writing increased in volume, fluency, and complexity. Furthermore, the students expressed they enjoyed writing more using the computer than the traditional paper and pencil approach (Daiute, 1992).

A new math laser-disc adventure program, the Jasper Series, allows students to actively participate in problem-solving to devise a successful rescue plan. Evaluations of the program have shown that students who received this form of multimedia instruction performed better than those who received regular mathematics instruction. After one year, they could more
accurately solve one-, two-, and multiple-step word problems and generate their own problems
to be solved. Also, students who participated in the Jasper Series found mathematics more
interesting and now believed they would be able to apply math to their daily lives.
Improvements in achievement and attitude were observed in both high- and low-achieving
students (CTGV, 1993).

Multimedia instruction has infinite possibilities for use in science education. Science is
best taught through a hands-on approach and CD-ROMS and laser discs offer students an
opportunity to experience visually things that would normally be impossible within the
classroom. Several multimedia encyclopedias and laser discs, such as Encarta, Interactive
NOVA, and BioSci, allow students to see images and hear sounds associated with the topics
they are studying (Duhrkopf & Kramer, 1991; Tally & Wilson, 1991). This is especially
beneficial in lab situations where students can repeatedly watch experiments using the laser disc
regardless of danger or cost (Couch, Couch, & Peterson, 1993).

One case study of a fifth grade classroom, where use of a multimedia system was
observed for the first six weeks it was there, showed that it was successfully integrated into the
science curriculum. The students used three laser discs, Interactive Nova: Animal Pathfinders,
National Geographic's Whales, and Voyage of the Mimi, with a Macintosh computer to
research and then create their own multimedia reports for presentation to the class. Most
students easily adapted to using the materials, and in fact seemed to enjoy the science activities
(Tally & Wilson, 1991).

Hill (1993, p. 20) observed that it had been predicted as early as 1894 that, “Books will
become obsolete in the schools. Scholars will soon be instructed through the eye.” One
hundred years later schools are getting closer to fulfilling this prediction. In some school
systems the move towards a multimedia curriculum is underway. California has recently
adopted Science 2000, a non-textbook science program (Hill, 1993). Other school systems are
considering doing this also. However, many are unsure how they are going to pay to get this
technology into the classroom. Many educators want to be sure that the benefits of multimedia instruction will increase achievement enough to justify the cost (Wilson, 1995).

In this study, the video was one of the methods of delivery of the curriculum. The video and other instructional materials (TQM, 1993) introduced the concepts of total quality management (TQM) and food safety to livestock production. This is a fairly new approach in teaching skills associated with livestock projects.

**Using TQM to Improve Food Safety in Livestock Production**

**Introduction**

Food safety is a current concern of both consumers and producers. The popular press mentions it almost everyday (Beware, 1994; EPA, 1994). In this study the question of safe animal food products is highlighted. As observed by Ritchie et al. (1994), young producers are obliged to examine the knowledge and skills about what they produce, how they do it, and whether they effectively utilize human, animal, and environmental resources in the process of production. The TQM approach, by focusing on high quality and consumer concerns, offers an opportunity to ensure that the handling of animals does not lead to chemical residues and other hazards on animal food products. In order to appreciate the role of TQM in addressing food safety concerns, it is pertinent to have a historical perspective of how safety concerns have been addressed in the past.

**Safety and consumer issues**

The U.S. government first became involved in controlling misleading information when a mail-fraud law was passed in 1872 (Aaker, 1978). The first legislation concerning product safety was the Federal Food and Drug Act of 1906, which forbade the adulteration of food and drugs and misbranding, that is, using false or misleading claims. The Sherman Act, the first legislative attempt to control monopoly power, was passed in 1890, and in 1914 the Federal Trade Commission was created to control unfair methods of competition. Aaker further noted
that the need to protect consumers from unfair methods of competition was recognized in 1938 in the Wheeler-Lea Amendment to the Federal Trade Commission Act.

In 1938, the Federal Food and Drug Act was updated by the Federal Food, Drug, and Cosmetic Act. It empowered the Food and Drug Administration to test the safety of new drugs before they are placed on the market. During the 1950s and 1960s, new legislation authorized the setting of safety standards for several other products, including flammable fabrics, household chemicals, toys, and motor vehicles. In the 1960s, Ralph Nader rose to prominence as a crusader on behalf of consumers. In order to regulate the safety requirements for a wider range of products, the Consumer Product Safety Commission (CPSC) was established in 1972 (Aaker, 1978).

In recent years important developments have included efforts to improve consumer redress, expand the representation of consumer interests in government, and reconcile state and federal product-liability laws. The benefits to consumers of deregulation trends of the 1980s were uncertain in some areas—telephone, air travel, banking—but polls showed that consumerism remained popular despite the anti-regulatory mood (Aaker, 1978).

As today's consumers are concerned about food safety, the U.S. Department of Agriculture (USDA), which is responsible for public health, guarantees the safety, wholesomeness, and proper labeling of meat and poultry products produced under federal inspection (Bjerklie, 1992). The Food Safety and Inspection Service (FSIS), an agency within the USDA, takes charge of inspecting and ensuring the safety of meat and poultry products provided to consumers. The hazard analysis critical control point (HACCP) concept, along with existing quality assurance programs, has been proposed to help livestock producers improve the safety and quality of their food products. The HACCP plan identifies potential problems that could occur in an operation, and it is the best system currently available for improving the micro-biological safety of food (Tompkin, 1990). No matter what and how the government did
to assure food safety, Bjerklie (1992) pointed out that it was the producer's responsibility, not the government, that made quality control programs mandatory in the plants.

The Food and Drug Administration is responsible for policing claims about food, drugs, and cosmetics, and the Federal Trade Commission handles claims about most other products. Local, state, and federal governments have established consumer-education programs that aim to help consumers choose more intelligently among products; improve the management of their money, time, and skills; and make their opinions heard on issues that affect them (Eiler, 1984).

The government assists consumers in obtaining redress in several ways. The law and the courts hold manufacturers liable for the safety of their products and for assuring that a product's performance corresponds reasonably to the claims made for it. In recent years, state attorney generals have helped many consumers who have been defrauded or who have encountered problems with contracts. Groups of consumers who have experienced similar problems may band together in a Class Action to sue a seller. The power of government agencies to force sellers to make restitution to consumers is limited; in most cases, government regulatory efforts are focused on preventing the sale of products that injure consumers or of activities that adversely affect them. The Food and Drug Administration may, for example, ban the sale of dangerous food items; it has no power, however, to force a food manufacturer to make refunds or to do anything for individuals injured by a product. The Consumer Product Safety Commission's power to require the repurchase, repair, or replacement of banned products is one exception. The Office of Consumer Affairs in the Department of Health and Human Services serves as a clearinghouse for consumer complaints. Some manufacturers have voluntarily recalled products after their sale to correct defects that had been discovered. The major U.S. automobile manufacturers recalled millions of cars in the 1970s and 1980s to make such corrections. Manufacturers of children's goods have also recalled defective products (Stanesby, 1986).
Various business organizations provide consumers with information about products, and many corporations have consumer affairs offices. Supported by local businesses, the Better Business Bureau works to prevent misleading advertising claims. Consumers Union, the consumer-supported, product-testing organization, provides comparative brand ratings in its magazine, Consumer Reports.

The Consumer Federation of America (CFA), a national federation of about 220 organizations, and the group of organizations headed by Ralph Nader have played an important part in representing consumer interests before the Congress and government agencies (Stanesby, 1986). Having looked at the overall government effort in addressing consumer concerns, we shall now examine efforts specific to the livestock industry.

In order to help all livestock producers avoid illegal drug residues, improve their management skills, and increase awareness of food safety concerns, several programs were typically designed and developed for specific needs of producers, such as pork quality assurance, poultry improvement plan, beef quality assurance, dairy 10-point plan, sheep project for youth and 4-H, and aquaculture (fish project). All these programs suggested that the only way to be competitive in the market place was a commitment to continuous improvement in quality (Wu, 1994). For example, pork quality begins at the farm. . . . Learning about procedures necessary to produce the safest and best quality pork products possible is the first step in professional pork production (PQA, 1992).

Coe et al. (1994) studied the provision of information about increasing public awareness of the value and sources of animal products, the level of care provided to farm animals, and environmental benefits of agriculture toward youth involved in animal projects. They perceived a relationship between the handling, managing, and use of farm animals and the value of animal projects. It was not just the processing methods that impacted the final foods, but also the initial steps of caring for and managing the raw agricultural products (Coe et al., 1994).
TQM in commodities production

Quality concerns have become an important issue for producers. Murphy (1986), in his book *Quality in Practice*, stated, “The quality philosophy in action puts the making of the product the consumer wants first”. (p. 4) Quality control is not just the responsibility of the manufacturing level; it is everyone’s business through the whole management system. Depew (1993) noted:

Many people subscribe to the philosophy that quality is something done as an organization. However, we now have learned that quality is more about what an organization is and not necessarily what it does. Quality is about empowering people to do the best they can today and to continuously improve tomorrow. (p. 45)

Changes in the world market-place caused several companies to focus more attention on product and service quality by restructuring operations, designing efficiencies into existing online processes, improving employee training and adopting quality oriented programs (Depew, 1993). These quality improvements are so-called “Total Quality Management.” The federal government established the Federal Quality Institute to provide the basics of TQM, start up services, and implement assistance to various agencies of the executive branch (Melan, 1993). Therefore, numerous organizations, including business, education, and government within a geographic area, have been established to share and disseminate information on quality improvement and to provide initiatives in various aspects of implementing TQM.

As the importance of education in accelerating agricultural development is recognized worldwide (Agrawal, 1983), many studies have called for systematic changes in agricultural education. For animal science education, elements of biotechnology, consumption and human health, and recycling should be included as well as traditional components of biology, production processes, marketing, and food (Kunkel & Skaags, 1994). TQM provides an effective way by directly addressing the crucial issue of systematic changes in agricultural education. It helps producers to manage available resources to produce the highest quality
product as effectively and efficiently as possible, resulting in both customer satisfaction and profit for the producers. With the recent consumer concern over the safety of food supplies, the concepts of TQM could help to enhance the ability of youth with livestock to make and implement responsible decisions as they produce quality, wholesome, and safe food products for human consumption.

Livestock production factors and projects

In developed areas of the world, the factors influencing the efficiency of livestock production are almost all within control of the producer. They include intensive rearing, feeding programs to ensure rapid weight gain or increased milk production, and breeding programs using the newest techniques in biotechnology and genetic engineering. Since World War II these methods have resulted in a near-doubling of the amount of milk produced per dairy cow in the United States and have caused increases in the rate and quality of livestock growth. However, future gains will probably depend on the use of sophisticated breeding techniques (Blakely, 1990).

In addition to artificial insemination, which has been used effectively since the 1930s, basic breeding techniques include various manipulations of egg and embryo. Typically, a prize dairy cow will be injected with a hormone that causes it to produce as many as 20 mature eggs during ovulation, rather than the usual one or two. The eggs are fertilized via artificial insemination, and the embryos flushed out within a week. Transferred into a surrogate-mother cow, an embryo will develop into a calf with the desirable characteristics of its genetic parents and its surrogate dam as well. Other techniques involve the cloning of embryos and the freezing of both eggs and embryos for storage or shipment (Briggs, 1980).

The use of gene manipulation to produce more commercially useful animals may prove to be the most important breeding technique. An animal and its offspring can be programmed for a specific trait by adding a foreign gene to its embryo. To date there have been few viable
transgenic farm animals, animals created with foreign gene components. Perhaps the first practical success in the field has been the development of the cow hormone, bovine somatotropin, which can be produced in quantity by genetically modified bacteria, and increases milk production when given to cows (Taylor, 1992; Currie, 1988; Sainsbury, 1986).

A survey of 4-H leaders to determine their perceptions of the need for a non-ownership animal science project dealing with beef cattle, sheep, swine, goats, and dairy cattle in Colorado (Wacker & Boyd, 1992) showed that non-ownership project and materials are a project alternative for urban 4-H members who cannot own livestock. Wacker and Boyd (1992) further observed that the activities make the project suitable to younger livestock members, since they provide an overview of the entire livestock industry. Wolverton (1991) noted that judging in an animal showmanship contest is based on preparation of animals for show and the exhibitors' apparent training, behavior, and appearance.

Ritchie et al. (1994) suggested that educators should be ready to be challenged to provide balanced, unbiased information on major social issues as the end of the twentieth century draws near. These issues include environmental, animal care, diet/health, and food safety. Youth with food production projects have the responsibility and obligations to produce a quality, wholesome, and safe product for human consumption. They need effective, balanced, and unbiased information on their food production projects. Ritchie et al. (1994) further noted that TQM, with its most important features of customer orientation, continuous improvement, and organization-wide aspects, could provide a means for addressing these needs that young producers will face in their food production process.

The *Swine Care Handbook* (PQA, 1992) was adopted by the National Pork Producers Council (NPPC) with these objectives: to raise producer awareness of animal welfare concerns and to provide information through educational programs to aid producers in continuing to improve their animal skills. The guidelines are based on current research and extension literature for animal science, veterinary medicine, and agricultural engineering.
According to the Youth and 4-H Guide for Evaluating Livestock Showmanship, (ISU Extension, 1991f), judging a livestock showmanship contest is based on preparation of animals for show, their apparent training, and appearance and behavior of the participating exhibitors. Animal confirmation should not be considered unless it affects the way an animal should be fitted and shown. Fine or technical points should not be overemphasized to the point they are given more weight then the effective presentation of a clean animal. The guide approved for all 4-H beef, sheep, and swine showmanship contests in Nebraska and Iowa has score cards for the above animal types whose items range from animal appearance to appearance and merits of the exhibitor.

According to the Youth and 4-H Guidelines for Care of Animals in a Public Setting (ISU Extension, 1991c) 4-H’ers participating in livestock shows have a chance to practice responsible behavior while taking care of their animals and themselves. 4-H’ers need to work cooperatively to provide an environment that meets the needs of exhibit animals and is conducive to encouraging the public to view the exhibits.

According to Important Information for 4-H Market Animal Exhibitors (ISU Extension, 1990a), 4-H’ers are advised that:

To prevent drug residue in your animals, you need to be knowledgeable of EPA/USDA regulations. These departments enforce regulatory laws enacted under the Food, Drug, and Cosmetic Act of 1906 and its amendments. The regulations are intended to prevent adulteration of food supply with illegal drug residues in market animals. (p.1)

4-H’ers are also advised by the above pamphlet on how to plan to exhibit market animals at county fairs, in order to comply with FDA\USDA residue avoidance regulations. According to the pamphlet, if animals have not been off the drug for the correct withdrawal time, they are not appropriate for slaughter. For cattle, the preslaughter withdrawal time ranges from one to 80 days, depending on the drug. For swine, withdrawal periods range from one to 70 days. By being aware of the withdrawal times, one can stop administering the drug soon
enough so the animal will be residue-safe when it is slaughtered. For poultry exhibitors, the
preslaughter withdrawal time for chickens and turkeys ranges from one to 28 days, depending
on the drug.

The Youth and 4-H publication *Strengthening Goal-Centered Learning in the Exhibit
Experience for Parents* (ISU Extension, 1993a) asks parents and leaders to perform important
tasks: to help 4-H’ers see the connection between their project goals and exhibit goals. It asks
them, as they work with 4-H’ers, to think about three parts of a measurable project goal: (1) the
action, (2) the result, and (3) the timetable.

*Background and History of 4-H* (ISU Extension, 1989) states that in recent years the 4-
H program in Iowa has been experiencing two significant trends. One involves a more precise
recognition that the basic purpose of 4-H centers on personal growth of the members. By
using 4-H projects as important vehicles for achievements and growth, 4-H’ers are able to build
life skills they can use the rest of their lives. The publication further observes that life skills are
built into 4-H projects and often activities and events help participants become contributing,
productive, and self-directed members of a forward moving society. 4-H educational
experiences are built around life skills that center on positive self-esteem, communication, and
decision-making. It was further noted that, today, 4-H offers youth opportunities in
communication, leadership, career development, livestock, home improvement, and computer
technology.

The Youth and 4-H *Consumer and Management Project Guide* (ISU Extension,
1995b) gives 4-H’ers skills they can use today and the rest of their life. It shows them how to
solve problems and make decisions that are right for them. Through the consumer project, 4-
H’ers learn how laws protect consumers or how the U.S. economy works. Knowing correct
procedures for running and participating in a business meeting will be important lifelong skills
to 4-H’ers according to *Project 4-H Hog Project* (ISU Extension, 1992a). Through the hog
project, 4-H’ers learn how to: select feeder pigs for their project, select proper feeds for their
pigs, combine these feeds into a balanced diet, figure cost and returns from their project, tell
when their pigs are sick, tell when their pigs are healthy, prepare their pigs for exhibition, handle
their pigs in a show ring, and determine if their pigs will be acceptable to the packer.

*4-H Skills for Life Animal Series* (ISU Extension, 1994b) gives ways of guiding,
encouraging, and rewarding progress. In this series covering beef, poultry, dairy, swine, and
sheep, it is emphasized that how leaders choose to be involved will often determine the success
the youth have in developing important life skills while learning what project animals are all
about.

Horton (1990) observed that leaders used 4-H project manuals as teaching resources to
direct project instruction and inspire group experiences. He noted that the manuals often came
with lesson plans to help group learning. Because fewer adults were willing to direct project
learning, Ohio 4-H began modifying project manuals to self-study with two primary
components, that is, experience based activities and member’s project guide.

**Program Evaluation**

The evaluation of the effect of teaching materials for 4-H’ers and 4-H’ers’ perceptions
to TQM cannot be complete without examining some principles of program evaluation. When
looking at the perceptions of 4-H’ers as they relate to TQM practices in livestock projects, we
are, in a way, evaluating an important aspect of the 4-H program.

**Definition**

Many definitions of evaluation can be found in the literature (Steele, 1970). The
definitions reflect the approach to evaluation taken in this study. At a general level, we can say
that evaluation is the process of deciding the value of something.

Tyler (1949) defined evaluation as the process of determining to what extent objectives
have been realized. Stufflebeam (1974) said that evaluation is the process of delineating,
obtaining, and providing useful information for judging decision alternatives. Suchman (1967)
defined it as the determination of results attained by some activity designed to accomplish some valuable goal. Stake (1982) said program evaluation requires collection, processing, and data interpretation pertaining to an educational program.

When approaching the more formal evaluation activities, one may want to reflect on the definition of evaluation to be used. It will help in making a selection of a design for the evaluation. After looking at the foregoing definitions and others in the literature, it is apparent that some are concerned with causal relationships, others are aimed at displays of evidence, and some are mainly focused on decision-making. According to Scriven (1984), evaluation is the assessment of value. His formed definition follows:

> evaluation is... a methodological activity which... consists simply in the gathering of and combining of performance data with a weighted set of goal scales to yield either comparative or numerical ratings, and in the justification of (a) the data gathering instruments; (b) the weightings; and (c) selection of goals. (p. 8)

**Evaluation models**

The following are some of the evaluation models that have emerged in literature:

1) Naturalistic/qualitative (Grotelueschen, 1980)
2) Scientific (Suchman, 1967)
3) Management oriented (Stufflebeam, 1974)
4) Adversarial oriented (Levine, 1974; Kourilsky, 1973; Wolf, 1975, 1979)
5) Consumer oriented (Scriven, 1974)
6) Objectives oriented (Tyler, 1949)
7) Expertise oriented (Floden, 1983)

The naturalistic inquiry and involvement of participants (stakeholders in that which is evaluated) are central in determining the values, criteria, needs, and data for the evaluation. Some of the proponents of this approach are Stake (1980), Patton (1980), Guba and Lincoln (1981), Rippey (1973), McDonald (1974), and Parlett and Hamilton (1976).
Those who use the naturalistic and participant-oriented approaches to evaluate typically prepare descriptive accounts—portrayals, as these have come to be called—of a person, project, program, activity, or some other entity around which clear boundaries have been placed. Not only is the entity richly portrayed but it is clearly positioned within the broader context in which it functions.

The experimental model of evaluations, described by Suchman (1967), attempts to determine cause and effect; that is, did program X cause results Y? It is based on the experimental design where a target population is identified. Members of that population are randomly assigned to the experimental group which receives the program and to a control group which does not. The control group may receive some other program known to not cause effect Y, called a placebo. Data collected from both groups at the end of the program and results are compared. If the variables under study are statistically significantly different, then it is assumed that the program was the cause.

The consumer oriented model would appear to be the most relevant to the 4-H study. In this model, the central issue is developing evaluative information on educational products, broadly defined, for use by educational consumers in choosing among competing curricula, instructions, products, and the like.

Scriven (1974) published a checklist which was the result of reviews commissioned by the federal government focusing on educational products developed by the federally sponsored research and development centers and regional laboratories. It was used in the examination of over 90 educational products, most of which underwent many revisions during that review. Scriven stressed that the items in this checklist were *necessitata*, not *desiderata*.

To be accepted and used, evaluations must begin with the assumption that the program under review is worthy and, at worst, is in need of improvement. To ensure that the full range of information needs in an institution are met, the management evaluation model called *CIPP*
proposes that programs should be scrutinized at the context, input, process, and product stage on a cyclical basis.

Meta-evaluation

Meta-evaluation (i.e., evaluation of the evaluation) provides a useful means of helping ensuring that evaluations offer sound guidance (Worthen & Sanders, 1987). As part of the strategy to improve meta-evaluation, Cronbach (1982) recommended against the use of comparative evaluations and Scriven (1984) insisted that an evaluator should not judge.

Meta-evaluation can be expected to facilitate early identification and correction of potentially fatal flaws in an evaluation plan and increase the likelihood that program summaries are valid and accepted by users and stakeholders (Schwandt, 1988).

Collecting, summarizing, and reporting evidence

Once evidence has been obtained—completed questionnaires or interview schedules, list of all office calls, notes on observations, or whatever—it needs to be in a form that can be used. The data need to be summarized in a way to be useful and understandable to those who will use the results. If there are several audiences or users, there will be a need to summarize the data in different ways to meet these needs.

Data may be summarized in both narrative and numerical form (Blackburn, 1984). Numerical analysis can take the form of a relatively complex and sophisticated statistical analysis. This may be appropriate if major audience(s) and user(s) understand such an analysis. However, Forest and Marshall (1978) concluded from their evaluation of the total impact of Cooperative Extension in Wisconsin county that complex statistical analysis was not necessary for users to understand the evidence.

The process of summarizing numerical data can include simply tallying answers or observations, graphing answers by hand or typewriter, or using a computer for analysis. These have been outlined by Fitz-Gibbon and Morris (1978).
Evaluation audiences will use implicit standards in comparing the results, but this will be
unknown unless inquiry is made. Forest and Marshall (1978), Grotelueschen (1980), and
Guba and Lincoln (1981) pointed out that different stakeholders and interest groups use
different standards to define success or effectiveness, and that it is necessary for the evaluator to
determine them. Forest and Marshall (1978) described a way of setting standards that can be
useful in extension settings where clear and acceptable standards from the outside sources may
not exist.

**Evaluating instructional materials**

Researchers who have studied the use of agricultural instructional materials have found
that materials are important tools to teach agriculture. In a study of elementary teachers who
were asked about their level of interest in programs that could assist them to teach about
agriculture, the highest scores were given to the list of materials currently available (Terry,
Herring, & Larke, 1992). Whent (1994) found that agriculture teachers shared instructional
materials, specifically catalogs, lesson plans, and textbooks, with science teachers.

Gamon, Thach, Sammons, and Khatib (1995a) found that the majority of Iowa high
school agriculture teachers purchased the IVATA (Iowa Vocational Agriculture Teachers
Association) instructional packets and incorporated at least some of the materials into their
classroom instruction. As with previous follow-up studies of the Iowa program (Bekkum &
Hoerner, 1992), teachers found certain types of content and certain types of instructional
materials to be of more use than others, although most were rated high.

**Theoretical Framework for the Study**

This dissertation continually emphasized quality—quality processes and quality
products. Because of the importance of this issue, it would be useful to consider the concept of
a “total quality curriculum,” imbued with the basic principles of Total Quality Management.
TQM embodies the theories of W. E. Edwards Deming (1986) and has been used effectively in the corporate world. It is now frequently touted as the best method to reform the schools (Bonstingl, 1992). However, not all educators are convinced.

Prawat (1993) is one of many critics who believes that a focus on products is antithetical to the development of learning communities, where the process is more important. Capper and Jamison (1993) question the basic values of TQM. However, given the fact that the TQM appears to embody many educationally desirable principles, it would seem useful to determine how the core principles and processes of TQM could be applied to the curriculum development process.

In making such a determination, the current literature provides little help. Bonstingl’s (1992) handbook makes a brief reference to the curriculum, and Glasser’s (1992) discussion of the “quality curriculum” recommends only that the curriculum teach useful knowledge and skills and emphasize the application of this knowledge and skills. Obviously, part of the problem is that TQM’s brief educational history means there is no empirical evidence available on the effectiveness of TQM as applied to educational problems.

Summary

This chapter was an attempt to synthesize the basic principles and processes of Total Quality Management and the current research on education in a way that makes sense to educational leaders. The objective was to remain true to the spirit of TQM without attempting to make a literal transition of a management system originally designed for the corporate world.

A systematic process to accomplish this goal was used, beginning with a careful reading of the basic TQM literature, especially those works concerned with the application of TQM to schools. The following sources were most helpful; Aguayo (1990), Deming (1986), Bonstingl (1992), Glasser (1992), and Smith and Hindi (1992). Next, current research on student achievement was reviewed, drawing chiefly from Wang, Haertel, and Walberg (1993). Finally,
current theory and research on curriculum was analyzed to identify the salient characteristics of curriculum quality. From these analyses, common principles and major attributes were identified as a discussion framework for the discussion in the chapter. In this context it should be emphasized that no attempt was made to force a fit between TQM and previously advocated models of school reform, such as "effective schools," "site-based management" and "outcome-based education." To do so might imply that TQM is an ever-expanding amorphous structure without its own unique characteristics.

TQM is actually a relatively simple management system with its own jargon, which can be troublesome at times. However, when we distill TQM down to its essence, what we find is a relatively simple philosophy of management with a set of relatively simple analytical tools. If one reduces TQM to a single concept, "customer driven" might capture its essence as well as other concepts. In TQM the customer is king, and the job of the organization is to make the king happy. This simple guiding principle brings a clarity of focus and energy to the running of human service organizations—something frequently missing in other management systems.

What may be the most surprising aspect about TQM is that the world took so long to discover it. Organizations have been run for about every conceivable purpose, but only recently have we seriously considered running them for the benefit of customers.

TQM concepts have the potential for application to the food and fiber industry. Consumer concerns over food safety in the food chain are increasing recently. Studies have shown that a majority of the consuming public appeared to express more concern with chemical, health, and spoilage issues as the general level of concern with food safety increased. To maintain the public's trust, survive, and even prosper, in the consumer-driven marketplace, livestock producers need to take proper steps to ensure that the products they supply remain high in quality and safety.

In public schools, the youth enrolled in agricultural education programs and 4-H membership are considered to be producers within the food chain. Through practice and
experience in livestock production projects, students apply what they have learned in educational instructions to real life situations (Phipps, 1980). There is increasing public awareness of the sources of animal products, the level of care provided to farm animals, and environmental benefits of agriculture related to youth involved in animal projects. As young producers learn to implement TQM strategies, they will develop awareness and skills which will help them improve their current livestock projects and form the foundation for future production as well.

If the 4-H program wants to help youth at a point in life where youngsters may be most likely to be at risk regardless of their background, it must be creative in the kind of programs it develops. The development of instructional materials to meet the changing needs of students and society is a continuing process. There is a need for extensive evaluation of instructional materials to guarantee that actual learning experiences provided are precisely those outlined in the learning units. The assessment of 4-H'ers' perceptions of TQM practices and evaluation of the effectiveness of TQM teaching materials are important components of the overall 4-H program evaluation.
CHAPTER III. METHODS AND PROCEDURES

Introduction

This chapter describes the methods and procedures used to implement this research, which included a pre-test and a post-test. The purpose of this study was to assess the perceptions of the 4-H youth regarding Total Quality Management (TQM) of their livestock projects. This research also sought to evaluate the effectiveness of the teaching materials presented to 4-H'ers through their clubs. The TQM assessment was conducted by this author, hereafter referred to as the researcher.

The decisions on appropriate methods and procedures were based on the specific objectives of the study. In this study, the steps followed were: 1) population and sample identification, (2) instrument development, (3) data collection, (4) managing non-respondents, (5) data coding, and (6) selection of data analysis techniques. This research was mainly a quantitative study. It included a pre-test aimed at establishing baseline data for perceptions of 4-H youth regarding total quality management of their livestock projects. These baseline data were necessary to evaluate the effectiveness of TQM teaching materials developed for use by youth with livestock projects. The pre-test was primarily a starting point assessment, a systematic way to identify educational deficiencies or problems, as well as a way of determining educational priorities. A post-test was administered to measure changes in perceptions of careful handling and other TQM practices by the young producers.

The instructional materials examined in this study were provided through a grant for the TQM project by the USDA. In the grant for the project there was a provision that each county in Iowa and Nebraska would receive a set of materials. Three regional training sessions were provided for extension staff and volunteers. The training on the use of the TQM materials was delivered by project directors. The counties had the option of endorsing (or not) these materials.
The counties also provided training to their volunteer club leaders. Each club leader had the option of using or not using the new materials.

**Population and Sample**

The sample in the 4-H youth study consisted of 800 4-H'ers from all over Iowa selected at random, from a list of 4-H'ers obtained from the 4-H office at Iowa State University. The list identified the youth according to the species of animal projects in which they were involved. The animal projects covered by the new TQM materials were in the following groups: (1) swine, (2) beef, (3) dairy, (4) sheep, (5) poultry, and (6) fish. However, due to the limitation of resources available for this project, it was decided to sample only from the 4-H'ers enrolled in swine, beef, sheep, and poultry projects. The total enrollment in the four animal projects which were the focus of this study was 28,908. Two hundred names per project were selected from each of the four animal projects, and 800 questionnaires were mailed in early October, 1993.

Fuller (1988) stated that as the sample increases to one hundred fifty, the more precisely it reflects the population, assuming random selection of the sample, irrespective of the population size. From one hundred fifty to two hundred it levels off, and above two hundred no further increase in precision is noted. This allows the researcher to generalize findings to the population if adequate randomization of the sample occurs.

**Development of Instruments**

Since this study was based on populations located throughout Iowa, mailed questionnaires were used as time and expense precluded personal contact (Tuckman, 1988). Content of the questionnaires was determined using a review of literature, and consultation with TQM co-project directors and faculty of Iowa State University. The questionnaires were reviewed by faculty and graduate students of the Department of Agricultural Education and Studies and members of the TQM project committee in Iowa and Nebraska. The ISU
Committee for Review of Research Involving Human Subjects reviewed the questionnaire and approved the research. A copy of the Human Subject Approval is provided in Appendix A.

Twenty questionnaires were mailed to young producers with a cover letter developed by the Agricultural Education Department. This pilot study was necessary as a check for validity and reliability. The review and testing resulted in several suggestions for improvement in the wording of both the cover letter and the questionnaires. Questions with possible ambiguous meanings were reworded. The program RELIABILITY was conducted using Statistical Analysis System (SAS, 1989) on twenty value questions to test internal consistency of items in questionnaires completed and returned by the 4-H'ers. A Cronbach Alpha score ranging from 0.78 to 0.83 (Table 2) was recorded for the various scales in the questionnaire. The Cronbach Alpha composite coefficient measures the reliability of the survey or the extent to which measurements can be depended upon to provide consistent information (Nunnally, 1982). The overall reliability for the various sub-scales was 0.78.

The questionnaire contained 20 questions that measured various TQM and food safety practices of the youth ranging from concern for consumers to the use of veterinarians. The TQM categories were provided by the TQM project co-directors in Iowa State Extension and the University of Nebraska-Lincoln Cooperative Extension as given in the TQM Curriculum for Youth Producers (TQM, 1993). Topics covered were provision of space, avoidance of hurt, reading directions, selection by performance, effect of handling, asking for help, responsibility for safe food, regular cleaning, veterinarian visits, reading labels, caring for animals, smooth loading, feed and medication records, study of feedback, effects of changes, vaccination programs, thinking about consumers, selection by appearance, regular record keeping, and to get awards. Items in the instrument were arranged in random order with about half (11) of the statements worded in a positive manner, for example, things usually go smoothly when I load animals and half (9) of the statements worded in a negative manner, for example, I learn how to care for my animals mostly by trial and error. Each item was ranked on a five-point Likert-
type scale from (a=5) *This is exactly like me* to (e=1) *This is not at all like me*. The negative items were recoded for analysis. Following the value questions were demographic questions ranging from age and gender to the type of animals kept. (See Appendix B for the instrument.)

In this study, the Likert scale is interpreted as:

- **exactly like me** 4.5-5
- **a lot like me** 3.5-4.4
- **somewhat like me** 2.5-3.4
- **a little like me** 1.5-2.4  
  low rating = below 2.5
- **not at all like me** 1.0-1.4  
  high rating = above 4.4

Using individual (not summated) Likert-type items (questions) as measurement tools is common in agricultural education, according to Clason and Dormody (1994). They reported that the *Journal of Agricultural Education* published 188 research articles in volumes 27 through 32. Responses to individual Likert-type items on measurement instruments were analyzed in 95, or more than half, of these articles.

A summated scale was proposed by Likert (1932) for the assessment of surveyed respondents' attitudes. Individual items in Likert's sample scale had five response alternatives: Strongly Approve, Approve, Undecided, Disapprove, and Strongly Disapprove. Likert noted that descriptors could be anything; it is not necessary to have negative and positive responses. He implied that the number of alternatives was also open to manipulation. Indeed, we see contemporary work using many classifications besides the traditional five-point classification; some researchers use an even number of categories, deleting the neutral response (Clason & Dormody, 1994).

There was a basic assumption in the original work of Likert (1932) that a perception scale would first be pilot-tested for reliability assessment of individual items. One method of assessing reliability might be to use the correlation between the item score and the total or use a
split-half procedure. Which ever method used, the researcher must discard items not correlated with the total. Thereafter, an attempt would be made to summarize data using totals. It appears that Likert did not consider the possibility of individual items being analyzed. Hence, the current confusion is whether a Likert scale refers to a summation of the item scores or if it refers to the number of response alternatives in individual items. The original monograph (Likert, 1932) shows that five-point, seven-point or other response alternatives to the scale were unintended. Although they would amount to a sort of scale when coded, they are not a Likert (summated) scale.

Clason and Dormody (1994) noted that scaling presumes the existence of an underlying (latent or natural) continuous variable whose value characterizes the respondent's attitudes or opinions. According to Clason and Dormody, if it were possible to measure the latent variable directly, the measurement scale would be, at best, an interval scale. Goldstein and Hersen (1984) stated this clearly:

The level of scaling obtained from the Likert procedure is rather difficult to determine. The scale is clearly at least ordinal. Those persons with the higher level properties in the natural variable are expected to get higher scores than those persons from lower properties... In order to achieve an interval scale, the properties on the scale variable have to correspond to differences in the trait on the natural variable. Since it seems unlikely that the categories formed by the misalignment of the five responses will all be equal, the interval scale assumption seems unlikely. (p. 52)

It is clear that each Likert-type item provides a discrete approximation of a continuous variable. Thus, a proper analysis of single items from Likert scales should recognize the discrete nature of the response. However, we should not confuse the above problem with the issue of parametric versus nonparametric analysis of the Likert scale scores, as addressed by Davis (1987) and Adams, Fagot, and Robinson (1965). The issue here is an examination of the proper analysis of single Likert-type items only. Despite the above controversy about the Likert scale, it was the best means of assessing perceptions that could be found in the literature.
Pre-test Data Collection

All the questionnaires were identified before they were mailed to permit a follow-up of non-respondents. The first batch of 800 questionnaires was mailed on September 22, 1993. Each questionnaire was accompanied by a note giving the purpose of the survey and asking the 4-H’ers to return the questionnaires by October 10, 1993. The follow-up questionnaires were mailed on February 10, 1994 to the non-respondents with a cover note asking the 4-H’ers to return the questionnaires by March 1, 1994. By February 1994, 306 questionnaires had been returned by the respondents. The data collection was completed following procedures used successfully by Dillman (1978).

Non-respondents

For the pre-test study, follow-up questionnaires were sent to 220 of the 494 non-respondents in February 1994. This sample size was determined using a formula developed by Krejcie and Morgan, (1970). Finally, 11 non-respondents were selected at random and contacted by phone. The questionnaire was introduced to them and their responses to seven of the questions were obtained. The final sample was 392 respondents, giving a response rate of 49%. A t-test was conducted between responses of the early and the late respondents and between those of the late respondents and the telephone respondents. Some significant differences were found. The six questions (practices) in each data set where differences were noted between the various categories of respondents (early, late, and phone) are indicated in Appendix D (1) and (2).

Researchers in the past have considered non-respondents in one of two ways. Most commonly, previous studies compared responses of early and late respondents to selected variables, using a t-test. If no significant differences were found, the results were generalized to the population and sample (Miller & Smith, 1983).

However, the use of early and late respondents have raised the concerns of researchers on the validity of results generalized to the population as a whole (Barrick & Na 1994). It
cannot be assumed that non-response is randomly distributed throughout a group. It has been shown that systematic differences can occur in the characteristics of respondents and non-respondents. It has been suggested that random telephone calls should be made to 10% of the non-respondents with the objective of eliciting responses to a random selection of questions drawn from the questionnaire (Ary, Jacobs, & Razavieh, 1985; Dillman, 1978).

Dillman (1978) and Fuller (1988) suggested that a response rate of 56% was acceptable. Response rates can range from 35% with a general population mailing to 56% using the quality mailing survey system (Maclean & Genn, 1979). Using the Dillman (1978) Total Design Method (TDM) could produce rates as high as 75%. Questionnaire length affects the response rate; longer questionnaires reduce the response rate (Dillman, 1978). From the foregoing, the return rate of 49% in the case of this study was somewhat low but within the expected range of responses (35-56%) reported by Maclean and Genn (1979).

**Data Coding**

As questionnaires were received, they were reviewed carefully for completeness and identity. Information obtained from the questionnaires was coded by the researcher, and data were transferred and stored using the central computer facilities of Iowa State University.

The accuracy of coding was determined by the row length. The row length was 34 columns for the 4-H data. In addition, columns for gender, coded as 0,1, and age (expected to range from 9-19) were checked for consistent data. Ages 9-11, 12-14, and 15 and over were coded as juniors, intermediates, and seniors (age groups), respectively. A random sample of entered questionnaires was checked for coding accuracy. After the first statistical program, FREQUENCIES, was conducted, a final check of data entry was performed to ensure no data entry errors had occurred. Inconsistent data were not found.
Data Analysis

Data were collected and stored in a file on the Iowa State University's mainframe computer, with back-up storage on a floppy-disc. For both the pre-test and post-test, the alpha level was set *a priori* at 0.5 level of significance. Data were entered into a Microsoft Works Spreadsheet and then exported to Wylbur in the Iowa State University mainframe. Using the Statistical Analysis System (SAS) program, descriptive statistics such as frequencies, means, and standard deviations were determined. Later, a complete program of analysis was developed that included correlation of variables, analysis of variance, plots, and distributions. The following procedures were the most relevant to the data: t-test, frequencies, correlations, means, sort by species, factor analysis, and multivariate analysis of variance (MANOVA). Also, a paired t-test was conducted to compare the pre-test and the post-test results. Usable pairs obtained from this analysis ranged from 152-159 for individual practices, whereas each of the various groupings of the TQM practices had 159 pairs.

Preliminary Factor Analysis

The recognizable categories of the questionnaire, as obtained from the *good management wheel spokes* given by *TQM curriculum for youth producers* (TQM, 1993, p. 104) were as follows:

1. **Animal resources:**
   - selection by appearance: "I select my project animals mainly by how they look."
   - selection by performance: "I consider the performance of the animal or its relatives when selecting a project animal."

2. **Human resources:**
   - asking for help: "I ask for help with my project when I don't understand how to do something."
   - to get awards: "I want to produce a quality animal so I can get a top award or ribbon."
   - effect of changes: "I know that how I handle my project makes a difference in how safe it is for people to eat."
<table>
<thead>
<tr>
<th>Vaccination programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I visit with my veterinarian about health care practices like vaccination I should be using.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thinking about consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I think about what consumers want when I raise my animal.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsibility for safe food</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I think it is up to food inspectors to see that food is safe to eat.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Veterinarian visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I only visit my veterinarian when I need health papers for a show or when my animal is really sick.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study for feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I study any feedback I get about the products I sell, such as carcass measurements, fat content, protein level or USDA grade.&quot;</td>
</tr>
</tbody>
</table>

3. **Operational processes:**

<table>
<thead>
<tr>
<th>Regular record keeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I do records once a year, when I have to turn them in to be graded or judged.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smooth loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Things usually go smoothly when I load or move animals.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reading labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I only read the label of a feed, medication or a chemical if I have a specific question.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effect of changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I know that changes I make for one part of my livestock operation affect other parts.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provision of space</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I make sure that my animals have space that is safe, secure, and large enough so they aren't crowded.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Avoidance of hurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;My animals or I get hurt a lot when I move, load or work with them.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feed and medication records</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I keep records of all the feed, medication, and chemicals I use in my project.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regular cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I put off cleaning my equipment and facilities until it is really bad or someone special is stopping by.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>And reading directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I read the directions on the label on all feeds, medications or chemicals before I use them.&quot;</td>
</tr>
</tbody>
</table>

Besides the above group categories, this researcher developed alternative categories which covered more groups than the three above. The various categories comprising group practices of TQM were used as the dependent variables for the multivariate analysis of variance.
(MANOVA). These groupings also formed the sub-scales of TQM used in determining the reliability of the questionnaire.

Alternative categories postulated by the researcher by making slight modifications to the three categories provided by the project (TQM, 1993) were as follows:

1. **Selection of animals:**

   - **selection by appearance**
     
     “I select my project animals mainly by how they look.”
   
   - **selection by performance**
     
     “I consider the performance of the animal or its relatives when selecting a project animal.”

2. **Concern for consumers:**

   - **to get awards**
     
     “I want to produce a quality animal so I can get a top award or ribbon.”
   
   - **effect of handling**
     
     “I know that how I handle my project makes a difference in how safe the animal is for people to eat.”
   
   - **thinking about consumers**
     
     “I think about what consumers want when I raise my animals.”
   
   - **responsibility for safe food**
     
     “I think it is up to food inspectors to see that food is safe to eat.”

3. **Care of animals/loading:**

   - **smooth loading**
     
     “Things usually go smoothly when I load or move animals.”
   
   - **provision of space**
     
     “I make sure that my animals have space that is safe, secure and large enough so they aren't crowded.”
   
   - **avoidance of hurt**
     
     “My animals and I get hurt a lot when I move, load or work with them.”
   
   - **regular cleaning**
     
     “I put off cleaning my equipment and facilities until it is really bad or someone special is stopping by.”

4. **Veterinarian help:**

   - **asking for help**
     
     “I ask for help with my project when I don't understand how to do something.”
vaccination programs

"I visit with my veterinarian about health care practices like a vaccination program I should be using."

caring for animals

"I learn how to care for my animals mostly by trial and error."

veterinarian visits

"I only visit my veterinarian when I need health papers for show or when my animal is very sick."

5. Reading labels and directions:

reading labels

"I only read the label of a feed, medication, or chemical if I have a specific question."

reading directions

"I read the directions on the label on all feeds, medication or chemical before I use them."

6. Records and management:

regular record keeping

"I do records once a year, when I have to turn them in to be graded or judged."

effect of changes

"I know that changes I make for one part of my livestock operation affect other parts."

feed and medication records

"I keep records of all the feed, medication or chemicals I use for my animal project."

study for feedback

"I study any feedback I get about the products I sell such as carcass measurements, fat content, protein level or USDA grade."

7. Total quality management (TQM):

all questions.

Post-test Data Collection

On February 20, 1995, approximately one year after the pre-test, questionnaires were mailed to the 392 4-H’ers who had previously responded. Just as in the pre-test, the questionnaires were identified by a number and were accompanied by instructions to guide the 4-H’ers in completing the instruments and returning them to the researcher as quickly as possible. After a three-week period, follow-up questionnaires were sent out to non-respondents, and finally a randomly selected sample (eleven non-respondents) was contacted on the telephone and their responses recorded. By June 1995, two hundred and twenty-seven (227) responses had been received for the post-test, a 58% response rate.
Data obtained from the respondents were recorded and analyzed using the SAS program of the Iowa State University mainframe as in the pre-test. Means and standard deviations, frequencies, correlations, factor analysis, analysis of variance, and multiple analysis of variance were performed. Special attention was paid to a paired t-test between responses on the pre-test and the post-test.

**Questionnaire Reliability**

The internal consistency of the items used to measure Total Quality Management was determined by computing the Cronbach’s alpha for each set of groupings of the individual practices of TQM. The first set included animal resources, human resources and operational processes. The alternative grouping included selection of animals, concern for consumers, care of animals and loading, veterinarian help, reading labels and records and management. For the pre-test data only, the Cronbach’s alpha overall reliability coefficient was 0.78 (Table 2) while for the combined data of the pre-test and the post-test results, the Cronbach’s alpha was 0.80. These figures indicate high reliability of the questionnaire. In other words, the items selected to measure Total Quality Management would ensure that repeated administration of the questionnaire would reproduce the scores. A Cronbach alpha composite coefficient measures the reliability of the survey, or the extent to which measurements can be depended upon to provide consistent information (Nunnally, 1982).
Table 2. Cronbach alpha reliability (internal consistency) of the TQM instrument

<table>
<thead>
<tr>
<th>TQM practices</th>
<th>Cronbach Alpha (Pre-test only)</th>
<th>(Pre-test &amp; Post-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouped into three (after TQM, 1993)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal resources</td>
<td>0.83</td>
<td>0.86</td>
</tr>
<tr>
<td>Human resources</td>
<td>0.79</td>
<td>0.82</td>
</tr>
<tr>
<td>Operational processes</td>
<td>0.79</td>
<td>0.82</td>
</tr>
<tr>
<td>Alternative Grouping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection of animals</td>
<td>0.83</td>
<td>0.86</td>
</tr>
<tr>
<td>Concern for consumers</td>
<td>0.81</td>
<td>0.84</td>
</tr>
<tr>
<td>Care of animals/loading</td>
<td>0.81</td>
<td>0.84</td>
</tr>
<tr>
<td>Veterinarian help</td>
<td>0.80</td>
<td>0.84</td>
</tr>
<tr>
<td>Reading labels and directions</td>
<td>0.81</td>
<td>0.84</td>
</tr>
<tr>
<td>Records and management</td>
<td>0.82</td>
<td>0.84</td>
</tr>
<tr>
<td>Total Quality Management</td>
<td><strong>0.78</strong></td>
<td><strong>0.80</strong></td>
</tr>
</tbody>
</table>
CHAPTER IV. FINDINGS

Introduction

This chapter presents the results of this study. The aim of this chapter is to present the data obtained from the study. The data are summarized into tables and charts as necessary. The results presented in this chapter address the objectives of this study. The primary purpose of this study was to assess the perceptions of the 4-H youth regarding the Total Quality Management (TQM) of their livestock projects and the production of safe food before and after they received the new Total Quality Management (TQM) Curriculum for Youth Producers (TQM, 1993). Thus, a secondary purpose was to assess the impact of the TQM curriculum on 4-H’ers’ perceptions. The chapter will present the results of the pre-test first and then later the post-test results. The specific objectives of the study were: (1) to identify the demographics of 4-H’ers, (2) to identify perceptions of youth regarding their implementation of TQM livestock practices for enhancing food safety, (3) to assess the effect of TQM instructional materials on young producers’ perceptions of their role in food safety, (4) to determine relationships between demographics and total quality management (TQM) perceptions and practices, and (5) to identify skill areas of animal care where the youth needed the most help.

Details of the demographic data are presented first. Next, the ratings of the TQM practices are discussed. The results of analysis of multivariate analysis of variance, showing the effect of various factors on TQM are presented, and a comparison between the pre-test and the post-test results is made. Finally, the chapter presents a factor analysis of individual TQM practices. The results are presented in the order of objectives.

Objective 1: Demographic Identification of 4-H’ers

The mean age of the 4-H’ers was 14. This was also the median age. The 4-H’ers’ ages ranged from 9 to 19 years (Table 3). According to the demographic data, many of the 4-H’ers (42%) were in the intermediate age group while junior and senior age groups each had
29% of the 4-H’ers. Also, many (43%) of the 4-H’ers had enrolled in 4-H for more than four years (Table 4). The mean for length of enrollment in 4-H was 5 years. Almost 20% of the 4-H’ers were also enrolled in FFA, but over 80% were not (Table 5). A majority (55%) of the respondents were male (Table 6).

Table 3. Percentages and frequencies of respondents by age

<table>
<thead>
<tr>
<th>Age and age grouping</th>
<th>Levels</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>9</td>
<td>6.3</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>9.6</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>13.2</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>13.7</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>15.3</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>13.4</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>12.0</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>9.6</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>5.2</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>1.4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>0.3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>154</td>
<td>100.0</td>
<td>365</td>
</tr>
</tbody>
</table>

According to the demographic data, one hundred and thirty-four 4-H’ers (49%) said they kept more than one species of animal. Fifty-one 4-H’ers (19%) indicated they kept swine only. Forty 4-H’ers (15%) indicated they kept beef only. Thirty-four 4-H’ers (12%) kept sheep, while 17 (6%) indicated they kept poultry only (Table 7).
Table 4. Percentages and frequencies of respondents by enrollment in 4-H

<table>
<thead>
<tr>
<th>Enrollment by years in 4-H</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.6</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>9.9</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>13.6</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>17.2</td>
<td>61</td>
</tr>
<tr>
<td>4</td>
<td>15.8</td>
<td>56</td>
</tr>
<tr>
<td>5</td>
<td>15.3</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>11.0</td>
<td>39</td>
</tr>
<tr>
<td>7</td>
<td>7.9</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>5.9</td>
<td>21</td>
</tr>
<tr>
<td>9</td>
<td>2.5</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>0.3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td><strong>354</strong></td>
</tr>
</tbody>
</table>

Table 5. Percentages and frequencies of 4-H respondents enrolled in FFA

<table>
<thead>
<tr>
<th>Enrollment by years in FFA</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>83.1</td>
<td>295</td>
</tr>
<tr>
<td>1</td>
<td>6.2</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>5.1</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>3.9</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>1.1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>0.6</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td><strong>355</strong></td>
</tr>
</tbody>
</table>
Table 6. Percentages and frequencies of respondents by gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>55.4</td>
<td>196</td>
</tr>
<tr>
<td>Female</td>
<td>44.6</td>
<td>158</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>354</td>
</tr>
</tbody>
</table>

Table 7. Percentages and frequencies of pre-test respondents by animal species

<table>
<thead>
<tr>
<th>Animal species</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swine only</td>
<td>18.48</td>
<td>51</td>
</tr>
<tr>
<td>Beef only</td>
<td>14.49</td>
<td>40</td>
</tr>
<tr>
<td>Sheep only</td>
<td>12.49</td>
<td>34</td>
</tr>
<tr>
<td>Poultry only</td>
<td>6.16</td>
<td>17</td>
</tr>
<tr>
<td>More than one species</td>
<td>48.55</td>
<td>134</td>
</tr>
<tr>
<td>Total</td>
<td>276</td>
<td>276</td>
</tr>
</tbody>
</table>

Objective 2: Perception Identification of 4-H’ers Regarding TQM Implementation

The perceptions of 4-H’ers regarding their implementation of total quality management practices were assessed on a 5-point scale, and results are displayed in Table 8. The positive statement on provision of space was accepted with 68.8% of the ratings being given for
"exactly like me" and 22.8% to "a lot like me". Asking for help was also accepted with 41.9% of the ratings being given to "exactly like me" and 39.3% to "a lot like me". The 4-H'ers tended to agree that they selected their animals by appearance with 40.5% of the ratings given to "a lot like me" and 18.3% to "exactly like me". The 4-H'ers avoided hurting their animals, where 53.7% of the ratings were given to "not at all like me", made regular veterinarian visits, where 47.7% of the ratings were given to "not at all like me", and undertook regular cleaning where 42.5% of ratings were for "not at all like me."

Table 8. Percentages and frequencies of pre-test respondents’ ratings of TQM practices

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exactly like me</td>
<td>A lot like me</td>
</tr>
<tr>
<td>&quot;I select my project animals mainly by how they look&quot;</td>
<td>18.3</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>41.9</td>
<td>149</td>
</tr>
<tr>
<td>&quot;I ask for help with my project when I don’t understand how to do something&quot;</td>
<td>52.2</td>
<td>191</td>
</tr>
<tr>
<td></td>
<td>26.7</td>
<td>95</td>
</tr>
<tr>
<td>&quot;I want to produce a quality animal so I can get a top award or ribbon&quot;</td>
<td>39.1</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>23.8</td>
<td>83</td>
</tr>
<tr>
<td>&quot;I do records once a year, when I have to turn them in to be graded or judged&quot;</td>
<td>23.3</td>
<td>83</td>
</tr>
<tr>
<td>&quot;Things usually go smoothly when I load or move animals&quot;</td>
<td>39.1</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>23.8</td>
<td>83</td>
</tr>
</tbody>
</table>
Table 8. (Continued)

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Percentage Frequency</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>“I visit with my veterinarian about health care practices like a vaccination program I should be using”</td>
<td>13.2 48</td>
<td>15.9 58</td>
<td>25.3 92</td>
<td>21.4 78</td>
<td>24.2 88</td>
<td></td>
</tr>
<tr>
<td>“I think about what consumers want when I raise my animals”</td>
<td>18.0 64</td>
<td>32.9 117</td>
<td>26.1 93</td>
<td>13.8 49</td>
<td>9.3 33</td>
<td></td>
</tr>
<tr>
<td>“I learn how to care for my animals mainly by trial and error”</td>
<td>16.3 58</td>
<td>24.2 86</td>
<td>24.5 87</td>
<td>16.1 57</td>
<td>18.9 67</td>
<td></td>
</tr>
<tr>
<td>“I read the directions on the label on all feeds, medications or chemicals before I use them”</td>
<td>6.3 23</td>
<td>13.1 48</td>
<td>28.1 103</td>
<td>24.9 91</td>
<td>27.6 101</td>
<td></td>
</tr>
<tr>
<td>“I think that it is up to food inspectors to see to it that food is safe to eat”</td>
<td>11.6 41</td>
<td>15.0 53</td>
<td>27.8 98</td>
<td>17.3 61</td>
<td>28.3 100</td>
<td></td>
</tr>
<tr>
<td>“I know that changes I make for one part of my livestock operation affect other parts”</td>
<td>21.8 77</td>
<td>41.8 148</td>
<td>25.7 91</td>
<td>7.9 28</td>
<td>2.8 10</td>
<td></td>
</tr>
<tr>
<td>“I consider the performance of the animal or its relatives when selecting a project animal”</td>
<td>42.1 90</td>
<td>44.9 96</td>
<td>10.7 23</td>
<td>1.4 3</td>
<td>0.9 2</td>
<td></td>
</tr>
<tr>
<td>“I make sure that my animals have space that is safe, secure and large enough so that they aren’t crowded”</td>
<td>68.8 148</td>
<td>22.8 49</td>
<td>6.0 13</td>
<td>0.5 1</td>
<td>1.9 4</td>
<td></td>
</tr>
<tr>
<td>“My animals and I get hurt a lot when I move, load or work with them”</td>
<td>0.5 1</td>
<td>1.9 4</td>
<td>6.5 14</td>
<td>37.5 81</td>
<td>53.7 116</td>
<td></td>
</tr>
</tbody>
</table>
Table 8. (Continued)

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Exactly like me</th>
<th>A lot like me</th>
<th>Somewhat like me</th>
<th>Little like me</th>
<th>Not at all like me</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I only visit my veterinarian when I need health papers for a show or when</td>
<td>7.9</td>
<td>9.8</td>
<td>13.1</td>
<td>21.5</td>
<td>47.7</td>
</tr>
<tr>
<td>my animal is really sick”</td>
<td>17</td>
<td>21</td>
<td>28</td>
<td>46</td>
<td>102</td>
</tr>
<tr>
<td>“I keep records of all the feed, medication or chemicals I use in my animal</td>
<td>29.0</td>
<td>43.0</td>
<td>15.4</td>
<td>9.3</td>
<td>3.3</td>
</tr>
<tr>
<td>project”</td>
<td>62</td>
<td>92</td>
<td>33</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>“I put off cleaning my equipment and facilities until it is really bad or</td>
<td>2.8</td>
<td>4.7</td>
<td>26.6</td>
<td>23.4</td>
<td>42.5</td>
</tr>
<tr>
<td>someone special is stopping by”</td>
<td>6</td>
<td>10</td>
<td>57</td>
<td>50</td>
<td>91</td>
</tr>
<tr>
<td>“I study any feedback I get about the products I sell, such as carcass</td>
<td>10.4</td>
<td>56.4</td>
<td>19.0</td>
<td>8.5</td>
<td>5.7</td>
</tr>
<tr>
<td>measurement, fat content, protein level or USDA grade”</td>
<td>22</td>
<td>119</td>
<td>40</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>“I read the directions on the label on all feeds, medications or chemicals</td>
<td>62.1</td>
<td>20.1</td>
<td>11.2</td>
<td>4.7</td>
<td>1.9</td>
</tr>
<tr>
<td>before I use them”</td>
<td>133</td>
<td>43</td>
<td>24</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>


The means and standard deviations of the twenty TQM practices are summarized in Table 9. The rating for avoidance of hurt, *My animals and I get hurt a lot when I move, load or work with them* was the highest (mean of 4.59 out of a possible highest score of 5). The 4-H’ers disagreed strongly to this negative statement. This was followed by the provision of space, *I make sure that my animals have space that is safe, secure and large enough so that they aren’t crowded* which scored 4.56, followed by asking for help, *I ask for help with my project when I don’t understand how to do something*, with a rating of 4.19.

The lowest rating was given to getting awards, *I want to produce a quality animal so I can get a top award or ribbon* with a mean of 1.78. This was a negative statement that was recoded. However, youth were likely to have thought that getting awards was a good objective of producing quality animals. The next lowest score was given to selection by appearance, *I select my project animals mainly by how they look* (mean = 2.24). Again, youth may have been confused by this negative statement, thereby thinking it was all right to select mainly by appearance. The third lowest rating was given to regular record keeping, *I do records once a year, when I have to turn them in to be graded or judged* (mean = 2.29).

When the twenty individual items were put into the groups suggested by the researcher, the highest rating was for care of animals and loading with a mean of 4.23, followed by reading labels and directions (mean of 3.64), and veterinarian help (mean of 3.21) (Table 9). The lowest rated grouped practice was records and management (mean = 2.84) followed by concern for consumers, which had a mean of 3.05. When using three groups according to the TQM manual (TQM, 1993), operational processes had the highest rating (mean = 3.77), while human resources had the lowest (mean = 3.13). Scores that were lower than the others may have been due to the ambiguity of the statements or lower ratings might be an indication of the need to direct future educational efforts into topics covered by these statements.
Table 9. Pre-test means and standard deviations of Total Quality Management (TQM) practices

<table>
<thead>
<tr>
<th>TQM practices</th>
<th>n</th>
<th>Means</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual practices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoidance of hurt</td>
<td>367</td>
<td>4.59</td>
<td>0.87</td>
</tr>
<tr>
<td>Provision of space</td>
<td>356</td>
<td>4.56</td>
<td>0.69</td>
</tr>
<tr>
<td>Asking for help</td>
<td>356</td>
<td>4.19</td>
<td>0.84</td>
</tr>
<tr>
<td>Regular cleaning</td>
<td>354</td>
<td>4.15</td>
<td>1.04</td>
</tr>
<tr>
<td>Selection by performance</td>
<td>366</td>
<td>3.98</td>
<td>1.06</td>
</tr>
<tr>
<td>Effect of handling</td>
<td>356</td>
<td>3.79</td>
<td>1.04</td>
</tr>
<tr>
<td>Reading directions</td>
<td>351</td>
<td>3.75</td>
<td>1.14</td>
</tr>
<tr>
<td>Effects of changes</td>
<td>354</td>
<td>3.72</td>
<td>0.98</td>
</tr>
<tr>
<td>Smooth loading</td>
<td>356</td>
<td>3.70</td>
<td>1.06</td>
</tr>
<tr>
<td>Feed and medication records</td>
<td>364</td>
<td>3.65</td>
<td>1.30</td>
</tr>
<tr>
<td>Reading labels</td>
<td>366</td>
<td>3.54</td>
<td>1.20</td>
</tr>
<tr>
<td>Thinking about consumers</td>
<td>356</td>
<td>3.36</td>
<td>1.19</td>
</tr>
<tr>
<td>Responsibility for safe food</td>
<td>353</td>
<td>3.36</td>
<td>1.34</td>
</tr>
<tr>
<td>Study of feedback</td>
<td>346</td>
<td>3.03</td>
<td>1.33</td>
</tr>
<tr>
<td>Veterinarian visits</td>
<td>352</td>
<td>3.01</td>
<td>1.37</td>
</tr>
<tr>
<td>Caring for animals</td>
<td>355</td>
<td>2.97</td>
<td>1.35</td>
</tr>
<tr>
<td>Vaccination programs</td>
<td>364</td>
<td>2.72</td>
<td>1.34</td>
</tr>
<tr>
<td>Regular record keeping</td>
<td>353</td>
<td>2.29</td>
<td>1.34</td>
</tr>
<tr>
<td>Selection by appearance</td>
<td>354</td>
<td>2.24</td>
<td>1.03</td>
</tr>
<tr>
<td>To get awards</td>
<td>366</td>
<td>1.78</td>
<td>1.01</td>
</tr>
<tr>
<td>Grouped into three</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal resources</td>
<td>364</td>
<td>3.66</td>
<td>0.53</td>
</tr>
<tr>
<td>Human resources</td>
<td>364</td>
<td>3.20</td>
<td>0.72</td>
</tr>
<tr>
<td><strong>Alternative grouping</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care of animals/loading</td>
<td>364</td>
<td>4.23</td>
<td>0.59</td>
</tr>
<tr>
<td>Reading labels and directions</td>
<td>363</td>
<td>3.64</td>
<td>0.90</td>
</tr>
<tr>
<td>Veterinarian help</td>
<td>364</td>
<td>3.21</td>
<td>0.77</td>
</tr>
<tr>
<td>Selection of animals</td>
<td>364</td>
<td>3.20</td>
<td>0.72</td>
</tr>
<tr>
<td>Concern for consumers</td>
<td>364</td>
<td>3.05</td>
<td>0.67</td>
</tr>
<tr>
<td>Records and management</td>
<td>364</td>
<td>2.84</td>
<td>0.70</td>
</tr>
<tr>
<td><strong>Total Quality Management</strong></td>
<td>364</td>
<td>3.42</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Scale: 5= exactly like me; 4=a lot like me; 3=somewhat like me; 2=a little like me; 1= not at all like me.

r recoded item.
As in the pretest, the post-test perceptions of 4-H’ers were assessed on a five-point likert-type scale. The results are displayed in Table 10. The positive statement on provision of space was accepted with 64.3% of the ratings being given for “exactly like me” and 29.2% to “a lot like me”. The next most highly rated TQM practice was reading directions with 62.1% of the ratings given to “exactly like me” and 20.1% to “a lot like me”. This was followed by the negative statement on avoidance of hurt to animals which was rejected with 53.7% of the ratings going to “not at all like me” and 37% to “little like me”. 4-H’ers agreed that they produced quality animals so as to get a top award or ribbon by giving 51.2% of the ratings to “exactly like me”. The purpose of the post-test was to confirm or reject any trends found in the pre-test. It also had an important function in helping to assess any increase or decrease of ratings as a result of presentation of the TQM materials to the 4-H’ers.

The means and standard deviations of the twenty TQM questions are summarized in Table 11. The highest score was given to provision of space, I make sure that my animals have space that is safe, secure and large enough so that they aren’t crowded (mean = 4.56). 4-H’ers rated highly (4.43) avoidance of hurt. This was a recoded statement meaning that neither animals nor 4-H’ers get hurt a lot. Reading directions, I read directions on the label on all feeds, medications or chemicals before I use them was also rated highly with a mean rating of 4.35. The highest rated group practice was care of animals/loading with a mean of 4.21 followed by reading labels (mean of 4.12). When the TQM practices were grouped into three (TQM, 1993) operational processes was the highest rated (mean = 3.83). This again confirms the trend in the pre-test. Just as in the pre-test, the lowest rated group practice was records and management which had a mean of 3.00, followed by concern for consumers, which had a mean of 3.13 in the post-test as compared to 3.05 in the pre-test.
Table 10. Percentages and frequencies of post-test respondents' ratings of the TQM practices

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exactly like me</td>
<td>A lot like me</td>
</tr>
<tr>
<td>&quot;I select my project animals mainly by how they look&quot;</td>
<td>13.8</td>
<td>52.3</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>114</td>
</tr>
<tr>
<td>&quot;I ask for help with my project when I don't understand how to do something&quot;</td>
<td>37.6</td>
<td>42.7</td>
</tr>
<tr>
<td></td>
<td>82</td>
<td>93</td>
</tr>
<tr>
<td>&quot;I want to produce a quality animal so I can get a top award or ribbon&quot;</td>
<td>51.2</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>111</td>
<td>65</td>
</tr>
<tr>
<td>&quot;I know that how I handle my project makes a difference in how safe the animal is for people to eat&quot;</td>
<td>42.2</td>
<td>37.6</td>
</tr>
<tr>
<td></td>
<td>92</td>
<td>82</td>
</tr>
<tr>
<td>&quot;I do records once a year, when I have to turn them in to be graded or judged&quot;</td>
<td>35.2</td>
<td>37.5</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>81</td>
</tr>
<tr>
<td>&quot;Things usually go smoothly when I load or move animals&quot;</td>
<td>26.4</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>57</td>
<td>88</td>
</tr>
<tr>
<td>&quot;I visit with my veterinarian about health care practices like a vaccination program I should be using&quot;</td>
<td>5.0</td>
<td>26.1</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>57</td>
</tr>
<tr>
<td>&quot;I think about what consumers want when I raise my animals&quot;</td>
<td>6.9</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>&quot;I learn how to care for my animals mainly by trial and error&quot;</td>
<td>6.5</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>&quot;I read the directions on the label on all feeds, medications or chemicals before I use them&quot;</td>
<td>1.4</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>&quot;I think it is up to food inspectors to see that food is safe to eat&quot;</td>
<td>4.2</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>16</td>
</tr>
</tbody>
</table>
Table 10. (Continued)

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Percentage Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exactly like me</td>
</tr>
<tr>
<td>&quot;I know that changes I make for one part of my livestock operation affect other parts&quot;</td>
<td>24</td>
</tr>
<tr>
<td>&quot;I consider the performance of the animal or its relatives when selecting a project animal&quot;</td>
<td>90</td>
</tr>
<tr>
<td>&quot;I make sure that my animals have space that is safe, secure and large enough so that they aren't crowded&quot;</td>
<td>148</td>
</tr>
<tr>
<td>&quot;My animals and I get hurt a lot when I move, load or work with them&quot;</td>
<td>1</td>
</tr>
<tr>
<td>&quot;I only visit my veterinarian when I need health papers for a show or when my animal is really sick&quot;</td>
<td>17</td>
</tr>
<tr>
<td>&quot;I keep records of all the feed, medication or chemicals I use in my animal project&quot;</td>
<td>62</td>
</tr>
<tr>
<td>&quot;I put off cleaning my equipment and facilities until it is really bad or someone special is stopping by&quot;</td>
<td>6</td>
</tr>
<tr>
<td>&quot;I study any feedback I get about the products I sell, such as carcass measurement, fat content, protein level or USDA grade&quot;</td>
<td>22</td>
</tr>
<tr>
<td>&quot;I read the directions on the label on all feeds, medications or chemicals before I use them&quot;</td>
<td>133</td>
</tr>
</tbody>
</table>
Objective 3: Effect of TQM Instructional Materials

Objective 3 was to assess the effect of the TQM instructional materials on young producers’ perceptions of their roles in producing safe food. The method used to realize this objective was to compare the results of the pre-test with those of the post-test. However, the researcher was aware that there are a number other factors in addition to the effect of instructional materials that could affect 4-H’ers responses on the post-test.

Table 12 displays the paired t-tests between post-test and pre-test results. Of the twenty TQM practices, 12 had a positive increase in the post-test over the pre-test results while the remaining had either no increase or a decrease. Of the three group TQM practices, two had a positive increase in the post-test over the pre-test. Two of the alternative grouping of six had a positive increase in the post-test, while the combined practices of Total Quality Management had an increase of 0.15 in the post-test mean over the pre-test mean on a scale of 1-5 ($t = 3.26; p < 0.05$). This change in scores in the post-test over the pre-test is an indication of the improvement of performance by the 4-H’ers. Since the new TQM materials had been available to 4-H’ers at the time the post-test was done, at least some of the improvement might be attributed to the effectiveness of the teaching materials. Other extraneous variables that could affect the validity of the assessment are historical events in the year interval, the pre-test effect, maturation of 4-H’ers, differences in the curriculum delivery in the 4-H clubs, and the county location of the 4-H’ers. It should be noted that only 17% indicated that food safety had been emphasized in their clubs. A look at the distribution of the percentages of the ratings for all the TQM practices reveals a fairly consistent distribution of the ratings over the Likert-type scale, when the results of the pre-test are compared to those of the post-test (Table 13). Also, the pre-test and the post-test are in agreement in terms of the practices that are the highest and lowest in mean ratings (Tables 9 and 11).
Table 11. Means and standard deviations of post-test respondents' ratings of TQM practices

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>n</th>
<th>Means</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual practices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provision of space</td>
<td>220</td>
<td>4.56</td>
<td>0.79</td>
</tr>
<tr>
<td>Avoidance of hurt</td>
<td>221</td>
<td>4.43</td>
<td>0.73</td>
</tr>
<tr>
<td>Reading directions</td>
<td>218</td>
<td>4.35</td>
<td>0.99</td>
</tr>
<tr>
<td>Selection by performance</td>
<td>217</td>
<td>4.25</td>
<td>0.79</td>
</tr>
<tr>
<td>Effect of handling</td>
<td>221</td>
<td>4.18</td>
<td>0.86</td>
</tr>
<tr>
<td>Asking for help</td>
<td>221</td>
<td>4.16</td>
<td>0.81</td>
</tr>
<tr>
<td>Responsibility for safe food</td>
<td>218</td>
<td>4.00</td>
<td>1.08</td>
</tr>
<tr>
<td>Regular cleaning</td>
<td>218</td>
<td>3.99</td>
<td>1.06</td>
</tr>
<tr>
<td>Veterinarian visits</td>
<td>218</td>
<td>3.90</td>
<td>1.31</td>
</tr>
<tr>
<td>Reading labels</td>
<td>217</td>
<td>3.89</td>
<td>0.89</td>
</tr>
<tr>
<td>Caring for animals</td>
<td>217</td>
<td>3.87</td>
<td>1.15</td>
</tr>
<tr>
<td>Thinking about consumers</td>
<td>218</td>
<td>3.38</td>
<td>1.12</td>
</tr>
<tr>
<td>Vaccination programs</td>
<td>221</td>
<td>3.00</td>
<td>1.0</td>
</tr>
<tr>
<td>Effects of changes</td>
<td>217</td>
<td>2.56</td>
<td>0.80</td>
</tr>
<tr>
<td>Study of feedback</td>
<td>215</td>
<td>2.44</td>
<td>0.98</td>
</tr>
<tr>
<td>Selection by appearance</td>
<td>221</td>
<td>2.24</td>
<td>0.76</td>
</tr>
<tr>
<td>Feed and medication records</td>
<td>218</td>
<td>2.16</td>
<td>1.04</td>
</tr>
<tr>
<td>Smooth loading</td>
<td>219</td>
<td>2.15</td>
<td>0.97</td>
</tr>
<tr>
<td>Regular record keeping</td>
<td>218</td>
<td>2.05</td>
<td>1.05</td>
</tr>
<tr>
<td>To get awards</td>
<td>219</td>
<td>1.70</td>
<td>0.85</td>
</tr>
<tr>
<td><strong>Grouped into three</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operational processes</strong></td>
<td></td>
<td>3.83</td>
<td>0.43</td>
</tr>
<tr>
<td><strong>Human resources</strong></td>
<td></td>
<td>3.40</td>
<td>0.41</td>
</tr>
<tr>
<td><strong>Animal resources</strong></td>
<td></td>
<td>3.23</td>
<td>0.51</td>
</tr>
<tr>
<td><strong>Alternative grouping</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care of animals/loading</td>
<td>220</td>
<td>4.21</td>
<td>0.57</td>
</tr>
<tr>
<td>Reading labels</td>
<td>218</td>
<td>4.12</td>
<td>0.74</td>
</tr>
<tr>
<td>Veterinarian help</td>
<td>220</td>
<td>3.74</td>
<td>0.66</td>
</tr>
<tr>
<td>Selection of animals</td>
<td>220</td>
<td>3.24</td>
<td>0.51</td>
</tr>
<tr>
<td>Concern for consumers</td>
<td>220</td>
<td>3.13</td>
<td>0.43</td>
</tr>
<tr>
<td>Records and management</td>
<td>218</td>
<td>3.00</td>
<td>0.57</td>
</tr>
<tr>
<td><strong>Total Quality Management</strong></td>
<td>221</td>
<td>3.51</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Scale: 5=exactly like me; 4=a lot like me; 3=somewhat like me; 2=little like me; 1=not at all like me.

^r recoded item.
Table 12. Paired-t tests between post- and pre-test ratings of TQM practice by 4-H’ers

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>n</th>
<th>Mean difference (Post-test/Pre-test)</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection by appearance*</td>
<td>157</td>
<td>-0.31</td>
<td>-3.17</td>
<td>0.0018*</td>
</tr>
<tr>
<td>Ask for help</td>
<td>157</td>
<td>-0.31</td>
<td>-3.17</td>
<td>0.0018*</td>
</tr>
<tr>
<td>To get awards*</td>
<td>158</td>
<td>-0.10</td>
<td>-0.99</td>
<td>0.3226</td>
</tr>
<tr>
<td>Effect of handling</td>
<td>159</td>
<td>0.53</td>
<td>5.39</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Regular record keeping*</td>
<td>156</td>
<td>-0.13</td>
<td>-1.02</td>
<td>0.3110</td>
</tr>
<tr>
<td>Smooth loading</td>
<td>158</td>
<td>0.31</td>
<td>2.98</td>
<td>0.0033*</td>
</tr>
<tr>
<td>Vaccination programs</td>
<td>157</td>
<td>0.23</td>
<td>1.78</td>
<td>0.0768</td>
</tr>
<tr>
<td>Thinking about consumers</td>
<td>157</td>
<td>-0.75</td>
<td>-5.86</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Caring for animals*</td>
<td>157</td>
<td>0.78</td>
<td>5.57</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Reading labels*</td>
<td>155</td>
<td>0.38</td>
<td>3.24</td>
<td>0.0014*</td>
</tr>
<tr>
<td>Responsibility for safe food*</td>
<td>155</td>
<td>0.55</td>
<td>4.21</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Effect of changes</td>
<td>156</td>
<td>-0.20</td>
<td>-2.03</td>
<td>0.0437*</td>
</tr>
<tr>
<td>Selection by performance</td>
<td>157</td>
<td>0.22</td>
<td>2.05</td>
<td>0.0418*</td>
</tr>
<tr>
<td>Provision of space</td>
<td>157</td>
<td>0</td>
<td>0</td>
<td>1.0000</td>
</tr>
<tr>
<td>Avoidance of hurt*</td>
<td>158</td>
<td>0.11</td>
<td>-1.12</td>
<td>0.2626</td>
</tr>
<tr>
<td>Veterinarian visits*</td>
<td>154</td>
<td>0.71</td>
<td>4.62</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Feed and medication records</td>
<td>157</td>
<td>0.25</td>
<td>1.89</td>
<td>0.0603</td>
</tr>
<tr>
<td>Regular cleaning*</td>
<td>156</td>
<td>-0.10</td>
<td>-0.83</td>
<td>0.4071</td>
</tr>
<tr>
<td>Study of feedback</td>
<td>152</td>
<td>0.41</td>
<td>3.03</td>
<td>0.0029*</td>
</tr>
<tr>
<td>Reading directions</td>
<td>155</td>
<td>0.66</td>
<td>5.75</td>
<td>0.0001*</td>
</tr>
</tbody>
</table>
Table 12. (Continued)

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>n</th>
<th>Mean difference (Post-test/Pre-test)</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grouped into three</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Animal resources</em></td>
<td>159</td>
<td>-0.03</td>
<td>-0.50</td>
<td>0.6197</td>
</tr>
<tr>
<td><em>Human resources</em></td>
<td>159</td>
<td>0.20</td>
<td>3.56</td>
<td>0.0005*</td>
</tr>
<tr>
<td><em>Operational processes</em></td>
<td>159</td>
<td>-0.11</td>
<td>2.06</td>
<td>0.0407*</td>
</tr>
<tr>
<td><strong>Alternative grouping of TQM practices</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection of animals</td>
<td>159</td>
<td>-0.03</td>
<td>-0.50</td>
<td>0.6197</td>
</tr>
<tr>
<td>Concern for consumers</td>
<td>159</td>
<td>0.05</td>
<td>0.86</td>
<td>0.3888</td>
</tr>
<tr>
<td>Care of animals/loading</td>
<td>159</td>
<td>0.03</td>
<td>0.48</td>
<td>0.6303</td>
</tr>
<tr>
<td>Veterinarian help</td>
<td>159</td>
<td>0.44</td>
<td>5.50</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Reading labels</td>
<td>158</td>
<td>0.51</td>
<td>5.62</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Records and management</td>
<td>159</td>
<td>0.12</td>
<td>1.84</td>
<td>0.0674</td>
</tr>
<tr>
<td><strong>Total Quality Management (TQM)</strong></td>
<td>159</td>
<td>0.15</td>
<td>3.26</td>
<td><strong>0.0014</strong>*</td>
</tr>
</tbody>
</table>

* p<.05.

* recoded item.
Table 13. Comparison of pre-test/post-test percentages for ratings of all the TQM practices

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Pre-test percentage</th>
<th>Post-test percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exactly like me</td>
<td>A lot like me</td>
</tr>
<tr>
<td>&quot;I select my project animals mainly by how they look&quot;</td>
<td>18.3</td>
<td>40.5</td>
</tr>
<tr>
<td></td>
<td>13.8</td>
<td>52.3</td>
</tr>
<tr>
<td>&quot;I ask for help with my project when I don't understand how to do something&quot;</td>
<td>41.9</td>
<td>39.3</td>
</tr>
<tr>
<td></td>
<td>37.6</td>
<td>42.7</td>
</tr>
<tr>
<td>&quot;I want to produce a quality animal so I can get a top award or ribbon&quot;</td>
<td>52.2</td>
<td>27.9</td>
</tr>
<tr>
<td></td>
<td>51.2</td>
<td>30.0</td>
</tr>
<tr>
<td>&quot;I know that how I handle my project makes a difference in how safe the animal is for people to eat&quot;</td>
<td>26.7</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>42.2</td>
<td>37.6</td>
</tr>
<tr>
<td>&quot;I do records once a year, when I have to turn them in to be graded or judged&quot;</td>
<td>39.1</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>35.2</td>
<td>37.5</td>
</tr>
<tr>
<td>&quot;Things usually go smoothly when I load or move animals&quot;</td>
<td>23.3</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>26.4</td>
<td>40.7</td>
</tr>
<tr>
<td>&quot;I visit with my veterinarian about health care practices like a vaccination program I should be using&quot;</td>
<td>13.2</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>26.1</td>
</tr>
<tr>
<td>&quot;I think about what consumers want when I raise my animals&quot;</td>
<td>18.0</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>6.9</td>
<td>18.5</td>
</tr>
<tr>
<td>&quot;I learn how to care for my animals mainly by trial and error&quot;</td>
<td>16.3</td>
<td>24.2</td>
</tr>
<tr>
<td></td>
<td>6.5</td>
<td>7.9</td>
</tr>
<tr>
<td>&quot;I only read the label of a feed, medication or chemical if I have a specific question&quot;</td>
<td>6.3</td>
<td>13.1</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>7.0</td>
</tr>
</tbody>
</table>
Table 13. (Continued)

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Pre-test percentage</th>
<th>Post-test percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exactly like me</td>
<td>A lot like me</td>
</tr>
<tr>
<td>“I think that it is up to food inspectors to see to it that food is safe to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eat”</td>
<td>11.6</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>4.2</td>
<td>7.4</td>
</tr>
<tr>
<td>“I know that changes I make for one part of my livestock operation affect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other parts”</td>
<td>21.8</td>
<td>41.8</td>
</tr>
<tr>
<td></td>
<td>11.2</td>
<td>28.5</td>
</tr>
<tr>
<td>“I consider the performance of the animal or its relatives when selecting a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>project animal”</td>
<td>35.8</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>42.1</td>
<td>44.9</td>
</tr>
<tr>
<td>“I make sure that my animals have space that is safe, secure and large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enough so that they aren’t crowded”</td>
<td>64.3</td>
<td>29.2</td>
</tr>
<tr>
<td></td>
<td>68.8</td>
<td>22.8</td>
</tr>
<tr>
<td>“My animals and I get hurt a lot when I move, load or work with them”</td>
<td>2.5</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>1.9</td>
</tr>
<tr>
<td>“I only visit my veterinarian when I need health papers for a show or when</td>
<td></td>
<td></td>
</tr>
<tr>
<td>my animal is really sick”</td>
<td>18.5</td>
<td>18.7</td>
</tr>
<tr>
<td></td>
<td>7.9</td>
<td>9.8</td>
</tr>
<tr>
<td>“I keep records of all the feed, medication or chemicals I use in my animal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>project”</td>
<td>35.7</td>
<td>21.4</td>
</tr>
<tr>
<td></td>
<td>29.0</td>
<td>43.0</td>
</tr>
<tr>
<td>“I put off cleaning my equipment and facilities until it is really bad or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>someone special is stopping by”</td>
<td>2.5</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>2.8</td>
<td>4.7</td>
</tr>
<tr>
<td>“I study any feedback I get about the products I sell, such as carcass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>measurement, fat content, protein level or USDA grade”</td>
<td>17.9</td>
<td>20.2</td>
</tr>
<tr>
<td></td>
<td>10.4</td>
<td>56.4</td>
</tr>
<tr>
<td>“I read the directions on the label on all feeds, medications or chemicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>before I use them”</td>
<td>32.5</td>
<td>29.1</td>
</tr>
<tr>
<td></td>
<td>62.1</td>
<td>20.1</td>
</tr>
</tbody>
</table>
Objective 4: Relationships Between Demographics and TQM Practices

After conducting the analysis of variance using two groupings of TQM practices, the effect of gender was found to be significant for operational processes and care of animals/loading (Table 14). Animal species interacted with gender to give significant results for animal resources and selection of animals. The pre-test MANOVA also shows gender as an important main effect that influences TQM ratings. Also, there were significant interactions between gender and animal species.

Table 14. Multivariate analysis of variance of pre-test respondents' ratings of TQM practices by gender, age group, animal species, and years in 4-H

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Animal resources</th>
<th>Human resources</th>
<th>Operational processes</th>
<th>Selection of animals</th>
<th>Concern for consumers</th>
<th>Care of animals/loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Species</td>
<td>1.09</td>
<td>0.56</td>
<td>0.41</td>
<td>1.09</td>
<td>0.71</td>
<td>0.17</td>
</tr>
<tr>
<td>Years in 4-H</td>
<td>0.68</td>
<td>0.68</td>
<td>1.39</td>
<td>0.68</td>
<td>1.27</td>
<td>0.05</td>
</tr>
<tr>
<td>Gender</td>
<td>0.89</td>
<td>1.85</td>
<td>4.02*</td>
<td>0.89</td>
<td>0.88</td>
<td>4.69*</td>
</tr>
<tr>
<td>Age group</td>
<td>1.16</td>
<td>1.72</td>
<td>0.40</td>
<td>1.16</td>
<td>2.16</td>
<td>0.33</td>
</tr>
<tr>
<td>[Yrs in 4-H]</td>
<td>1.14</td>
<td>1.10</td>
<td>0.28</td>
<td>1.14</td>
<td>1.05</td>
<td>0.43</td>
</tr>
<tr>
<td>[Species]</td>
<td>6.36*</td>
<td>0.53</td>
<td>0.46</td>
<td>6.36*</td>
<td>0.25</td>
<td>0.90</td>
</tr>
<tr>
<td>[Gender]</td>
<td>0.62</td>
<td>1.08</td>
<td>0.55</td>
<td>0.62</td>
<td>1.40</td>
<td>0.36</td>
</tr>
<tr>
<td>[Species]</td>
<td>0.04</td>
<td>1.79</td>
<td>0.02</td>
<td>0.04</td>
<td>0.30</td>
<td>0.37</td>
</tr>
<tr>
<td>[Age group]</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>[Yrs in 4-H]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Gender]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p< .05.
Table 15 summarizes the means for gender in both operational processes and care of animals/loading. The results in Table 15 indicate that female 4-H'ers had a slightly higher score (mean of 3.78) compared to males' mean of 3.73 in operational processes. Also, female 4-H'ers scored higher (mean of 4.26) for care of animals/loading as compared to the males' mean score of 4.17.

Table 15. Means and standard deviations of the source of significant variation in pre-test respondents’ ratings of TQM practices

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>125</td>
<td>3.73</td>
<td>0.53</td>
<td>4.02*</td>
</tr>
<tr>
<td>Females</td>
<td>151</td>
<td>3.78</td>
<td>0.48</td>
<td>4.02*</td>
</tr>
<tr>
<td>Care of animals/loading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>125</td>
<td>4.17</td>
<td>0.60</td>
<td>4.69*</td>
</tr>
<tr>
<td>Females</td>
<td>151</td>
<td>4.26</td>
<td>0.47</td>
<td>4.69*</td>
</tr>
</tbody>
</table>

Scale: 5=exactly like me; 4=a lot like me; 3=somewhat like me; 2=a little like me; 1=not at all like me.
*p < .05.

In the post-test (Table 16) the MANOVA shows species and enrollment in 4-H as the significant main effects affecting TQM perceptions. Species and length of enrollment in 4-H were each found to influence the scores in care of animals and loading, according to a multivariate analysis of variance (Table 16). Enrollment in 4-H also interacted with animal species to affect the scores for concern for consumers. Also, animal species interacted with
Table 16. Multivariate analysis of variance of post-test respondents’ ratings of TQM practices by gender, age group, animal species, and years in 4-H

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Animal resources</th>
<th>Operational processes</th>
<th>Selection of animals</th>
<th>Concern for consumers</th>
<th>Care of animals/Loading</th>
<th>Reading labels</th>
<th>TQM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>0.80</td>
<td>1.36</td>
<td>0.80</td>
<td>2.36</td>
<td>4.25*</td>
<td>1.14</td>
<td>1.51</td>
</tr>
<tr>
<td>Years in 4-H</td>
<td>0.18</td>
<td>0.98</td>
<td>0.18</td>
<td>0.66</td>
<td>4.49*</td>
<td>2.18</td>
<td>0.08</td>
</tr>
<tr>
<td>Gender</td>
<td>2.12</td>
<td>0.08</td>
<td>2.12</td>
<td>0.01</td>
<td>0.80</td>
<td>3.58</td>
<td>0.64</td>
</tr>
<tr>
<td>Age group</td>
<td>0.93</td>
<td>1.39</td>
<td>0.93</td>
<td>1.92</td>
<td>2.04</td>
<td>0.43</td>
<td>1.07</td>
</tr>
<tr>
<td>[Yrs in 4-H] [Species]</td>
<td>0.33</td>
<td>0.58</td>
<td>0.33</td>
<td>2.74*</td>
<td>1.48</td>
<td>0.31</td>
<td>1.91</td>
</tr>
<tr>
<td>[Species] [Gender]</td>
<td>0.34</td>
<td>2.19</td>
<td>0.34</td>
<td>0.31</td>
<td>0.96</td>
<td>3.41*</td>
<td>2.89</td>
</tr>
<tr>
<td>[Species] [Age group]</td>
<td>0.30</td>
<td>0.57</td>
<td>0.30</td>
<td>1.51</td>
<td>0.50</td>
<td>0.44</td>
<td>0.60</td>
</tr>
<tr>
<td>[Yrs in 4-H] [Gender]</td>
<td>0.40</td>
<td>0.05</td>
<td>0.40</td>
<td>0.29</td>
<td>1.82</td>
<td>0.67</td>
<td>0.54</td>
</tr>
<tr>
<td>[Yrs in 4-H] [Age group]</td>
<td>5.08*</td>
<td>4.23*</td>
<td>5.08*</td>
<td>1.44</td>
<td>7.47*</td>
<td>0.03</td>
<td>4.66*</td>
</tr>
</tbody>
</table>

* p<.05.
gender to affect the scores for reading labels, while enrollment and age group interacted to affect animal resources, operational processes, selection of animals, care of animals and loading, and the combination of all the practices of Total Quality Management (TQM).

**Objective 5: Skill Areas Identification**

The very low recoded score on getting awards (mean =1.70) reflects a high desire to produce a quality animal for a top award or ribbon. The second lowest score (mean =2.05) was given to regular record keeping, indicating that 4-H'ers tended to do records once a year, when they had to turn them in to be graded or judged. 4-H'ers also tended to select their project animals mainly by appearance (mean =2.24).

The post-test confirmed the pre-test trend of the highest and lowest rated practices. Thus, provision of space and avoidance of hurt were practices or topics that were highly rated by 4-H'ers. The question of awards, regular record keeping, and selection of animals by appearance were areas that received the lowest ratings.

**Factor Analysis**

Borg and Gall (1989, p. 620) noted that factor analysis is helpful to the researcher because it provides an empirical basis for reducing the many variables to a few factors by combining variables that are moderately or highly correlated with each other. Each set of variables that is combined forms a *factor*, which is a mathematical expression of the common element that cuts across the combined variables.

In this study, the objective of factor analysis was to identify the underlying factors connected with TQM practices of the 4-H'ers. As recommended by Ford, MacCallum, and Tait (1986), Norusis (1990), and Hair, Anderson, Tatham, and Black (1992), a maximum likelihood factor analysis was conducted since the researcher assumed that the variance of each practice measured could be decomposed into common and unique portions. The naming of the factors identified was done in consultation with ISU faculty.
Hair et al. (1992) indicated that factor analysis needed at least a sample of 50 but preferably 100 observations. They recommended four to five observations per variable but pointed out that in many instances, researchers are forced to factor-analyze a set of variables when only a 2 to 1 ratio of observations to variables is available. In this study, the TQM practices that comprised a factor ranged from 4 to 7 (Tables 17 and 18). Ford et al. (1986) indicated that only variables with loadings greater than .40 should be considered in defining a factor. This guideline was followed in this evaluation of TQM perceptions and, accordingly, only TQM practices with factor loadings of .40 or higher were reported.

The statistical factor analysis of the twenty questions on TQM practices revealed two main factors and a weak third factor. Five of the twenty practices were associated with one strong factor, five practices were associated with another strong factor, while five other practices were associated with the third weak factor. The first factor was comprised of thinking about consumers, vaccination programs, reading directions, effect of changes and study for feedback. The second factor was comprised of questions about responsibility for safe food, reading labels, avoidance of hurt, regular cleaning, and caring for animals, while the third factor had questions on asking for help, to get awards, selection by performance, and provision of space (Table 17). This initial factor analysis was done with the pre-test data only. No attempt was made to name the initial three factors as they changed after post-test data was included.

Table 18 shows the final scores after post-test data were incorporated for the factor analysis. The results indicated that the practices could be associated with two main factors. Thinking about consumers, vaccination programs, reading directions, study of feedback, effect of handling, effect of changes, and selection by performance fell into one main factor which was identified as "Responsibility" or "Responsible behavior." The loadings for this factor ranged from .51 to .71. Responsibility for safe food, reading labels, caring for animals and regular record keeping constituted the second factor which was identified as "Safety precautions". The loadings of this factor ranged from .43 to .64 (Table 18).
Table 17. Factor analysis of individual TQM practices using pre-test data

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>Factor 1 loadings</th>
<th>Factor 2 loadings</th>
<th>Factor 3 loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking about consumers</td>
<td>.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccination programs</td>
<td>.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading directions</td>
<td>.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect of changes</td>
<td>.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study for feedback</td>
<td>.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility for safe food</td>
<td></td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>Reading labels</td>
<td></td>
<td>.61</td>
<td></td>
</tr>
<tr>
<td>Avoidance of hurt</td>
<td></td>
<td>.51</td>
<td></td>
</tr>
<tr>
<td>Regular cleaning</td>
<td></td>
<td>.46</td>
<td></td>
</tr>
<tr>
<td>Caring for animals</td>
<td></td>
<td>.46</td>
<td></td>
</tr>
<tr>
<td>Asking for help</td>
<td></td>
<td></td>
<td>.51</td>
</tr>
<tr>
<td>To get awards</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>Selection by performance</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>Provision of space</td>
<td></td>
<td></td>
<td>.45</td>
</tr>
</tbody>
</table>
Table 18. Factor analysis of individual TQM items using pre-test and post-test data

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loadings of Factor 1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Thinking about consumers</td>
<td>0.71</td>
</tr>
<tr>
<td>Vaccination programs</td>
<td>0.63</td>
</tr>
<tr>
<td>Reading directions</td>
<td>0.59</td>
</tr>
<tr>
<td>Study of feedback</td>
<td>0.59</td>
</tr>
<tr>
<td>Effect of handling</td>
<td>0.54</td>
</tr>
<tr>
<td>Effect of changes</td>
<td>0.52</td>
</tr>
<tr>
<td>Selection by performance</td>
<td>0.51</td>
</tr>
<tr>
<td>Responsibility for safe food</td>
<td>0.64</td>
</tr>
<tr>
<td>Reading labels</td>
<td>0.55</td>
</tr>
<tr>
<td>Caring for animals</td>
<td>0.51</td>
</tr>
<tr>
<td>Regular record keeping</td>
<td>0.43</td>
</tr>
</tbody>
</table>

<sup>a</sup> Factor 1 = Responsibility (responsible behavior).

<sup>b</sup> Factor 2 = Safety precautions.
CHAPTER V. DISCUSSION

The purpose of this chapter is to discuss and elaborate on the findings. The discussion will be organized along the study's major objectives. The primary purpose of this study was to assess the perceptions of 4-H youth regarding the total quality management of their livestock projects and the production of safe food before and after they received the new Total Quality Management (TQM) Curriculum for Youth Producers (TQM, 1993). Hence, the specific purpose of this study was to evaluate the 4-H’ers perceptions of their TQM practices. A secondary purpose of the study was to determine the impact (if any) of the new TQM curriculum. The discussion of the major findings of the study will be organized along the following specific objectives of the study:

1. Discussion of the findings related to the demographics of the 4-H’ers.
2. Discussion of the findings pertaining to the perceptions of the youth regarding their implementation of TQM livestock practices for enhancing food safety.
3. Discussion to determine the effect of TQM instructional materials on young producers’ perceptions of their roles in producing safe food.
4. Discussion to determine relationship between demographics and total quality management (TQM) perceptions and practices.
5. Discussion to determine skill areas of animal care where youth needed the most help.

Demographics of 4-H’ers

One of the major objectives of this study was to analyze and describe the important personal characteristics of the 4-H’ers. Included in the survey were questions about the respondents’ personal characteristics, such as age, years of enrollment in 4-H, years of enrollment in FFA, gender and type of animal species raised.
The respondents varied widely in their age distribution from nine years to 19 years. The typical respondent was an intermediate (42%, 12-14 years), while the mean age was 14 years. However, 84.2% of the 4-H’ers were 11 years or older. The age finding of 4-H’ers to be 9-19 years agrees with the ISU Extension (1990c) pamphlet that indicated that the 4-H audience is primarily 9-19 years of age. Wessel and Wessel (1982) also reported that participants are primarily 9 to 19 years and reside in every demographic area: farm, city, and in-between.

The 4-H’ers period of enrollment in 4-H varied from 0 to 10 years. The mode (17.2%) for the period of enrollment was 3 years (mean = 5 years). This result is in agreement with Seevers and Dormody (1994) where the number of years 4-H members had been in 4-H ranged from one to seven years with a mean of 5.9 years in the organization. The population sampled by Seevers and Dormody was slightly older (member’s ages ranged from 12 to 20 with a mean of 16.3 years of age).

In this study 16.9% of the 4-H’ers indicated they were members of FFA, while 83.1% said they were not. This proportion of 4-H’ers in FFA is slightly higher than the 14% observed by Frick et al. (1994), who evaluated 4-H member knowledge and perception of agriculture.

Results also stated that 54.4% of the respondents were male compared to 44.6% females, which is a slightly higher proportion of males than those reported in a similar study by Seevers and Dormody (1994) i.e., 40.8% males and 59.2% females. Frick et al. (1994), who assessed 4-H member knowledge and perception of agriculture, reported an even higher proportion of female 4-H’ers, i.e., 65.6% females and 34.4 % males, while from Alabama, Ellis and Henderson (1993) reported 56% females and 44% males.

The animal species kept by the 4-H’ers in this study were swine, beef, sheep, and poultry. As was shown in the results, almost half of the 4-H’ers raised more than one species of animal, 19% swine only, 15 % beef only, 12% sheep only and 6% poultry only. These figures reflect the importance of swine in Iowa’s agricultural enterprises. Also, since many 4-
H'ers had more than one animal type, their application of TQM principles would necessarily be broad and flexible. The Iowa 4-H and Youth Programs Report (ISU Extension, 1993b) indicated that beef was the leading project followed by swine and sheep, while poultry had the smallest enrollment of the four animal types in this study.

As noted by Wessel and Wessel (1982), when a state accepts an awards program, it receives rules for the contest and frequently literature for training club leaders and members. Also, it was through projects and associated contests that private support made its impression on the 4-H movement. Wessel and Wessel observed that even before the Smith-Lever Act of 1914, most contests had private sponsors. The items covered by the TQM questionnaire such as getting awards, care of animals and loading are similar to criteria covered in projects reviewed in the literature (Wessel and Wessel, 1982; ISU Extension, 1991f; Gamon & Dehegedus-Hetzel, 1994); Gamon, Laird, & Roe, 1992; Steele et al., 1993). The shows or contests have been important activities in 4-H programs, which have emphasized showmanship and grooming or trimming skills for youth to learn (ISU Extension, 1991a; ISU Extension, 1992a).

Perceptions of Youth Regarding Their Implementation of TQM Livestock Practices for Enhancing Food Safety

Total Quality Management principles were best demonstrated by the 4-H’ers’ responses to the statement on avoidance of hurt. 4-H’ers did their best to avoid hurting the animals. This statement was closely followed, as a highly rated performance practice, by provision of space, I make sure that my animals have space that is safe, secure, and large enough so they aren’t crowded, asking for help, I ask for help with my project when I don’t understand how to do something, and regular cleaning. These practices resemble leadership life skills (Seever & Dormody, 1995; 1994). Miller (1976, p. 2) defined leadership life skills development as a self-assessed and organization-specific “development of life skills necessary to perform leadership functions in real life.” Miller (1975, 1976) had two of the earliest
sources of indicators of youth leadership life skills development. Other studies on life skills among 4-H members were done by Blackwell (1990), Mueller (1989), Orr and Gobeli (1986), and Shih (1993). It would appear that the above highly rated practices fall into work-related sub-domains measured by Luft (1986) and sub-domains of skills in working with groups as conceptualized by Seevers et al. (1995).

The lowest rated practices were regular record keeping, selection by appearance, and production of a quality animal so as to get a top award or ribbon. These low rated practices, as confirmed by the post-test, may be an indication of curriculum deficiency in the topics that touch on these practices. It is possible that low ratings in these statements could be partly due to the ambiguity of the statements. Also, the 4-H’ers may have failed to detect the nature of the two negative statements, *I select my project animals mainly by how they look*, and *I want to produce a quality animal so I can get a top award or ribbon*. On the other hand, since the trend was confirmed in the post-test, the 4-H’ers might not have been well prepared on these topics. Blackburn (1984, 1994) noted that emphasis on leadership, decision-making, organizing, administering, and group process skills is indicative of the importance placed on personal growth in the changing 4-H programs. Blackburn (1984; 1994) also noted that 4-H’ers are developing peer relationships, self-identity, and a desire for independence from parents. To meet these needs, advanced level programs have been or are being established for older 4-H’ers. Lindley (1993) observed that universities can help identify the skills needed as well as the development of training programs that are responsive to those needs. Lindley (1993) further suggested that land grant universities can also help with the review and revision of agriculture curriculum for research and development. Curriculum revision is essential if young people are going to become leaders in animal production.
Effect of TQM Materials on Young Producers' Perceptions of Their Roles in Producing Safe Food

Of the twenty TQM practices, twelve had a positive increase in their post-test means as compared to the pre-test means. Also, the overall construct, Total Quality Management, had a positive increase in the post-test. This would appear to be an improvement in the performance of the 4-H’ers. While it would be fair to assume that some of this increase in performance could be attributed to the effect of teaching materials (the TQM curriculum), which had not been administered at the time of the pre-test, there were a number of extraneous variables not under the control of the researcher that could have influenced this increase. One such effect that could have influenced the increase was the interaction of the pre-test and the treatment (TQM curriculum). The pre-test gave the 4-H’ers an opportunity to think about their practices and to minimize (in the post-test) the guessing that results from a lack of a clear understanding of what is expected from the respondents. Other extraneous variables in this study were the interaction of history and testing. For example, the post-test was conducted one year after the pre-test, and the 4-H’ers are expected to have not only matured by being one year older but also to have encountered many more experiences relative to TQM. Also class effects such as the differences between various 4-H clubs could affect the validity. Teaching location and instruction could be another variable that could have affected the results. In the case of the TQM materials assessed in this study, the counties had the option of endorsing the teaching materials. So the effectiveness of the delivery of the curriculum could have been affected by the acceptance of the materials by the various counties from which the 4-H’ers were sampled. One way in which the true effect of the teaching materials could be evaluated is by conducting an experimental design that could control the extraneous variables. The Solomon Four-Group design (Borg & Gall, 1989, p. 705) would be an effective design to achieve three purposes: (1) to assess the effect of the experimental treatment relative to the control treatment; (2) to assess the effect of a pre-test
relative to no pre-test; and (3) to assess the interaction between pre-test and treatment conditions.

McCracken (1991) noted that there is a potential infinite universe of variables that might be confounding relationships. The choice of which variables to include in our research model is a function of the substantive and theoretical insights into the problem under investigation. The fact that the post-test was done on the same subjects using the same instrument as in the pre-test eliminates a number of confounding variables such as selection, instrumentation, and mortality, but as noted above the study could not control maturation, and location and delivery variations.

While the overall effect of improved teaching technology on learning cannot be disputed, there has been a mixed reaction in the literature regarding the effectiveness of specific teaching materials. For example, while Becker and Shoup (1985) demonstrated effectiveness of technology, Bower and Agnew (1986) found no difference. Rorbach and Stewart (1986) found that a microcomputer package called CAI (Computer Assisted Instruction) was less effective than the lecture/discussion in teaching a rather complex agricultural economics concept. Although studies (Gamon et al., 1995a) have shown teachers expressing strong needs for teaching materials, there is a need to perform controlled experiments to determine what if any difference is made by providing teaching materials including the 4-H TQM curriculum.

The Relationship Between the Demographics and Total Quality Management (TQM) Practices

Gender was found to significantly affect the ratings for operational processes and care of animals. In both group practices the means for female 4-H’ers were higher than those for males. Other workers have reported gender differences in the performance of 4-H’ers in various skills. For example, Seevers and Dormody (1994) found that gender predicted 1.7% of the variance in youth leadership life skills (YLLSDS) scores among 4-H members.
As expected, gender differences become clearer later in life when the youth enter high school. For example, Sutphin and Newson-Stewart (1995) found significant differences by gender on one sub-scale. They also noted that although there were no significant differences in another sub-scale, significant gender differences were identified when the sub-scale was integrated with another. According to Sutphin and Newson-Stewart, females were more likely to study agriculture to develop life skills than the males.

As observed from the post-test, the type of animal species and years of enrollment in 4-H were important determinants of the performance in the care of animals. It would be reasonable to assume that since each animal type required specific handling skills, this, in turn, affected how 4-H’ers viewed the concepts of TQM. The unique experiences that 4-H’ers gained in each of these animal projects formed the basis of the perceptions of 4-H’ers regarding what is safe handling of the animals. The diversity of the information and approaches for various animal types (ISU Extension, 1992a; 1991d; 1990a) helped in shaping the divergent perceptions of TQM.

As the results indicated, respondents who had been in the 4-H program for more than 4 years scored higher than those who had been in the program for 4 years and less. This would seem to confirm that the 4-H program had a beneficial effect on shaping 4-H’ers perceptions. It serves to show that the youth’s time in 4-H was worth the effort. This confirms the findings of other workers, such as Boyd et al. (1992) who reported a positive relationship between the level of participation in 4-H and development of leadership life skills. The results of this study are also in agreement with the findings of Seevers and Dormody (1994), who reported that participation in 4-H leadership activities had a positive relationship with youth leadership life skills development, explaining 12.6% of Youth Leader Life Skills Development Scale (YLLSDS) scores.
Skill Areas Needing Most Help

As has already been noted earlier in this chapter, the 4-H TQM curriculum should pay particular attention to records and management and consumer concerns. Since the TQM approach to teaching and instruction attempts to introduce market and consumer concepts to education, it would help the youth if the curriculum prepared them better in bookkeeping and consumer-related matters. Introducing the idea of the market place to 4-H’ers is one way of preparing them for difficult decisions they have to make in the future, in determining what to buy and what to discard in the complex world of supply and demand. As noted from the findings, the lowest rated group practice was concern for consumers, which is an indication that 4-H’ers need more guidance on looking ahead of the production stage to what is needed to make their produce more palatable to consumer tastes.
CHAPTER VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

American consumers are increasingly vigilant about the safety of their food supply. Agricultural education programs should provide information that youth and the public can use to make better decisions about producing and purchasing food. Livestock producers are no longer just production-oriented; they tend to be more responsible for serving consumers. New instructional approaches are needed that will give students a greater responsibility in the learning process. TQM is a new approach that is still not clearly understood, but might be useful in the learning process.

Purpose and Objectives of the Study

The primary purpose of this study was to assess the perceptions of 4-H youth regarding the total quality management of their livestock projects. A secondary purpose was to assess the impact of the new Total Quality Management (TQM) Curriculum for Youth Producers (TQM, 1993) on the perceptions of 4-H'ers.

The study had the following objectives:

1) To identify the demographics of the 4-H'ers.
2) To identify the perceptions of the youth regarding their implementation of TQM livestock practices for enhancing food safety.
3) To assess the effect of the TQM instructional materials on young producers' perceptions of their roles in producing safe food.
4) To determine relationships between demographics and total quality management (TQM) practices.
5) To identify skill areas of animal care where youth needed the most help.

Methods and Procedures

For this study the sample consisted of 800 4-H'ers with livestock projects selected at random from a list of Iowa 4-H club members supplied by Iowa's 4-H office. The class of
sampling was the type of animals kept by the 4-H'ers. The questionnaire was developed by a team of 17 extension specialists responsible for the 4-H TQM Project in Iowa and Nebraska. It was reviewed and tested for validity and reliability by Iowa State University Agricultural Education faculty and by conducting a pilot study with 13 4-H’ers, which yielded an initial overall Cronbach alpha score of 0.78.

The questionnaire was mailed to the sample, with a follow-up mailing within three weeks of the initial mailing. The return rate of 392 questionnaires was forty-nine percent (49%). Besides the follow-up of late respondents by mailing them reminder notes and additional questionnaires, a randomly selected sample of 11 non-respondents were reached by telephone and their responses recorded. A t-test revealed some differences between the early, late, and phone respondents and these differences are given in Appendix D.

The questionnaire consisted of 20 statements, which included various TQM practices. Each of these 20 items had a Likert-type scale of 1-5. After the TQM questions, biographic information of the 4-H’ers was requested.

The information from the questionnaires was coded and stored on the Iowa State University mainframe computer. Accuracy of coding was verified. Data were analyzed using the Statistical Analysis System (SAS). The statistical procedures used to analyze the data included frequency counts, percentages, means, standard deviations, one-way and multivariate ANOVA, and t-tests. A .05 level of significance was set a priori.

A post-test was conducted by sending questionnaires to the respondents of the pre-test. Results of the ratings on the post-test were compared with ratings on the pre-test. The return rate was 49% for the pre-test and 58% for the post-test.
Findings

Demographics of 4-H’ers

a. Major findings: 4-H’ers varied widely in their age distribution. The range was 9 to 19 years. The modal age was the intermediate age group (12-14 years), which included of 43% of the respondents. The junior (9-11) and senior (15 years and over) age groups each had 29% of the total number. More than 40% of the 4-H’ers had enrolled in 4-H for over four years while 57% had been in the program for four years and under. About 2% of the 4-H’ers were also members of FFA. Males were in the majority (55%) of the 4-H’ers compared to females (45%). About half (49%) of 4-Hers kept more than one type of animal species. The most popular project for members with only one animal species was swine (19%) followed by beef only (15%) and sheep only (12%) while only 6% of the 4-H’ers had poultry only.

b. Conclusions: The 4-H’ers with livestock projects tended to be older than the average 4-H’er. 4-H’ers were fairly evenly divided by gender, but there were more males than in the 4-H population as a whole. For those with only one species livestock, the most popular species was swine. Almost half had more than one species.

c. Recommendations: Manuals for livestock projects might be targeted towards an older audience than manuals for a general 4-H population. The relative importance of the animal projects should be put into consideration when instruction and teaching materials are being designed. Gender and years in 4-H should be included in considering curriculum matters.

Identification of the perceptions of the youth regarding their implementation of TQM practices

a. Major findings: The highest rated practice was avoidance of hurt with a mean rating of 4.59 out of a highest possible rating of 5. This was followed by provision of space with a mean rating of 4.56 and asking for help with a mean rating of 4.19. The highest group practice in the alternative grouping was care of animals with a mean rating of 4.23 followed by reading labels with a mean of 3.64.
b. **Conclusion:** The 4-H’ers had the highest rated TQM perceptions in topics related to ensuring that they and their animals do not get hurt, providing enough safe space for their animals, and in asking for help when they need it.

c. **Recommendation:** The highest rated practices should continue to be emphasized in designing instruction and materials on TQM.

**Assessment of the impact of TQM instructional materials on 4-H’ers perceptions**

a. **Major findings:**

A comparison between the pre-test and post-test result showed slightly higher ratings for the post-test over pretest in some practices and in the combined TQM construct. However, the design of the study could not control all the possible extraneous variables, and so the extent to which the slight increase in the post-test ratings could be attributed to the teaching materials could not be determined.

b. **Conclusion:** It was not clear to what extent teaching materials could have an impact on TQM perceptions but their role might be clarified in a controlled experiment.

c. **Recommendation:** A controlled experiment, using designs that effectively control extraneous variables, should be carried out to clarify the role of TQM instruction materials.

**Determination of the relationships between demographics and perceptions of TQM**

a. **Major findings:** The analysis of variance showed a significant influence of gender and length of enrollment in 4-H on the TQM ratings. Species also had significant interactions with these main effects. Thus the study confirmed what is known about differential maturation of girls compared to boys.

b. **Conclusion:** Gender and length of enrollment could have a role in determining perceptions of TQM. Type of animals may also have a role in influencing perceptions.

c. **Recommendation:** Gender, length of enrollment and type of animal project should be considered when designing instruction and experiences for 4-H’ers.
Identification of skill areas where the youth need most help

a. **Major findings:** The lowest rated practices were getting awards with a mean rating of 1.70 followed by regular record keeping (mean = 2.05) and selection by appearance (mean = 2.24). The lowest rated group practice was records and management (mean = 3.00) followed by concern for consumers (mean = 3.13). The post-test confirmed the trend of the lowest rated practices.

b. **Conclusion:** Record-keeping was an area receiving lower attention form 4-H’ers. Awards and ribbons are important to 4-H’ers; and concern for consumers is something they had not considered. The lower ratings in these areas might be a reflection of curriculum deficiency in these areas.

c. **Recommendation:** More attention should be given to these lowest rated practices in the 4-H curriculum.

**Summary of Conclusions**

Conclusions, based on the analysis of the data and the review of literature, can be summarized as follows:

1) The species of animals kept by 4-H’ers determined how safety and appropriate care were perceived.

2) Gender played a significant role in determining how TQM concepts were perceived.

3) The 4-H’ers gave the lowest ratings to TQM practices covering awards, records and management, and consumer concerns.

4) The 4-H’ers were doing well in using TQM in the areas of careful handling and avoidance of hurt to animals. Also, the 4-H program seems to make a difference as shown by higher TQM scores for those who had been in the program longer.
5) The factor analysis identified *Responsible Behavior* and *Safety Precautions* as possible categories of TQM practices.

6) TQM, as a philosophy, can be applied to 4-H projects. It is a management philosophy that claims devotees in many diverse settings—business, industry, schools—as well as many agricultural production situations. As young producers learn to implement TQM strategies, they will develop awareness and skills to improve their production projects and form the foundation for future production.

**Summary of Recommendations**

Based on the results of this study and the review of literature, the following recommendations were made:

1) 4-H instructional materials should consider including Total Quality Management (TQM) as an integral part of the livestock project member-manuals.

2) Gender of participants should be considered when planning for educational instructional materials and activities.

3) Agricultural educators should consider increasing their emphasis on the topics of awards, record-keeping, and concern for consumers as they provide educational materials to 4-H.

4) While assessing the perceptions of 4-H’ers with regard to getting awards in county and state fairs, it is important to remember that 4-H’ers may rightly see the awards as the main incentive for their efforts.
Recommendations for Further Study

Based on the results of this study, the following recommendations for further study were made:

1) There is need for further investigation in the role of gender in TQM.
2) If further investigations were to be made to determine the impact of TQM teaching materials, a controlled experimental design should be used.
3) The two main topics identified by factor analysis as covering the TQM practices, *Responsible Behavior* and *Safety Precautions*, should be topics for further research related to the 4-H curriculum and food safety responsibilities of young producers.

Implications for Agricultural Education

As a result of the findings of this study, Total Quality Management might play a role in improving instruction and learning in agricultural education. Due to its focus on satisfying the customer, the TQM approach could be a major catalyst in the implementation of the clientele-based approach to teaching and learning. Agricultural educators should continue to go to youth and other clients of agricultural extension to determine their perceptions of agricultural needs, then use these perceptions to tailor instruction and communication to the needs of the customers. In helping address the needs of customers, all programs have a mission to provide a quality education to all youth.

Quality services provided by the 4-H program to 4-H’ers produce a highly educated individual adequately equipped to interact with and contribute to the larger society. If the organization is not of the highest quality, youth cannot learn and achieve to their highest potential. Thus they receive a less than adequate education, which in turn makes them inferior competitors for employment. This chain of events directly, or indirectly, impacts the economic competitiveness of the country in the world market. If the youth program (4-H) provides the highest quality service to its clients, everyone benefits from the quality service.
As has been defined earlier in this dissertation, agricultural education is the scientific study of the principles and methods of teaching and learning as they pertain to agriculture. These principles involve, among others, needs assessment, curriculum planning and development, learning by doing, the psychology of teaching and learning, and feedback through evaluation. This study has contributed to many of the above principles in one way or another.

It was observed in this study that teaching materials might have a role in determining the level of learning. It was also noted that it was not easy to determine the actual impact of teaching materials on learning. Careful investigation into the impact of teaching materials could therefore play a role in determining suitability of teaching materials.

The role of awards and positive reinforcement in learning was also touched by the respondents' response to the question on awards. This study shows that the importance of learning skills need to be balanced off with the obvious gains through competition. The response on awards also underscores the importance of motivation in learning.

The fact that the questions pertaining to book-keeping and management were poorly rated could be an indication of an underlying need for more emphasis on management related topics in agricultural education. Such emphasis could go a long way in preparing learners for managerial and leadership careers.

The idea of assessing perceptions of the target audience as was done in this study could be used to improve not only the content but also the delivery of agricultural education programs. The humanistic approach of evaluating how principles are perceived, as followed in this study, could contribute towards fairer and more acceptable evaluations in agricultural education. Also getting feedback from the clients of teaching and learning could be one way of emphasizing the role of the ‘teacher’ as a ‘facilitator’ of learning as opposed to the ‘top-down’ approach where the teacher is the source of all knowledge and the learner is on the receiving end.
BIBLIOGRAPHY


TQM. (Summer, 1994). *Total Quality Management (TQM) curriculum for youth producers.* Project Report, Nebraska Extension & Iowa State University Extension.

TQM. (1993). *Total quality management (TQM) curriculum for youth producers: Leader guide and 17 learning activities for youth.* Iowa State University Extension, Ames, IA; Cooperative Extension, University of Nebraska-Lincoln Institute of Agriculture and Natural Resources.


ACKNOWLEDGMENTS

First, I give glory to the Almighty through whose blessing and grace my academic goal has now become a reality. Next, I would like to extend my great sense of indebtedness to the Rotary Foundation for availing to me the opportunity to pursue a doctoral program at Iowa State University. I also highly appreciate the funding support I received from Iowa State University (especially through the assistance of Dr. George Jackson, Associate Dean of the Graduate College, Office of the International Students and Scholars, the Department of Agricultural Education and Studies, and Dr. Patricia Swan, Dean of the Graduate College) who provided graduate assistantships to enable me to complete my studies after the Rotary International funding expired.

My major professor, Dr. Julia A. Gamon, and my co-major professor, Dr. Robert A. Martin, played a major role right from the conception of the project to its completion. The assistantship facilitated by Dr. Gamon through the TQM project in the Fall of 1993 and Spring of 1994 was crucial to the realization of my academic goals. Other members of the Program of Study Committee (POS), including Drs. Allen Knapp, Wade Miller, David Cox, and Hayward Horton deserve special thanks for their support and suggestions.

The study could not have been completed without the immeasurable support of Kenya’s Ministry of Research, Technology and Technical Training, who approved my study leave. Mr. David Dickson of Ames Rotary Club helped me to settle in Ames. The encouragement of the Kenya Student Association kept my morale and spirit high. All my family members deserve special thanks for their support and prayers. Above all, the encouragement of my mother, Milkah Waigwe, and the spirit of my deceased father, Perminus Githendu, were the major impetus behind my academic pursuit. I thank my family for their understanding during the long period of absence from home. I dedicate this dissertation to my son, Robert Irungu Githendu (born December 8, 1995), and thank his mother, Phyllis, for all the love, support,
and encouragement that kept my hope and spirit alive!
Interoffice Communication

April 18, 1995

To: Dr. Pat Keith, Chair
   Committee for Review of Research Involving Human Subjects

From: Julia Gamon, Associate Professor
       Agricultural Education & Studies
       217 Curtiss Hall
       4-0897

Re: Request for Continuation of Approval
    Total Quality Management for Youth Livestock Producers-Approved 7/14/93

I was the principal investigator for the project as originally approved and the last contact was to be July 15, 1993. The project has been delayed, and we need a new last contact date, June, 1995, and a new principal investigator, Mukiri Wa Githendu. I will continue as investigator. The terms of the research - problem, methods, nature of the data - all remain the same.

Decision of the University Human Subjects Review Committee:

✓ Project Approved

Project Not Approved

No Action Required

Patricia M. Keith
Name of Committee Ch.

4-19-95
Date

Signature of Committee Ch.

Approved for Continuation

4-19-95

Dr. Keith
APPENDIX B. QUESTIONNAIRE
4-H/FFA ANIMAL PROJECTS

Directions: Please circle the letter of the answer that sounds like you.

1. I select my project animals mainly by how they look.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

2. I ask for help with my project when I don't understand how to do something.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

3. I want to produce a quality animal so I can get a top award or ribbon.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

4. I know that how I handle my project makes a difference in how safe it is for people to eat.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

5. I do records once a year, when I have to turn them in to be graded or judged.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

6. Things usually go smoothly when I load or move animals.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

7. I visit with my veterinarian about health care practices like a vaccination program I should be using.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.
8. I think about what consumers want when I raise my animals.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

9. I learn how to care for my animals mostly by trial and error.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

10. I only read the label of a feed, medication or chemical if I have a specific question.
    a. This sounds exactly like me.
    b. This sounds a lot like me.
    c. This sounds somewhat like me.
    d. This sounds a little like me.
    e. This doesn't sound at all like me.

11. I think it is up to food inspectors to see that food is safe to eat.
    a. This sounds exactly like me.
    b. This sounds a lot like me.
    c. This sounds somewhat like me.
    d. This sounds a little like me.
    e. This doesn't sound at all like me.

12. I know that changes I make for one part of my livestock operation affect other parts.
    a. This sounds exactly like me.
    b. This sounds a lot like me.
    c. This sounds somewhat like me.
    d. This sounds a little like me.
    e. This doesn't sound at all like me.

13. I consider the performance of the animal or its relatives when selecting a project animal.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

14. I make sure that my animals have space that is safe, secure and large enough so that they aren't crowded.
    a. This sounds exactly like me.
    b. This sounds a lot like me.
    c. This sounds somewhat like me.
    d. This sounds a little like me.
    e. This doesn't sound at all like me.

15. My animals or I get hurt a lot when I move, load or work with them.
    a. This sounds exactly like me.
    b. This sounds a lot like me.
    c. This sounds somewhat like me.
    d. This sounds a little like me.
    e. This doesn't sound at all like me.
16. I only visit with my veterinarian when I need health papers for a show or when my animal is really sick.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

17. I keep records of all the feed, medication or chemicals I use in my animal project.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

18. I put off cleaning my equipment and facilities until it is really bad or someone special is stopping by.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

19. I study any feedback I get about the products I sell, such as carcass measurements, fat content, protein level or USDA grade.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

20. I read the directions on the label on all feeds, medications or chemicals before I use them.
   a. This sounds exactly like me.
   b. This sounds a lot like me.
   c. This sounds somewhat like me.
   d. This sounds a little like me.
   e. This doesn't sound at all like me.

Background Information

21. What was your age on January 1, 1993? ____________

22. How many years have you been in 4-H? ____________

23. How many years have you been in FFA? ____________

24. Are you male or female? ____________

25. Please indicate the following for each of your livestock projects.

<table>
<thead>
<tr>
<th># of animals</th>
<th>Check if exhibiting at fair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swine</td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C. QUESTIONNAIRE COVER LETTERS, AND TQM CURRICULUM TOPICS
March 20, 1995

Dr. Doyle Wolvertin
Professor
Extension Animal Science
Youth Specialist

Dear Doyle:

Re: Evaluation of TQM materials

The evaluation of the TQM materials is proceeding. Last month Mukiri Wa Githendu sent out the posttests to the almost 400 Iowa 4-H'ers who completed the pretest in the fall of 1993. He has about a 50% return, is doing a paired comparison of the scores, and expects to finish his study by June.

As you said in your recent letter, the Iowa agriculture teachers put a set of materials in their summer packet; 160 teachers picked these up at their conference last summer. One of my graduate students sent the pretest to a sample of Iowa high school agriculture students last spring as part of his master's study. I am hoping to do a posttest with high school agriculture students yet this spring. We'll be doing an evaluation of use and value of the summer packet materials, including the TQM materials, with the agriculture teachers this fall.

It sounds as though the TQM materials are receiving wide use. They certainly are worthy of an award for excellence.

I'll keep you apprised of the results we get. Feel free to share this letter or the contents with the TQM Design Team.

Sincerely,

Julia Gamon,
Associate Professor
Agricultural Education & Studies
October 11, 1993

Dr. Deb Hall
114 Agriculture Hall
University of Nebraska-Lincoln
Lincoln, NE 68583-0700

Dr. Doyle Wolverton
Ext. Animal Science
C204 AnS
University of Nebraska-Lincoln
Lincoln, NE 68583-0908

Dear Deb and Doyle:

TOTAL QUALITY MANAGEMENT PROJECT

Enclosed is a copy of the questionnaire we sent out on September 30 in respect to the above project. All in all, 800 questionnaires were sent out—200 per species—beef, poultry, sheep, and swine. Two hundred names were selected at random from each list of those enrolled in the project. We were unable to get names for the dairy members due to time constraints of the 4-H computer person.

The participants of this survey have been asked to respond by October 10, 1993, and we will do a follow-up of non-respondents if we can get another list from the 4-H office. We pretested the questionnaire with 4-H'ers in Polk County, and there were no problems in completion of the instrument.

We will keep you posted as soon as we have received some responses. Thank you for your help in designing the questionnaire.

Sincerely,

Julia Gannon
Associate Professor

Enclosure

pc: Committee Members
September 22, 1993

Dear Youth Livestock Producers:

We need to know how you care for your animals. Your answers will help extension teach about livestock, poultry and fish.

Please fill out the form and send it back to us by October 10, 1993. It should take 10 minutes. Your parent or guardian needs to sign the bottom of this letter, but we'd like for you to fill out the form by yourself as much as you can. If you don't want to fill it out, just send it back blank. We've given you an envelope with a stamp and an address to use to send it back.

Your name will be kept apart from your answers so that no one will know how you have answered the questions. The number on the form is there so that we can ask you again if we have not heard from you by October 10.

We are very interested in your answers, because you are an important part of livestock production now and in the future.

Sincerely,

Julia Gannon,
Associate Professor
Agricultural Education & Studies

JG:kmv

Enclosures

Parent/Guardian: Please sign here if you are willing for your child to fill out this form.
February 10, 1994

Dear Youth Livestock Producers:

We haven't heard from you! We wrote last fall and asked you to tell us how you care for your animals. Your answers will help extension teach about livestock, poultry and fish.

Please fill out the form and send it back to us by March 1, 1994. It should take only 10 minutes or less. Your parent or guardian needs to sign the bottom of this letter, but we'd like for you to fill out the form by yourself as much as you can. If you don't want to fill it out, just send it back blank.

Your name will be kept apart from your answers so that no one will know how you have answered the questions. The number on the form is there so that we can ask you again if we have not heard from you by March 1.

We are very interested in your answers, because you are an important part of livestock production now and in the future.

Sincerely,

Jillia Gamon,
Associate Professor
Agricultural Education & Studies

JG:kmv

Enclosures

Parent/Guardian: Please sign here if you are willing for your child to fill out this form.
February 27, 1994

Dear 4-H'er:

We haven't heard from you! We wrote recently and asked you to tell us how you care for your animals. Your answers will help extension teach about livestock, poultry and fish.

Please fill out the form and send it back to us by March 6, 1995. It should take only 10 minutes or less. Your parent or guardian needs to sign the bottom of this letter, but we'd like for you to fill out the form by yourself as much as you can.

Your name will be kept apart from your answers so that no one will know how you have answered the questions. The number on the form is there so that we can ask you again if we have not heard from you by March 6.

We are very interested in your answers, because you are an important part of livestock production now and in the future.

Sincerely,

Mukiri wa Githendu
Research Assistant

Julia Gamon,
Associate Professor
Agricultural Education & Studies

MG:mg

Enclosures

Parent/Guardian: Please sign here if you are willing for your child to fill out this form.
February 9, 1995

Dear 4-H’er:

Thank you for your previous response to our survey on how you care for your animals. Your answers are important and will help extension teach about livestock, poultry, and fish.

We hope you will, by now, have seen the new TQM videos and other materials. We need to know whether your ideas, regarding the issues we had raised last year, have remained the same.

Again your name will be kept apart from your answers so that no one will know how you have answered the questions. We are very interested in your answers, because you are an important part of livestock production now and in the future.

Please kindly respond by February 20, 1995.

Sincerely,

Mukiri wa Githendu
Research Assistant

Julia Gamon
Associate Professor

Parent/Guardian: Please sign here if you are willing for your child to fill out this form.
TOTAL QUALITY MANAGEMENT
A Model TQM Program for Youth Livestock Producers

What: Extension Service/United States Department of Agriculture Food Safety special project being developed by youth and livestock specialists from Iowa State University and University of Nebraska-Lincoln.

Purpose: To extend TQM (Total Quality Management) concepts to 4-H and FFA youth who are involved in animal production, thereby enhancing their ability to make and implement responsible decisions as they produce quality, wholesome and safe food products for human consumption. These animal species will be addressed:
- Beef
- Dairy
- Fish
- Poultry
- Sheep
- Swine

Products: Satellite program
Date: October 14, 1993
Times: 1:00 p.m. and 7:30 p.m. (Central Daylight Savings Time)
Length: About 50 minutes
Supporting materials: Site facilitator guide
Purpose: To introduce youth to the TQM concept as it relates to their ability to make and implement responsible decisions in the production of quality, wholesome and safe food products for human consumption.

16 learning activities for youth
Length: About 30 minutes
Components:
- Single-topic videos
  Length: 5-7 minutes
- Hands-on activities
  Length: About 20 minutes
Purpose: The videos will show the consequences of correct vs. incorrect management methods on the end food product. The activities will provide experiential group learning opportunities and will indicate how the topic may apply to other species.

Distribution: One free copy of all materials produced will be distributed to each county Extension office in Iowa and Nebraska. Each state 4-H office will also receive one free copy of the materials. The materials will be available October 14, 1993.
Topics of satellite program:
*What is TQM and how does it relate to animal production?
*Why is TQM important to young producers?
*What is product quality?
*How is product quality achieved?
  Human resources (Examples are responsibility, knowledge, and skills)
  Animal resources (Examples are animal health and feeding)
  Environmental resources (Examples are facilities and recordkeeping)
*How are these three resource categories combined to produce a quality product?

Topics of learning activities/videos:
General
  Handling market animals
  Planning (developing my TQM plan)

Specie specific
Aquaculture:
  Producing quality products
  Selecting chemicals

Beef:
  Producing quality products
  Vaccinating
  Implanting

Dairy:
  Producing quality products
  Milking
  Sanitizing

Poultry:
  Producing quality products
  Medicating
  Air quality

Sheep:
  Producing quality products
  Vaccinating
  Selecting genetics

Swine:
  Producing quality products
  Vaccinating
  Selecting genetics

Programs and activities of Cooperative Extension are available to all potential clientele without regard to race, color, national origin, age, sex, religion, or disability.

Prepared in June, 1993 by Deb Hall, University of Nebraska-Lincoln curriculum specialist, 4-H youth development; Amy Church, Iowa State University Extension 4-H summer program assistant; and Melva Berkland, Iowa State University Extension communications specialist.
APPENDIX D. T-TESTS BETWEEN EARLY, LATE, AND TELEPHONE RESPONDENTS
Appendix D (1). Pre-test t-test comparisons between early, late, and phone respondents

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>t</th>
<th>n</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I do records once a year...&quot;</td>
<td>-1.97</td>
<td>351</td>
<td>0.049*</td>
</tr>
<tr>
<td>[Early] [Late]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;My animals and I get hurt a lot...&quot;</td>
<td>-2.19</td>
<td>158</td>
<td>0.030*</td>
</tr>
<tr>
<td>[Early] [Late]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Early] [Phone]</td>
<td>2.40</td>
<td>296</td>
<td>0.017*</td>
</tr>
<tr>
<td>&quot;I put off cleaning my equipment...&quot;</td>
<td>-2.53</td>
<td>127</td>
<td>0.012*</td>
</tr>
<tr>
<td>[Early] [Late]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;I consider the performance of the animal...&quot;</td>
<td>-2.50</td>
<td>295</td>
<td>0.012*</td>
</tr>
<tr>
<td>[Early] [Phone]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Late] [Phone]</td>
<td>-2.26</td>
<td>78</td>
<td>0.026*</td>
</tr>
</tbody>
</table>

*p < .05.
Appendix D (2). Post-test: t-test comparisons between early, late, and phone respondents

<table>
<thead>
<tr>
<th>TQM practice</th>
<th>t</th>
<th>n</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I do records once a year...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Early] [Late]</td>
<td>2.34</td>
<td>207</td>
<td>0.020*</td>
</tr>
<tr>
<td>&quot;I keep records of all feed...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Early] [Late]</td>
<td>-2.87</td>
<td>207</td>
<td>0.004*</td>
</tr>
<tr>
<td>&quot;I visit with my veterinarian...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Early] [Phone]</td>
<td>3.11</td>
<td>189</td>
<td>0.002*</td>
</tr>
<tr>
<td>[Late] [Phone]</td>
<td>2.10</td>
<td>38</td>
<td>0.0421*</td>
</tr>
<tr>
<td>&quot;I put off cleaning my equipment...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Early] [Phone]</td>
<td>-2.88</td>
<td>12</td>
<td>0.014*</td>
</tr>
<tr>
<td>&quot;My animals and I get hurt...&quot;</td>
<td></td>
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*p<0.5.