

2008

Perceptions of agricultural extension educators regarding livestock waste management education in the North Central Region

David Kwaw-Mensah
Iowa State University

Follow this and additional works at: <http://lib.dr.iastate.edu/rtd>



Part of the [Agricultural Education Commons](#), and the [Other Education Commons](#)

Recommended Citation

Kwaw-Mensah, David, "Perceptions of agricultural extension educators regarding livestock waste management education in the North Central Region" (2008). *Retrospective Theses and Dissertations*. 15807.
<http://lib.dr.iastate.edu/rtd/15807>

This Dissertation is brought to you for free and open access by Iowa State University Digital Repository. It has been accepted for inclusion in Retrospective Theses and Dissertations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

**Perceptions of agricultural extension educators regarding livestock waste management
education in the North Central Region**

by

David Kwaw-Mensah

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Agricultural Education (Agricultural Extension Education)

Program of Study Committee:
Robert A. Martin, Major Professor
Harold Crawford
Lynn B. Jones
Jerald DeWitt
Lee Burras

Iowa State University

Ames, Iowa

2008

Copyright © David Kwaw-Mensah, 2008. All rights reserved.

UMI Number: 3310862

Copyright 2008 by
Kwaw-Mensah, David

All rights reserved

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

The logo for UMI (University Microfilms International) consists of the letters "UMI" in a bold, serif font, with a registered trademark symbol (®) to the upper right of the "I".

UMI Microform 3310862
Copyright 2008 by ProQuest LLC
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

DEDICATION

This dissertation is dedicated to the Most High God my creator and savior, without whose grace, power and wisdom I would not have reached this height in my academic pursuit; and to my parents, whose upbringing, love and support constantly sustained my early childhood, secondary and university education.

TABLE OF CONTENTS

LIST OF FIGURES	vi
LIST OF TABLES	vii
ACKNOWLEDGEMENTS	ix
ABSTRACT	x
CHAPTER 1. INTRODUCTION	1
Statement of the Problem	6
Purpose of the Study	6
Need for the Study	7
Definition of terms	7
CHAPTER 2. REVIEW OF LITERATURE	10
Andragogy	10
Settings and transactional Modes of Andragogy	13
Instructional Methods, Techniques and Devices of Andragogy	13
The Perception Construct and Research Findings Regarding Perception	15
Perceptions Regarding Instructional Methods and Learner	
Preferences for Learning Strategies in Extension Education	21
The Theoretical Framework for the Study	25
Limitations of the Theory of Reasoned Action Model	28
CHAPTER 3. METHODS AND PROCEDURES	29
Research Design and Instrumentation	29
Data Source	31
Data Collection	32
Data Analysis	33
Limitations of the Study	34
CHAPTER 4. FINDINGS	36
Demographic Characteristics	38
Distribution of age, Highest Level of Academic Qualification and	39
Work Experience as Extension Professionals of County Extension	
Educators	
Distribution of Formal Teaching Experience and Main	42
Responsibility of County Extension Educators	
General Perceptions of County Extension Educators Regarding Livestock	44
Waste Management	
Perceptions of County Extension Educators about Education Regarding	48
Livestock Waste Management	

Perceptions of County Extension Educators about the Extent of Use of Teaching Methods and Tools used in Livestock Waste Management Education	50
Perceptions of County Extension Educators about the Effectiveness of Teaching Methods and Tools used in Livestock Waste Management Education	53
Visual Summaries of the Extent of use and Effectiveness of Selected Teaching Methods and Tools used in Livestock Waste Management Education	56
Comparison of Perceptions based on Demographic Characteristics of County Extension Educators	59
Themes from Additional Comments by Extension Educators Regarding Livestock Waste Management Education	62
CHAPTER 5. DISCUSSION	64
General Perceptions Regarding Livestock Waste Management	67
Perception Regarding Livestock Waste Management Education	68
Comparison of Perceptions based on Demographic Characteristics	70
Major Comments by County Extension Educators Regarding Livestock Waste Management Education	72
The Modified Behavioral Intention Model	77
In-service Educational Model for County Extension Educators Focused on Livestock Waste Management Education	81
Needs Assessment	83
Program Development	84
Program Delivery	86
Program Evaluation	87
Feedback	88
CHAPTER 6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	89
Summary	89
Conclusions	92
Recommendations	93
Recommendations for Future Research	94
Implications and Educational Significance of the Study	95
APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL LETTER AND FORM	97
APPENDIX B. APPROVED SURVEY QUESTIONNAIRE	102
APPENDIX C. REQUEST LETTER TO STATE AGRICULTURE AND NATURAL RESOURCES LEADERS	111

APPENDIX D. COVER LETTER TO QUESTIONNAIRE	113
APPENDIX E. FOLLOWUP LETTER	115
APPENDIX F. ADDITIONAL COMMENTS BY EXTENSION EDUCATORS	117
REFERENCES	125

LIST OF FIGURES

Figure 1. The behavioral intension model based on Ajzen and Fishbein (1980) and Ajzen (1988)	26
Figure 2. Gender distribution of county extension educators	39
Figure 3. The modified behavioral intention model based on Ajzen and Fishbein (1980) and Ajzen (1988)	80
Figure 4. An In-service Educational Program Model for County Extension Educators Focused on Livestock Waste Management Education	82

LIST OF TABLES

Table 1. Independent samples t-test indicating significant differences in means to responses from early and late respondents	37
Table 2. Age distribution of county extension educators	39
Table 3. Distribution of county extension educators' level of education	39
Table 4. Frequency and percentage distribution of county extension educators' highest educational degrees	40
Table 5. Distribution of county extension educators' years of work as extension professionals	42
Table 6. Years of distribution of formal teaching experience of county extension educators at the High School level	42
Table 7. Years of distribution of formal teaching experience of county extension education at the community College level	43
Table 8. Years of distribution of formal teaching experience of county extension educators at the University level	43
Table 9. Frequency and percentage distribution of county extension educators' main areas of county extension responsibility	44
Table 10. Means and standard deviations of the general perceptions of County extension educators regarding livestock waste management	45
Table 11. Frequency distribution of county extension educators' responses to statements about general perceptions regarding livestock waste management	47
Table 12. Means and standard deviations of the perceptions of county extension educators about education regarding livestock waste management	49
Table 13. Frequency distribution of county extension educators' responses to statement about perceptions regarding livestock waste management education	50
Table 14. Means and standard deviations regarding the extent to which selected teaching methods and tools are used in livestock waste management education	51

Table 15. Frequency regarding the extent to which selected methods and tools are used in livestock waste management education	52
Table 16. Means and standard deviations regarding the effectiveness of selected teaching methods and tools used in livestock waste management education	54
Table 17. Frequency regarding the effectiveness of selected methods and tools used in livestock waste management education	55
Table 18. Summary of the extent of use of selected methods and tools used in livestock waste management education	57
Table 19. Summary of the effectiveness of selected methods and tools used in livestock waste management education	58
Table 20. Intercorrelations among perceptions of county extension educators and selected demographic characteristics	61
Table 21. Themes derived from additional comments by county extension educators regarding livestock waste management education	63

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation and gratitude to Dr. Robert A. Martin, my major professor and Department Chair, for his excellent professional leadership, mentorship and motivation during my PhD program in the Department of Agricultural Education and Studies at Iowa State University. I am also sincerely grateful to Dr. Jerald DeWitt, Director at the Leopold Center for Sustainable Agriculture, Iowa State University, for his invaluable support with a graduate assistantship and professional mentorship during my program. Additionally, I am thankful to Dr. Harold Crawford, Professor Emeritus and Dr. Lynn B. Jones, Associate Professor Emeritus of Agricultural Education and Dr. Lee Burras, Professor of Agronomy, as members of my program of study advisory committee. I am sincerely thankful to Dr. Mack Shelley in the Department of Political Science, Iowa State University, for his guidance with the statistical analysis of this study.

My gratitude also goes to the late Dr. Alfred Merrill Blackmer, Dr. Michael Owen, Dr. Mahdi Al-Kaisi, all of the Agronomy Department, Iowa State University and Mr. George Cummins, Iowa State Cooperative Extension Field Crop Specialist in Charles City, Iowa, who had faith in me and recommended me for admission to the PhD program in the Department of Agricultural Education and Studies.

My gratitude also goes to my immediate family and family friends John and Jeanie Nordyke, Randy Heitz and family, Charles Anokye Agyei and Audrey Bowser, whose diverse support and encouragement immensely contributed to my success at Iowa State University. Finally, I am thankful to the Most High God, who sustained me with life, health, wisdom and resilience during my education at Iowa State University.

ABSTRACT

Livestock production in the United States yields large quantities of livestock waste annually. The North Central region of the United States produces a variety of livestock including swine, cattle and poultry. Livestock waste is a rich source of plant nutrients and organic matter. The environmental risks of pollution associated with livestock waste raises major concerns of agricultural educators, researchers and policy makers. Best management practices have been developed for livestock waste management. There is limited research information regarding livestock waste management education.

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and its related educational processes.

This study was descriptive and used survey questionnaires to gather research information. A simple random sampling technique was used to draw 360 county extension educators from the North Central region to participate in the study. The findings of this study were based on 201 completed survey questionnaires and generalized over the study population based on controlling non-response error.

This study revealed that county extension educators in the North Central region were predominantly middle-aged males with master's degrees. County extension educators in this study maintained that livestock waste management was a controversial issue and meant different things to different people. Overall, county extension educators indicated positive perceptions regarding livestock waste management; livestock waste management education and the effectiveness of teaching methods used in livestock waste management education.

County extension educators were varied in their perceptions regarding the extent to which they used selected teaching methods, teaching tools and the effectiveness of teaching tools.

County extension educators frequently used the educational methods and tools of discussion, lecture-discussion, demonstrations, individualized instruction, field days; newsletters and print/broadcast media. County extension educators indicated that discussions, lecture-discussion, demonstrations, individualized instruction, field days, meetings, problem solving, small-group work, case studies, workshops, computers and the Internet are effective educational methods and tools, but some of which were not used extensively.

Correlations between demographic characteristics and perceptions were negligible to low with a few moderate to very high. The study's findings contributed to the potential redesign of the behavioral intention model based on Ajzen and Fishbein (1980) and Ajzen (1988).

CHAPTER 1

INTRODUCTION

The extension educational process is a vital component of any agricultural development process, which may include the transfer of a particular technology (Seevers, Graham, Gamon & Conklin, 1997; Pickering, 1987) or the communication of specific information to help farmers form sound opinions and make sound decisions about their agricultural production systems (van den Ban & Hawkins, 1996). The term “extension” was initially used to describe adult education programs in England during the second half of the 19th Century, when universities expanded their work beyond university campuses into neighboring communities (Wikipedia, 2007; Seevers et al., 1997). During the early years of the concept, agricultural extension was known as the application of scientific research and new knowledge to agricultural practices through farmer education (Wikipedia, 2007). The extension idea was introduced to the United States through city libraries and by 1890 extension courses were frequently offered (Seevers et al., 1997). In 1891, one of the first colleges in the United States to offer an agricultural extension program with off-campus courses on soils and crops, plant and animal nutrition was the agricultural college at Rutgers in New Jersey (Seevers et al., 1997). Similarly, one of the first colleges in the United States to offer on-campus teaching in a noncredit non-examination course to farmers was the Ohio University (Seevers et al., 1997).

Extension education today is also considered as a branch of adult education that is nonformal and usually occurs outside of formally structured social institutions such as schools (Seevers et al., 1997; van den Ban & Hawkins, 1996). Cranton (2006) described adult education as education in which,

“mature, socially responsible individuals participate in sustained informal or formal activities that lead them to acquire new knowledge, skills or values; elaborate on existing knowledge, skills or values, revise their basic beliefs and assumptions; or change the way they see some aspects of themselves or the world around them” (p. 2).

As an adult education process, extension functions by engaging teaching as an information delivery and problem-solving tasks, which could be with individuals, groups or by mass media (Seevers et al., 1997). Seevers et al (1997) described the extension educational process as:

“The composite of actions where an extension educator conducts a situational analysis of individual and community needs, establishes specific learner objectives, implements a plan of work and evaluates the outcomes of the instruction to determine if behavioral changes have occurred” (p.246).

Education is generally described as learning knowledge, skill and attitudes (Etling, 1993).

Etling (1993) further distinguished between formal, nonformal and informal education.

Formal education is associated with traditional schools while informal education is associated with daily learning experiences, which are neither planned nor organized (Etling, 1993). On the other hand, nonformal education is an

“intentional and systematic educational enterprise in which content is adapted to the unique needs of the students in order to maximize learning and minimize other elements, which often occupy formal school teachers such as taking roll, enforcing discipline, writing reports, supervising study hall” (Etling, 1993, p. 73).

The preceding description of nonformal education perfectly fits extension education as a very useful means of equipping farmers and other adult learners with the information and skills necessary to enhance their efficiency as agricultural producers and managers of agricultural production systems. Currently, one area of concern related to nonformal education programs in extension is the focus on the environment, in general, and livestock waste management, in particular.

Livestock production in the United States yields large quantities of livestock waste as a by-product (ISU Extension, 2003; Lowrance & Hubbard, 2000; Kellogg, Lander, Moffitt & Gollehon, 2000). In the North Central region of the United States, the emphasis on livestock production varies with states, primarily due to ecological factors but also due to consumer demands (USDA, 2002). Broadly speaking, livestock in the North Central Region encompasses swine, cattle, poultry, sheep, goats, horses and ponies, mules, donkeys and burros (USDA, 2002). Although livestock waste has been documented as a rich source of plant nutrients and organic matter (McAndrews, Liebman, Cambardella & Richard, 2006; Loecke, Liebman, Cambardella & Richard, 2004; ISU Extension, 2003; Grandy, Porter, & Erich, 2002; Kellogg et al., 2000; Minnesota Institute for Sustainable Agriculture, 1998; Clark, Horwath, Shennan & Scow, 1998; Brumm, 1998), the environmental risks associated with livestock waste as a potential pollutant of air, soil and water quality, if not properly managed, remains a major concern of agricultural educators, researchers and policy makers (Hubbard, Newton & Hill, 2004; Varel, 2002; Hao, Chang, Larney & Travis, 2001; Varel & Miller, 2001; Kellogg et al., 2000; Varel, Nienaber & Freetly, 1999; Goolsby, Battaglin, Lawrence, Artz, Aulenbach, Hooper, Keeney & Stensland, 1999; Zebarth, Paul & Van Kleeck, 1999; Gangbazo, Pesant, Barnett, Charuest & Cluis, 1995; Sharpley, Meisinger,

Breeuwsma, Sims, Daniel & Schepers, 1998; Forster, 1998; Bruening & Martin, 1992; Goldberg, 1989; Joung, 1983; Westerman & Overcash, 1980; Gast, Nelson, & Randall, 1978).

Traditionally, nutrients from livestock waste are recycled in agriculture when applied to crop and pasture lands to promote plant growth (Kellogg et al., 2000). However, environmental concerns regarding the degradation of the quality of soil, surface and groundwater resources due to surface runoff and leaching of excess nitrogen and phosphorus have been raised from its over-application to crop and pasture lands (Goolsby, Battaglin, Aulenbach & Hooper, 2001; Rabalais, Turner & Wiseman, Jr., 2001; Rowe, 2001; Sweeten, 1998). Best management practices (BMPs) for livestock waste management have been developed as solutions to the potential problems associated with livestock waste pollution of the environment (Fukumoto, 2005; Alam, Thompson, Trooien & Schlegel, 2003; Tyson, 1995). Nevertheless, the effectiveness of such BMPs especially for nitrogen and phosphorus management has been questioned (Boesch, Brinsfield & Magnien, 2001). According to Boesch et al (2001), standard BMPs have not significantly reduced agricultural nonpoint sources of pollution. The report by Boesch et al (2001) further indicates that large increases in the agricultural inputs of nitrogen and phosphorus during the last half of the 20th century have been widely accepted as posing the most serious threats to the Chesapeake Bay ecosystem, including the expansion of seasonal hypoxia in deeper parts of the Bay. Given the importance of good environmental quality to sustainable livelihoods and human health, it is imperative that adequate education regarding livestock waste management is provided for farmers by extension educators. Livestock waste management education has been recognized as one of extension's initiatives in the United States (Richardson & Mustain, 1993).

According to Richardson & Mustain (1993), a number of educational programs, which focus on different aspects of waste management, have been initiated by the cooperative extension service of the United States.

The significance of livestock waste management education to environmental quality and human health raises the following key questions.

- i) Do county extension educators in the North Central region educate farmers about livestock waste management?
- ii) Do county extension educators in the North Central region adopt standardized educational processes to educate farmers about livestock waste management?
- iii) What teaching methods do county extension educators adopt to educate farmers about livestock waste management?
- iv) What perceptions do county extension educators have regarding livestock waste management education?
- v) Do perceptions of county extension educators influence the educational processes adopted for farmer education regarding livestock waste management?

The fourth and fifth preceding questions are closely related to the attitude theory of Fishbein & Ajzen (1975) that a person's belief serves as the foundation that determines the person's attitude, intentions and behaviors. It has been reported that positive beliefs and attitudes lead to specific intentions and behaviors (Knobloch & Martin, 2000).

Statement of the problem

Research findings indicate that livestock waste management is essential for environmental protection and good human health (Zahn, Dispirito, Do, Brooks, Cooper & Hatfield, 2001; Goosby, et al., 1999; Bouldin & Klausner, 1998; Sharpley et al., 1998). Best management practices (BMPs) have been developed as essential technical components of livestock waste management (Fukumoto, 2005; Alam et al., 2003; Tyson, 1995). However, research findings regarding the educational component of livestock waste management is lacking. Lack of research information about the educational component of livestock waste management makes it unclear what extension educators are doing regarding livestock waste management education and the perceptions they have regarding the educational processes involved in livestock waste management. The focused problem of this study was the perceptions of extension educators regarding livestock waste management and the educational processes involved in livestock waste management education in the North Central region of the United States.

Purpose of the Study

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. The specific objectives of the study were to:

- 1) Describe the demographic characteristics of county extension educators.
- 2) Identify the general perceptions of county extension educators regarding livestock waste management.

- 3) Identify the perceptions of county extension educators regarding education about livestock waste management.
- 4) Describe the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management.
- 5) Compare perceptions based on demographic characteristics of the participants.

Need for the Study

A core extension educational program, which is subject to meaningful modifications within the context of local conditions, is essential to any concerted effort aimed at addressing a major regional agricultural issue. Appropriate livestock waste management in the North Central region has regional implications for environmental protection and human health in the region (Zilberman, Metcalfe & Ogishi, 2006; McCann, Nowak & Nunez, 2006; Powers & Horn, 2001; Sund, Evenson, Strevett, Nairn, Athay & Trawinski, 2001; Zilberman, Ogishi, & Metcalfe, 2001). This study was therefore aimed at contributing information that would be useful for the successful education of farmers in the North Central region regarding livestock waste management.

Definition of Terms

The following terms have been defined within the context of this study.

Education: A process of teaching and learning within formally structured social institutions or learning outside these institutions (nonformal education) (van den Ban & Hawkins, 1996).

Extension: The conscious communication of information to help people form sound opinions and make good decisions (van den Ban & Hawkins, 1996).

Extension Education: The conscious communication of information within non-formally structured social institutions to help people form sound opinions and make good decisions

through partnerships that utilize experience and research knowledge (van den Ban & Hawkins, 1996).

Extension Educator: A skilled individual who teaches people in a non-formally structured social institution to help people form sound opinions and make good decisions through partnerships that utilize experience and research knowledge (van den Ban & Hawkins, 1996).

Livestock: Domesticated animals intentionally reared in an agricultural setting to produce food or fiber, or for their labor (Wikipedia, 2007).

Livestock waste: A mixture of excreta and associated losses, bedding, wash-waters, sprinkling waters from livestock cooling, precipitation polluted by falling on or flowing onto an animal feeding operation and other materials polluted by livestock (Illinois EPA, 2001).

Livestock waste management system: Any land, structures, or practices utilized for the collection, containment, storage, distribution, land application, or disposal of animal process wastes generated by confined feeding operations (The Kansas Department of Health and Environment, 2007).

Nonpoint source pollution: The deposition of natural and man-made pollutants into lakes, rivers, wetlands, coastal waters and underground sources of water through runoff from rainfall or snowmelt (EPA, 1994). Source: EPA Brochure EPA-841-F-94-005, 1994.

North Central Region : A geographical location in the USA, which encompasses the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. SARE <http://ncr.sare.org/apply.htm>

Perception: Perception is the process by which we (*individuals or a group of people*) receive information or stimuli from our environment and transform it into psychological awareness (van den Ban & Hwakins, 1996).

Transformative learning: A process by which previously uncritically assimilated assumptions, beliefs, values, and perspectives are questioned and thereby become more open, permeable and better justified (Cranton, 2006).

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. The specific objectives of the study were to:

- 1) Describe the demographic characteristics of county extension educators.
- 2) Identify the general perceptions of county extension educators regarding livestock waste management.
- 3) Identify the perceptions of county extension educators regarding education about livestock waste management.
- 4) Describe the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management.
- 5) Compare perceptions based on demographic characteristics of the participants.

This chapter consists of three major sections, which include a description of andragogy (its assumptions, settings, transactional modes, instructional methods and devices), the construct of perception and research findings related to perceptions and finally, the theoretical framework for the study, which is the theory of reasoned action (TRA).

Andragogy

The concept of andragogy or adult education is “the art and science of helping adults learn” (Cookson, 1998; Merriam and Caffarella, 1999, p. 272; Galbraith, 2004, p. 7).

Andragogy draws heavily on the philosophy of humanism and the third force psychology, which focuses learning from the perspective of human growth and self-actualization

(Cookson 1998; McNeil, 2006). Humanists believe that the education curriculum should provide learners with experiences that are intrinsically rewarding and should further contribute to the learner's personal liberation and development (McNeil, 2006). From the perspective of learning for human growth and self-actualization, learners are permitted to express themselves, act out, experiment, make mistakes, be seen, get feedback and also discover who they are (McNeil, 2006). Learning for human growth according to Cookson (1998) is "characterized by personal involvement, self-initiative, its pervasiveness and provision for evaluation by the learner" (p. 216).

Andragogy functions on the basis of the following five basic assumptions about adult learners (Cookson, 1998, p. 218-219).

1. Adult learners generally have a psychological disposition towards self-direction.
2. Adult learners bring a vast reservoir of experience to the learning situation, which can and should be utilized.
3. Adults' readiness to learn is influenced by developmental tasks associated with adult roles in family and work life.
4. Adults learn for the purpose of immediacy of application.
5. Adult learners are intrinsically motivated.

Besides the five basic assumptions of andragogy about the adult learner, Long (2004) indicates two conflicting views about adult learners from the perspectives of main street Americans and many professional educators of adults. According to Long (2004), main street Americans perceive adult learners as less capable than younger learners. On the other hand,

many professional educators of adults perceive adult learners as super learners (Long, 2004).

Who truly is the adult learner? Cranton (2006) defined adult learners as

“mature, socially responsible individuals who participate in sustained informal or formal activities that lead them to acquire new knowledge, skill, or values; elaborate on existing knowledge, skill, or values, revise their basic beliefs and assumptions, or change the way they see some aspects of themselves or the world around them” (p. 2).

Galbraith (2004) described adults as autonomous individuals with desires, goals and expectations. From the standpoint of autonomy, desires, goals and expectations, adults are neither super-learners nor idle clock-watchers, but have the capability to participate in learning on an equal basis in making decisions affecting their own welfare (Galbraith, 2004). Furthermore, adult learners have a wide range of cognitive, personality, experiential and role characteristics, which influence adult learning (Galbraith, 2004). The variability in the needs of adults as socially matured individuals makes adult learning voluntary and participation in learning activities may be to either develop personally or in response to a professional or practical need (Cranton, 2006). In summary, adults’ previous life experiences and the orientation to learning based on the application of what is learned, influence adult learning (Galbraith, 2004). Adults’ participation in any learning activity is thus influenced by intrinsic motivation (Cookson, 1998) and normative beliefs (Park, 2000).

Wlodkowski (2004) described intrinsic motivation as “an evocation; it is energy called forth by circumstances that connect with what is culturally significant to people” (p. 143). Park (2000) described normative beliefs as individuals’ perceptions regarding certain behaviors as influenced by the judgment of significant others in societies. Thus, intrinsic

motivation of adults to engage in learning activities is associated with adults' perceptions and adherence to behavioral intentions (Chatzisarantis & Biddle, 1998).

Settings and Transactional Modes of Andragogy

Andragogy occurs in a variety of settings and transactional modes besides the traditional formal structure of classrooms and written assignments (Etling, 1993; Boyd & Apps, 1980). Evening or weekend classes, community action groups and weeks of intensive seminars are all forms of andragogy (Boyd & Apps, 1980).

The transactional mode of andragogy characterizes the nature of adult learners' situations, which may be individual, small groups or community (Kang & Song, 1984; Boyd & Apps, 1980). According to Boyd & Apps (1980), the individual transactional mode of andragogy describes the situation where an adult learns by him/herself as in independent study courses. The group transactional mode describes a situation where adult learners meet together either in a classroom or work together at some place on some problems or concerns they may have (Boyd & Apps, 1980). In the group transactional mode, members of the group have a common purpose or goal and also share a commitment to attend regular meetings at specific times and places for a certain period of time. In other situations, a group of citizens from a community may gather to resolve a particular challenge facing their community. When that happens, the community transactional mode of andragogy has been engaged (Boyd & Apps, 1980).

Instructional Methods, Techniques and Devices of Andragogy

Conti & Kolody (2004) discussed guidelines for selecting methods and techniques for andragogy and further distinguished between methods, techniques and devices. Andragogy methods identify the ways in which adults are organized in an educational activity and the

relationships that are established between adult learners and the agency providing the educational activity (Conti & Kolody, 2004). Techniques are the different processes that are engaged to promote learning once methods have been determined and devices are those things such as visual aids, which support the techniques and facilitate the learning process (Conti & Kolody, 2004).

The following are some instructional techniques that have been successfully used in adult education: case story, discussion, lecture, interactive television, distance learning techniques, learning contracts, course portfolios, critical thinking techniques, demonstration and simulation, case study, forum, panel, symposium and mass media (Galbraith, 2004; Kang & Song, 1984). There is no one technique that can be considered as superior (Creswell & Martin, 1993; Kang & Song, 1984). However, depending on the teaching-learning situation the adult educator may determine which instructional technique is most appropriate and relevant (Creswell & Martin, 1993). According to Creswell and Martin (1993) successful adult educators employ a variety of instructional techniques and strategies, depending on program content, expected outcomes, the learning environment and available educational resources. In their study to assess teaching strategies used in private pesticide applicator education, Creswell & Martin (1993) concluded that the lecture, discussion and questioning methods were the most predominantly used instructional methods in pesticide applicator training. Newsome, Wardlow & Johnson (2005) compared the experiential-teaching and the lecture-teaching methods on student cognitive achievement on delayed posttests and on student attitude toward the subject matter. The results indicated that no single teaching method is necessarily more effective in all classes or subject matter areas, but argued that there is need for careful selection and use of a variety of teaching methods based on the

students, subject matter and classroom situation (Newsome et al., 2005). Although the subjects for the study by Newsome et al (2005) were young high school agricultural science students, the conclusions of their study may be applicable to adult education situations. It was however suggested in another study that instructional methods for adult educational programs should be constantly evaluated for relevance (Martin & Omer, 1990).

It is deduced from the foregoing discussion that choices made by adult educators to use specific methods, techniques and devices are potentially based on evaluations regarding their appropriateness and effectiveness as influenced by perceptions. The following is a variety of agricultural and extension education research studies, which have been conducted in relation to the perception construct.

The Perception Construct and Research Findings Regarding Perceptions

Perceptions constitute complex psychological processes, which are affiliated with awareness and yield judgments (Clark, 1994). Coates (1998) described perceptions as processes, which involve the senses and enable individuals to arrive at true beliefs about their environment. According to van den Ban & Hawkins (1996, p.282) perception is “the process by which we receive information or stimuli from our environment and transform it into physiological awareness.” Perceptions are rather relative, selective, organized and directional (van den Ban & Hawkins, 1996). Perceptions are selective because

“At any moment our senses are receiving a veritable flood of stimuli from the environment around us. Despite its capacity to process vast amount of information, our nervous system cannot make sense of all the stimuli available. Hence an individual pays attention only to a selection of these stimuli. Several physical and psychological factors, including attitudes

influence what he or she selects or pays attention to” (van den Ban & Hawkins, 1996. p. 60).

Secondly, perceptions are organized because people tend to structure their sensory experiences in ways that make sense to them (van den Ban & Hawkins, 1996). Finally, perceptions are directional because individuals perceive what they expect or are set to perceive and individual mental sets influence what people select, how they organize and interpret it (van den Ban & Hawkins, 1996).

The diversity of adults regarding motivation, goals, cognitive development and academic preparation, employment background, experience, skill level and initiative (Rollins & Yoder, 1993) influence perceptions and present challenges to the processes of extension education. According to the theory of constructivism “all knowledge and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context” (Crotty, 2005, p.42). Simply stated, meaning or truth is subjective, based on perceptions and individual realities. Therefore, personal experiences of adults based on their realities lead to personal preferences. George Alexander Kelly (1955) posited his personal construct theory (PCT) as an alternative constructivism, that the world is perceived by individual persons in terms of whatever meaning each person applies to it and that each person has the freedom to choose different meanings of whatever he or she wants. Fundamentally, the PCT postulates that “a person’s processes are psychologically channelized by the ways in which he anticipates events” (Kelly, 1955, p. 46). Cognition and affect, which are greatly influenced by the psychological functions of reflection, feeling, sensing and intuition (Cranton, 2006), directly underpin human perceptions and convictions,

which are also closely linked to attitudes, personality traits and work centrality or role (Ladebo, 2004).

In organizations, organizational beliefs and values define the cultural identity, work role, perceptions and behavior of employees (Bolman & Deal, 2003; Schaubert, 2001). Bolman & Deal (2003) discussed the four organizational frames (structural, human resources, political and symbolic), which define organizations and their employees and linked faith, ritual and culture, which are closely linked to beliefs and values of organizations to the symbolic frame. Schaubert (2001) defined the culture of an organization as the values, beliefs, principles, practices and behaviors of the organization. Professionally, extension educators have a common cultural identity based on work function, principles, philosophy and common goals (Ladebo, 2004; Schaubert, 2001; White & Brockett, 1987). However, the diversity in cultural backgrounds, personal beliefs and value systems of people in the United States potentially define an individual's convictions, perceptions, attitudes and behaviors (Schaubert, 2001).

The importance of perceptions in agriculture is reflected in the number of research studies that have been conducted globally in agricultural education regarding some major agricultural issues (Farouque & Takeya, 2007; Chizari, Lindner & Zoghie, 1999; Bruening, Radhakrishna & Rollins, 1992; Blezek & Dillon, 1991).

In the United States, Warnick, Thompson & Gummer (2004) determined the perceptions of science teachers in Oregon, regarding educational reform with the integration of science in agricultural education. Science teachers in Oregon perceived the integration of science in agricultural education to contribute to educational reform by helping students meet state standards (Warnick et al., 2004). Bruening, Radhakrishna & Rollins (1992) studied the

perceptions of farmers in Pennsylvania about the usefulness of information and organizational sources. Bruening, Radhakrishna & Rollins (1992) concluded that farmers perceived water pollution and manure management as the most serious environmental issues. However, farmers were uncertain if nutrient management and groundwater contamination were serious environmental issues (Bruening, Radhakrishna & Rollins, 1992). In China, the perceptions of teachers regarding teacher training and reforms of curriculum and instruction in agricultural schools were studied (Shao & Bruening, 2005). Chinese agriculture teachers had the perception that trying new ideas in their teaching practice and high quality teacher training and professional development programs could enhance curriculum and instructional reforms in agricultural education in China (Shao & Bruening, 2005). In Africa, Ikeoji, Agwubike & Disi (2007) studied the perceptions of agricultural science teachers regarding problems and challenges of vocational agriculture delivery in secondary schools in the Delta State of Nigeria. In the Delta State of Nigeria, head agricultural science teachers perceived poor funding of vocational agriculture, keeping abreast with developments in the field of agriculture and communicating such developments to students were the most challenges to the delivery of vocational agriculture in secondary schools (Ikeoji et al., 2007). Ikeoji et al (2007) recommended that those perceived challenges of poor funding of vocational agriculture, keeping abreast with developments in the field of agriculture and communicating such developments to students should be built into short-period in-service education and refresher programs of serving teachers in agricultural science. Ozor, Agwu, Chukwuone & Garforth (2007) also studied the perceptions of farmers and extension professionals regarding cost-sharing of agricultural technology transfer in Nigeria. The study of Ozor et al (2007)

concluded that 80.6% of farmers and 85.7% of extension professionals had favorable perception towards cost-sharing, which served as a pointer towards acceptance of the reform.

In Asia, Farouque & Takeya (2007) studied the perception of farmers regarding the integration of soil fertility and nutrient management for sustainable crop production, in Bangladesh. In Europe, Mattila, Kaustell, Leppälä, Hurme & Suutarinen (2007) conducted a study in Finland to determine framers' perceptions of necessary management skills. Mattila et al (2007) concluded that farmers perceived the application for subsidies and the acquisition of information on subsidies, the investment decision process and the maintenance of safety, health, the ability and motivation to work as the most challenging managerial tasks and topics. Some research findings on perceptions involving extension professionals and agricultural science teachers in Europe, the Middle East, Africa and the United States have been reported (Al-Subaiee, Yoder & Thompson, 2005; Chirazi, Lindner, & Lashkarara, 2001; Jayaratne, Martin & DeWitt, 2001; Udoto & Flowers, 2001; Williams & Wise, 1997; Androulidakis & Siardos, 1994).

In the Macedonia region of Greece, the perceptions of extension agents regarding their relevance and competence in certain task areas of their profession were studied (Androulidakis & Siardos, 1994). Androulidakis & Siardos (1994) concluded that regardless of experience, extension agents in the Macedonia region of Greece perceived themselves as more relevant as professionals in executing extension programs in response to clientele requests at the right time and competent in developing and maintaining desirable clientele relations. Baker & Villalobos (1997) determined the perceptions of county faculty of the Florida Cooperative Extension Service (FCES) regarding the professional development needs of specialists. The same study concluded that county directors perceived state specialists as

very successful in the areas of their ability to utilize the research base in solving problems, interfacing with industry groups and communication skills (Baker & Villalobos, 1997).

Positive perceptions or beliefs lead to specific intentions and attitudes that foster positive behavior (Knobloch & Martin, 2000). In the Middle East, studies revealed positive perceptions of extension professionals regarding the concept of sustainable agriculture (Chirazi et al., 2001; Al-Subaiee et al., 2005). In Iran, although wheat farmers of the Luresran Province did not perceive sustainable agricultural practices as effective farming practices for wheat production due to risks associated with those farming practices and lack of profitability, extension agents were of an opposite view (Chirazi et al., 2001). Instead of sustainable agricultural practices, wheat farmers of the Luresran Province of Iran perceived agricultural extension courses on the use of chemical fertilizers, pesticides, agricultural machinery, soil tillage, the benefits of crop rotation and seed treatment as the most useful to their farming business (Chirazi et al., 2001). In the Riyadh region of Saudi Arabia, the positive perceptions of extension agents regarding sustainable agriculture provided the basis for the development of sustainable agricultural programs by extension agents in that region of Saudi Arabia (Al-Subaiee et al., 2005). In East Africa, teachers of agricultural education in Kenya had positive perceptions about sustainable agriculture and further perceived themselves as knowledgeable in sustainable agricultural practices (Udoto & Flowers, 2001). However, Udoto & Flowers (2001) reported that agricultural education teachers had concerns about the amount of labor and management required for the implementation of sustainable agricultural practices and its cost effectiveness. In Iowa, Williams & Wise (1997) studied the perceptions of secondary school agricultural education teachers and their students regarding sustainable agriculture practices. Williams & Wise (1997) reported that agriculture teachers

perceived the concept of sustainable agriculture as new and needed to learn additional things about the concept. On the other hand, their agriculture students rated themselves as knowing very little about sustainable agricultural practices. Thus, confirming the perceptions of the teachers regarding sustainable agricultural practices (Williams & Wise, 1997). In another study, where perceptions regarding the concept of sustainable agriculture were determined as part of emerging trends for educating extension educators, the concept was perceived by extension educators as somewhat ambiguous (Jayaratne, Martin & DeWitt, 2001). However, extension educators in this study had positive perceptions regarding the benefits associated with sustainable agricultural practices.

Perceptions Regarding Instructional Methods and Learner Preferences for Learning Strategies in Extension Education

Extension education is an essential component of any agricultural development process (Park, Cho & Lee, 2007; Rogers, 2003; Creswell & Martin, 1993; Martin & Omer, 1990; Kang & Song, 1984). Kang & Song (1984) indicated “the primary responsibility of extension workers is education” (p. 130). A number of proven educational methods exist from which the extension educator may choose to set up learning situations and maximize the transfer of information to adult learners (Kang & Song, 1984). Once an extension educator has assessed and identified the needs of an area or a community it is his or her responsibility to choose the instructional methods that will be most effective in achieving the educational objectives (Kang & Song, 1984). In choosing instructional methods used for extension education, the perceptions of extension educators regarding the usefulness and effectiveness of the methods influence the methods chosen (Park et al., 2007; Creswell & Martin, 1993; Martin & Omer, 1990; Kang & Song, 1984).

Park et al (2007) studied the use of e-learning systems of the computer-based agricultural extension programs for agricultural extension in South Korea. The study concluded that adults prefer interactive learning rather than reading technical information. In a study to determine the perceptions of extension professionals and post-secondary agricultural instructors regarding the instructional methods in adult educational programs in Iowa (Martin & Omer, 1990), respondents placed a very high priority on a variety of instructional methods. However, respondents relied more on the lecture-discussion instructional method (Martin & Omer, 1990). In the same study, agricultural extension professionals considered the use of media outlets such as radio programs, television broadcasts and satellite programming to be very effective in educating community members (Martin & Omer, 1990). Creswell & Martin (1993) identified and assessed the instructional methods and tools used by county extension agriculturalists in the training of pesticide applicators in selected states. This study concluded that respondents, as a whole, did not use a variety of instructional methods and tools in pesticide training. However, the lecture, discussion and questioning methods were the predominant methods of instruction in pesticide applicator training by county extension agriculturalists. In adult education programs, learners' preferences for learning strategies can serve as useful guides for the determination of strategies that adult educators may adopt for certain learning activities (Rollins & Yoder, 1993).

Dollisso & Martin (1999) found that young farmers were motivated to participate in extension educational programs where learning activities were hands-on and by trial and error, whether individually or in groups. The conclusion of the study conducted by Dollisso & Martin (1999) has implications for program planning in agricultural education. In another

study where a livestock system environmental assessment tool (LSEA) was developed to support cooperative extension programs, close collaboration with livestock commodity groups proved to be the most effective delivery method (Koelsch, Howard, Pritchard & Hay, 2000). One-to-one meetings with extension educators were met with apprehension by producers and were relatively ineffective, unless producers initiated the request. Producers' preference was participation in small group meetings (Koelsch et al., 2000). In another study, farmers in Iowa had the perception that improved communications and education were needed to ensure proper management of chemicals used in agriculture (Bruening & Martin, 1992). In the same study the instructional methods of discussions, field demonstrations (tours), on-farm evaluation, county and local meetings, trade fairs and educational tools such as magazines, printed materials (brochures), visual materials (slides, photographs), television programs, video tapes and radio were identified as useful for farmer-extension education (Bruening & Martin, 1992). Miller (1997) studied the attitudes and perceptions of secondary teachers regarding the usefulness of an interactive communications network (ICN) for agricultural education at the secondary school level. According to Miller (1997), teachers were more positive about ICN technology and perceived that the obstacles to the use of the technology were less significant. In another study at the college level, the perceptions of agriculture faculty regarding electronic technologies in teaching were studied (Dooley & Murphy, 2001). Although agriculture faculty members perceived themselves as confident in their technical competence, their lack of experience to teach learners at a distance was due to less available training and assistance in the use of instructional technologies for distance education (Dooley & Murphy, 2001). In the Southern region of the United States, agriculture teachers perceived that the most critical needs of adults involved in agricultural production

pertained to farm management and the use of the latest farm technology (Chizari & Taylor, 1991). Chizari & Taylor (1991) recommended that state supervisors and secondary school agriculture teachers focus on the areas of farm management and the use of the latest farm technology when planning adult educational programs in agricultural production. Trede & Russell (1999) studied the perceptions of stakeholders of urban agriculture education in the United States towards linkages and curriculum in urban agricultural programs. Stakeholders of urban agriculture education perceived linkages established with communities in which an urban agriculture program resided to enhance the development of urban agricultural programs. Furthermore, stakeholders perceived that communications, leadership and decision-making were important to agribusiness linkages with urban agriculture programs and should therefore be emphasized in agricultural education (Trede & Russell, 1999).

In the North Central region, past and recent studies on the perceptions of extension educators regarding major agricultural issues with implications for agricultural education focused on pesticide application (Creswell, 1990); sustainable agriculture (Jayaratne, 2001) and water quality (Camara, 2006). Research findings on the construct of perception with extension educators as subjects are limited in the region. Specifically, the research could find no information on the perceptions of extension educators regarding livestock waste management education in the region.

The North Central region has great diversity in its physical and socio-cultural environments (USDA, 2002). Variations in the topography, soils, vegetation and livestock of the region place different emphases on livestock production in the region (USDA, 2002). It is therefore likely that the perceptions of extension educators in the North Central region regarding livestock waste management and the educational methods needed to educate

farmers about livestock waste management may vary across the states of the region. As an important agricultural hub of the United States, any research intervention in the North Central region that seeks to promote agricultural productivity or protect the environment with an education component would be economically beneficial and further sustain livelihoods in the region.

This study was conducted with the purpose to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. Consequently, the following research questions were to be answered by the study.

- 1) What are the perceptions of county extension educators regarding livestock waste management?
- 2) What are the perceptions of county extension educators regarding education about livestock waste management?
- 3) What are the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management?

The Theoretical Framework for the Study

The theoretical framework for the study was the theory of reasoned action (TRA) (Ajzek and Fishbein, 1980). The following figure gives a diagrammatic representation of the TRA model (Figure 1).

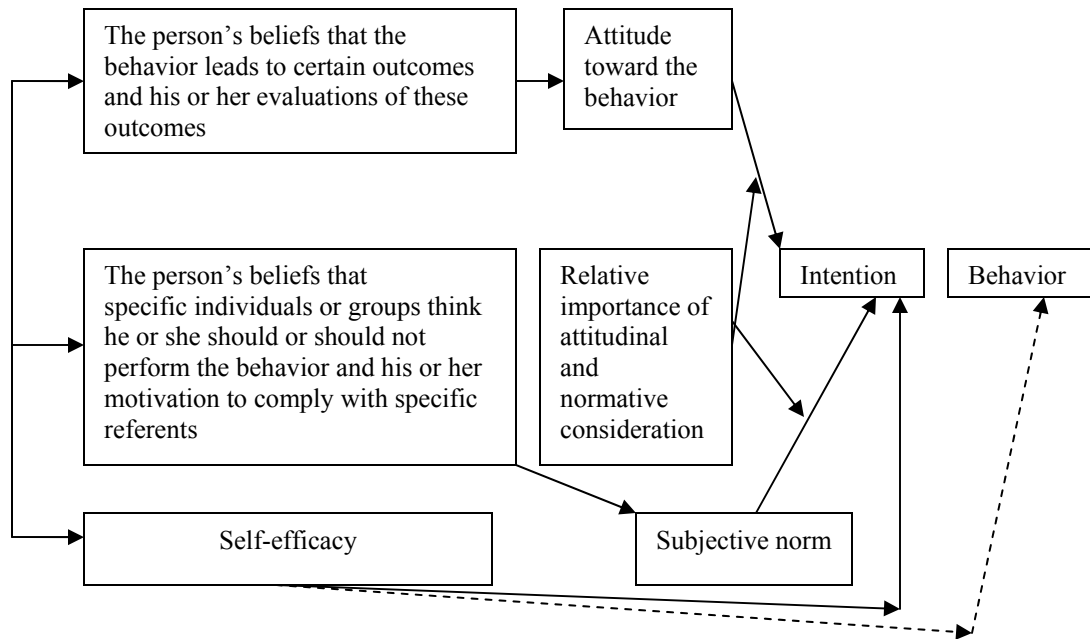


Figure 1. The behavioral intention model based on Ajzen and Fishbein (1980) and Ajzen (1988). *Arrows indicate the direction of influence*

Source: van den Ban & Hawkins (1996, p.82).

The TRA, which addresses beliefs, attitudes and perceptions is expressed algebraically as $B \sim I = (Aact) w1 + (SN) w2$ (Taylor, 2001), where B is the Behavior, I is the Intention for the behavior, Aact is the person's attitude towards the behavior and SN is the influence of the person's subjective norms (Taylor, 2001). The w1 and w2 in the model represent the empirically derived weights regarding the importance of each term (Wikipedia, 2007). In the TRA model, the contribution of an opinion by a referent is weighted by the motivation that an individual has in order to comply with the wishes of that referent (Taylor, 2001). Lindner (1998) defined motivation as "the inner force that drives individuals to accomplish personal or organizational goals." In its simplest form, the TRA model can be expressed as $BI = (AB) W1 + (SN) W2$, where BI = behavioral intention, (AB) = one's

attitude toward performing the behavior, W = empirically derived weights and SN = one's subjective norm related to performing the behavior (Wikipedia, 2007).

According to the TRA, a person's behavior is determined by his or her attitude towards the outcome of that behavior and by the opinions of his or her social environment (Taylor, 2001). Although human behavior is guided by beliefs, attitudes and intentions, Ajzen and Fishbein (1980) proposed that it is the intentions of individuals that predict individual behaviors and they defined intentions as an individual's plans to either perform or not to perform a particular behavior. Given the definition of intentions, it is imperative to understand the meanings of beliefs and attitudes.

Beliefs and attitudes are either the "thoughts about objects, events or situations in the world" or "a tendency to approve or disapprove of an object, event, or condition, respectively (Sproule, 1991, p. 121 & 122). Taylor (2001) defined attitude as a person's salient beliefs about whether the outcome of his action will be positive or negative. However, van den Ban & Hawkins (1996, p. 81) defined attitudes as "the more or less permanent feelings, thoughts and predispositions a person has about certain aspects of his (*or her*) environment". According to Galbraith (2004, p.12), attitudes are "those affective elements that are connected to our likes or dislikes, positive or negative, and for or against feelings towards a person or thing." From the foregoing definitions of beliefs and attitudes, it can be deduced that human values are based on beliefs and beliefs guide human attitude (Galbraith, 2004). An individual's positive beliefs about the outcome of his or her behavior will lead to a positive attitude about that behavior. Otherwise the individual's attitude about the behavior is negative (Taylor, 2001). In contrast to attitude, a person's beliefs about what others will think concerning his or her behavior (his or her subjective norms) are a function of his or her

perceptions of others (normative norms) about the outcome of the behavior (Taylor, 2001). An individual's attitude and behavior are not only influenced by his or her personal opinions, but also by his or her perceptions of the expectations from the social environment. Salient beliefs and subjective norms of individual persons influence their perceptions (Taylor, 2001). From the perspective of this study, the TRA is useful in addressing the beliefs of extension educators in the North Central region regarding livestock waste management and how those beliefs influence their perceptions regarding livestock waste management education.

Limitations of the Theory of Reasoned Action Model

The TRA model is a very useful predictive tool of human behavior. However, the model has some limitations. The first major limitation of the model is correspondence (Taylor, 2001), which implies that for behavior to be predicted, attitude and intention must be in accord with action, target, context and time (Taylor, 2001). The limitation of correspondence makes the TRA only applicable to behavior that is consciously thought out beforehand (Taylor, 2001). Otherwise, decisions that are not rational or behaviors that are not consciously considered cannot be explained by the TRA. The second limitation of the TRA model is about functions. The model functions on the assumption that when an individual has an intention to act, the person will be free to act without any limitation (Taylor, 2001). In practice, constraints such as environmental or organizational limits, limited time or ability and unconscious habits, limit the freedom of an individual to act (Furneaux, 2005). In summary, behaviors that are not consciously considered or may be based on habitual actions, irrational or ad-hoc decisions cannot be explained by the TRA model and thus serve as limitations to the model (Taylor, 2001).

CHAPTER 3

METHODS AND PROCEDURES

Research Design and Instrumentation

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. The specific objectives of the study were to:

- 1) Describe the demographic characteristics of county extension educators.
- 2) Identify the general perceptions of county extension educators regarding livestock waste management.
- 3) Identify the perceptions of county extension educators regarding education about livestock waste management.
- 4) Describe the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management.
- 5) Compare perceptions based on demographic characteristics of the participants.

The research design for this study was a simple random sample survey. The study was descriptive and used a survey questionnaire to gather research information.

The survey questionnaire was developed and formatted to suit the purpose of this study after carefully reviewing two existing survey questionnaires by Jayaratne (2001) and Creswell (1990). A panel of five experts from the departments of Agricultural Education and Studies, Agricultural and Biosystems Engineering and Agronomy at Iowa State University critically reviewed the survey questionnaire for face and content validity (Ary et al., 2006). The external validity and reliability of the survey questionnaire were determined through a

pilot study with 15 County Extension Educators in Iowa. The reliability of the instrument was determined by calculating Cronbach's reliability coefficient (Cronbach's α). The overall Cronbach's reliability coefficient (Cronbach's α) for the survey questionnaire was .75.

The survey questionnaire was divided into five parts. Parts I and II used 5-point Likert-type scales that ranged from 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree to answer questions that were related to the general perceptions of county extension educators regarding livestock waste management (Part I) and education regarding livestock waste management (Part II), respectively. Part III of the survey questionnaire also used a 5-point Likert-type scale to identify perceptions of county extension educators regarding the extent of use and effectiveness of extension teaching methods and tools. Perceptions regarding the extent of use of teaching methods and tools had a scale that ranged from 1=Not used, 2=Rarely used, 3=Sometimes, 4=Frequently used and 5=Always used. Perceptions regarding the effectiveness of teaching methods and tools had a scale that ranged from 1=Not Effective, 2=Of little effectiveness, 3=Somewhat Effective, 4=Effective and 5=Very Effective. For the purpose of this study, the effectiveness of a teaching method or tool is defined as the perceived level of achieved success, when the teaching method or tool is used to deliver extension educational programs. Part IV of the survey questionnaire had questions with multiple choice answers and others with blank spaces for respondents to indicate their responses on demographic information. Part V of the survey questionnaire was for respondents to include any additional comments on livestock waste management education they found necessary.

The internal validity of the study was based on the following assumptions:

1. Respondents will provide accurate and unbiased information to reflect the actual perceptions of extension professional in the North Central region of the USA regarding livestock waste management and the educational processes used to educate farmers regarding livestock waste management.
2. Respondents will independently answer the questions without any interaction with other subjects.

The adaptation and modification of existing survey instruments that have been validated and tested for reliability controlled measurement errors of this study. However, non-response error was considered a potential weakness of the study. The non-response error was corrected by randomly selecting 12 extension educators, one from each state from the non-response group who were interviewed by telephone for their responses to randomly selected questions from each part of the survey. The responses from the telephone interviews were compared with those, which had been received by post and were found to be similar. The study population was limited to the county extension professionals in the North Central region of the United States. Findings of the study were therefore limited to the study population as such.

Data Source

The target population for the data source of the study was county extension educators in the North Central region of the United States. States included were Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. The list of state agriculture and natural resources (ANR) leaders in the North Central region was obtained from the office of the state ANR leader at Iowa State University, Ames, Iowa. A letter, which was signed by the researcher, his major professor and the state

ANR leader at Iowa State University, was mailed to each state ANR leader in the region requesting for an up-to-date frame of county extension educators in each state of the region. Requesting for up-to-date frames of county extension educators was an attempt to minimize frame error. Frames included the names, physical addresses, email addresses and telephone numbers of county extension educators in each state of the region.

A simple random sampling technique was used to draw a sample of 30 county extension educators from each state yielding a total number of 360 as potential participants of the study. The decision to select a total number of 30 county extension educators from each state was based on limited resources. However, a sample size of 360 extension educators gives a maximum margin of error of 5% at a probability value of .50 ($p = .50$) according to Ary et al (2006). At the probability value of .50 ($p = .50$), the sample size can be estimated using the formula $n = [(1/E)/\sqrt{pq}]^2 \cdot z^2$ where n = sample size needed, E = desired margin error, $p q$ = variance of hypothesized proportion, which can be used to estimate the standard error $SE (\sigma_p) = \sqrt{(pq/n)}$ and z = z score of confidence level (Ary et al., 2006). In the SE formula, p represents the proportion of respondents agreeing and $q = 1-p$ is the proportion not agreeing (Ary et al., 2006, p. 419). Using $p = .50$ is considered as safe to estimate the needed sample size because the variance of a hypothesized proportion (pq) is at its maximum possible value of .25 when $p = q = .50$ according to Ary et al (2006).

Data Collection

Prior to initiating this study, approval was sought from the Office of Research Assurances (ORA) at Iowa State University, Ames, Iowa, to use human subjects for the descriptive study. Following approval of the study (Appendix A), copies of the approved questionnaire and a cover letter co-signed by the researcher and his major advisor were

mailed with pre-addressed and stamped return envelop to all research participants in the North Central region. The purpose of the letter was to inform research participants of their selection to participate in a study, which was voluntary, the purpose of the study and to inform participants of their rights to withdraw from the study at anytime during the study if they decided to do so.

Two weeks after mailing the questionnaire to the research participants, follow-up letters were mailed to nonrespondents asking them to participate in the study. The letter also reminded nonrespondents of their rights to withdraw from the study if they found it necessary as explained in the cover letter and the need for their timely responses. Four weeks after the first mailing a second reminder letter was mailed to nonrespondents, requesting their response to the questionnaire. One week after the second mailing, telephone interviews were conducted with 12 randomly selected extension educators from the non-response group to obtain their responses. Questionnaires that were received after the second mailing reminder were considered as late responses, which were compared with early responses for any differences using independent samples t-test. The response rate of participants was estimated as a percentage of the total number of survey questionnaires mailed to all participants. The mathematical relationship $RR, \% = (T R / T N M Q) \times 100$, was used to estimate the response rate, where RR is the response rate, TR is the total number of responses and TNMQ is the total number of mailed questionnaires.

Data Analysis

Data from questionnaire items were coded and entered into a Statistical Package for Social Science (SPSS-windows) computer program for analysis. Prior to analyzing the responses, early and late responses were compared using independent samples T-test. Data

analysis was done in anticipation to summarize descriptive statistics such as means, standard deviations and percentages of all variables of interest from the study. Correlation analysis of data from the study variables was conducted to identify any relationships between demographic information and the perceptions of participants. Parts of the analyzed data were summarized as tables and other data were presented as figures.

Limitations of the Study

The study was limited to the North Central region of the USA and to the target population of county extension educators. The study did not involve all county extension Educators in the region, but a random sample of 360 extension educators was selected (30 extension educators per state) for the study.

The major construct of this study was the focus on perceptions. The study sought to determine the perceptions of county extension educators in the North Central region regarding livestock waste management and the educational processes used to educate farmers about livestock waste management. Transformative learning has the potential to change beliefs, attitudes, values and perceptions of adult learners. Therefore, the findings of this study only reflected the perceptions of extension educators in the North Central region during the period when this study was conducted.

This study had the potential of measurement error through inaccurate answers from respondents. Measurement error was controlled through a critical evaluation of the survey questionnaire by a panel of five experts for face and content validity.

A pilot study of the questionnaire was conducted to test for its reliability prior to administering it to the population sample. Non-respondent error was controlled by randomly

selecting a sample of nonrespondents who were contacted by telephone for their responses, which were compared with responses received by post (Lindner, Murphy & Briers, 2001).

CHAPTER 4

FINDINGS

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. The study sought to answer the following research questions with implications to design a relevant educational model to meet the needs of county extension educators in the North Central region regarding farmer education about livestock waste management.

- 1) What are the perceptions of county extension educators regarding livestock waste management?
- 2) What are the perceptions of county extension educators regarding education about livestock waste management?
- 3) What are the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management?

Out of 360 randomly selected county extension educators in the study, 201 (56%) returned usable questionnaires. Seventy-five (37.3%) of the usable questionnaires were totally completed and 126 (62.7%) were partially completed. Non-response error of this study was controlled by conducting a telephone interview with 12 randomly selected nonrespondents; one from each state of the study area and their responses were compared with data received from returned questionnaires. This procedure was appropriate according to Linder et al (2001), to address the non-response error.

An independent sample t-test procedure was used to determine if there were significant differences between early and late respondents (Linder et al., 2001). Overall, the results of the independent sample t-test did not show statistically significant differences between early and late respondents. Consequent to the t-test result, it was reasonable for the findings of this study to be generalized over the study population. However, a few significant differences between early and late respondents regarding certain individual statements were observed from the t-test results and they are presented in Table 1.

Table 1. Independent Sample t-test indicating significant differences in means to responses from early and late respondents (N= 201)

Statement	T-test for Equality of Means	
	df	Sig. (2-tailed)
Part I - General Perceptions		
Best management practices for livestock waste management do not improve the value of livestock waste as fertilizer.	198	.022*
Biosecurity is irrelevant to livestock waste management.	197	.037*
Part II- Perceptions regarding Education		
Extension professionals should have some knowledge about how adults learn.	198	.022*
Extension professionals should involve learners in planning educational programs.	197	0.14*
Extension professionals should involve learners in the delivery of educational programs.	197	.005**
Part III- Perceptions regarding Educational Tools and Methods		
The extent of use of video tapes.	188	.048*
The extent of use of compact disks.	186	.015
The extent of use of research publications.	192	.010**
The extent of use of satellite.	182	.036*

Table 1. (continued)

	df	Sig. (2-tailed)
The effectiveness of case study.	182	.004**
The effectiveness of small group work.	187	.007**
The effectiveness of testing.	181	.021*
The effectiveness of posters.	176	.017*
The effectiveness of video tapes.	171	.021*
The effectiveness of computers.	180	.045*

A single asterisk indicates significant differences at $p \leq .05$; a double asterisk indicates significant differences at $p \leq .001$.

The findings of this study are presented on the basis of the objectives of the study and in the order presented in the purpose statement of the study. First, the demographics related to the study sample are presented to describe the characteristics of the respondents. Subsequently, the findings are presented and described in the following order: 1) the general perceptions of county extension educators regarding livestock waste management; 2) the perceptions of county education educators regarding education about livestock waste management; 3) the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management; 4) comparison of perceptions based on demographic characteristics of the respondents.

Demographic Characteristics

A majority of the respondents (N=201) were male (76%) as depicted in Figure 2.

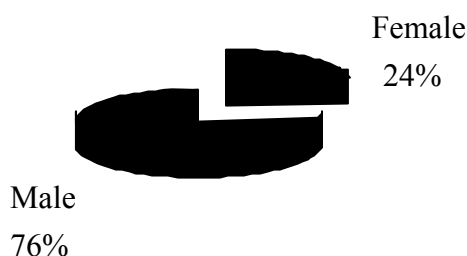


Figure 2. Gender distribution of county extension educators

Distribution of age, highest level of academic qualification and work experience as extension professionals of county extension educators

The age distribution of county extension educators in this study is presented in Table 2. The mean age of county extension educators is 47.2 years. However, the majority (30.4%) of county extension educators in this study were in the age range of 51 to 57. Only 1.0% of county extension educators had ages equal to or greater than 65 years and 9.1% were less than 30 years of age in the age range of 23 to 29 (Table 2).

Table 2. Age Distribution of County Extension Educators (N = 201)

Age category (years)	23-29	30-36	37-43	44-50	51-57	58-64	≥ 65
Frequency of respondents	18	22	24	36	60	34	2
Percentage of respondents	9.1	11.1	12	18	30	17	1.0

The majority (69.7%) of county extension educators had master's degrees, whereas 19.4 and 8.5 % had bachelor's and doctorate degrees, respectively, as their highest level of formal education (Table 3).

Table 3. Distribution of county extension educators' levels of education (N=201)

Level of education	Bachelors Degree	Masters Degree	Doctorate Degree
Frequency of respondents	39	140	17
Percentage of respondents	19.4	69.7	8.5

The frequency distribution of the highest educational degrees of county extension educators is presented in Table 4. The majority of county extension educators (61.7%) had their highest educational degrees in agronomy, soil science, animal science, horticulture, agricultural engineering and agricultural education (Table 4). Four percent (n = 8) of county extension educators had their highest educational degrees in extension education and rangeland science and 1.0 % (n = 2) had their highest degrees in ministerial leadership and political science (Table 4).

Table 4. Frequency and percentage distribution of county extension educators' highest educational degrees (N=201)

Highest Educational Degree	Frequency	Percentage of respondents
Agronomy	42	20.9
Soil Science	7	3.5
Animal Science	36	17.9
Horticulture	3	1.5
Agricultural Engineering	5	2.5
Agricultural Education	31	15.4
Administration	1	0.5
Administration of Higher Education	1	0.5
Adult Education	3	1.5
Adult learning and leadership	1	0.5
Agricultural Economics	8	4.0
Agribusiness Economics	1	0.5
Agricultural Business	1	0.5
Agricultural leadership and Education	1	0.5
Biology	1	0.5

Table 4. (continued)

	Frequency	Percentage of respondents
Business Administration	1	0.5
Dairy Science	2	1.0
Distance education and Design Technology	1	0.5
Veterinary Medicine	1	0.5
Education	3	1.5
Entomology	2	1.0
Environmental Education	1	0.5
Environmental Science	1	0.5
Environmental Science and Policy	1	0.5
Extension Education	4	2.0
Fisheries and Wildlife	1	0.5
Food/Consumer Science	1	0.5
Higher Adult Education and Leadership	1	0.5
Management	1	0.5
Ministerial Leadership	1	0.5
Physical Geography	1	0.5
Plant Pathology	2	1.0
Political Science	1	0.5
Professional Agriculture	1	0.5
Public Administration	1	0.5
Rangeland Science	4	2.0
Sustainable Agriculture	1	0.5

Approximately 25% (n = 149) of county extension educators had worked for 5 to 34 years as extension professionals, whereas 4.5% (n = 9) and 19.5 % (n = 39) had worked for 35 to 56 and less than one year to four years, respectively, as extension professionals (Table 5).

Table 5. Distribution of county extension educators' years of work as extension professionals (N= 201)

Years of experience	≤1-4	5-14	15-24	25-34	35-45	46-56
Frequency of respondents	39	50	51	48	7	2
Percentage of respondents	19.5	25	26	24	3.5	1

Distribution of formal teaching experience and main responsibility of county extension educators

More than 75.1% (n = 151) of the respondents had no formal teaching experience at the high school level (Table 6).

Table 6. Years Distribution of Formal Teaching Experience of County Extension Educators at the High School level (201)

Years of formal teaching at the High School level	Frequency	Percentage
0.0	151	75.1
0.5	1	0.5
1.0	10	5.0
2.0	2	1.0
3.0	2	1.0
4.0	19	9.5
5.0	3	1.5
6.0	1	0.5
9.0	1	0.5
10.0	1	0.5
12.0	4	2.0
15.0	1	0.5
16.0	1	0.5
18.0	1	0.5
35.0	1	0.5

Seven percent ($n = 14$) of county extension educators had taught for one to two years at the community college and 87.1% ($n = 175$) did not have any formal teaching experience at the community college level (Table 7).

Table 7. Years Distribution of Formal Teaching Experience of County Extension Educators at the Community College level (201)

Years of formal teaching at the Community College level	Frequency	Percentage
0.0	175	87.1
1.0	7	3.5
2.0	7	3.5
3.0	2	1.0
4.5	1	0.5
6.0	2	0.5
8.0	1	0.5
10.0	2	1.0
12.0	1	0.5
19.0	1	0.5

Seventeen percent ($n = 34$) of county extension educators had taught for 2 to 8 years at the university level and 4.0% ($n = 8$) had taught for 10 to 27 years at the university level (Table 8). Nine (4.5%) of county extension educators had taught for only six months to one year at the university level and 73.6% ($n = 148$) had no formal teaching experience at the university level (Table 8).

Table 8. Years Distribution of Formal Teaching Experience of County Extension Educators at the University level (201)

Years of formal teaching at the University level	Frequency	Percentage
0.0	148	73.6
0.5	2	1.0
1.0	7	3.5
2.0	8	4.0
3.0	4	2.0
4.0	10	5.0
4.5	1	0.5
5.0	6	3.0
6.0	5	2.5
8.0	3	1.5
10.0	1	0.5

Table 8. (continued)

	Frequency	Percentage
15.0	1	0.5
20.0	2	1.0
27.0	1	0.5

The majority (68.2%) of county extension educators (n = 137) had agriculture and natural resources as their main responsibility, followed by 4-H and youth development (9.5%) and administration (8.5%), respectively (Table 9). The percentages of county extension educators with family and community development as their main responsibilities were 3.0% and 5.0%, respectively (Table 9).

Table 9. Frequency and percentage distribution of county extension educators main areas of county responsibility (N=201)

Main county extension responsibility	Frequency	Percentage of respondents
Agriculture and Natural Resources	137	68.2
Community Development	10	5.0
Family Development	6	3.0
4-H and Youth Development	19	9.5
Administration	17	8.5

General perceptions of county extension educators regarding livestock waste management

The means and standard deviations of county extension educators' responses to statements related to perceptions about livestock waste management are presented in Table 10. The following statements had mean ratings approximately equal to four or greater than four on a five-point Likert-type scale. "Livestock waste management means different things to different people" (mean = 4.27). "Livestock waste management is a controversial issue" (mean 4.29). "Livestock waste management is a complex environmental issue" (mean =

4.15). “Livestock waste management is essential to human health” (mean = 3.99). “Best management practices for livestock waste management protect water quality” (mean = 4.28). “A single set of best management practices applies in all situations of livestock waste management” (mean = 4.29, reverse coded). “Biosecurity is irrelevant to livestock waste management” (mean = 4.05, reverse coded). (Table 10). On the other hand, the following statements scored means less than three on the five-point Likert-type scale. “Best management practices for livestock management are easy to understand” (mean = 2.76). “Best management practices for livestock waste do not improve the value of livestock waste as fertilizer” (mean = 1.96). “State plans for livestock waste management must exceed the federal national pollutant discharge elimination” (mean = 2.57). “Not all best management practices are acceptable agricultural practices” (mean = 2.86, reverse coded) (Table 10). The mean responses of county extension educators regarding the statements “federal regulations are adequate for sustainable livestock waste management” and “the highest risk with livestock waste management is nonpoint source pollution were 3.08 and 3.05, respectively (Table 10).

Table 10. Means and standard deviations of the general perceptions of county extension educators regarding livestock waste management (N=201)

Statement	n	Mean	SD
Livestock waste management means different things to different people	201	4.27	0.65
Livestock waste management is a controversial issue	201	4.29	0.73
Livestock waste management is a complex environmental issue	201	4.15	0.80
Livestock waste management is essential to human health	201	3.99	0.79
Best management practices for livestock waste management are easy to understand	200	2.76	0.96

Table. 10 (continued)

	n	Mean	SD
Best management practices for livestock waste management include riparian buffers	201	3.82	0.76
Best management practices for livestock waste management do not improve the value of livestock waste as fertilizer	200	1.96	0.86
State plans for livestock waste management must exceed the federal national pollutant discharge elimination	199	2.57	0.89
Best management practices for livestock waste management protect water quality	200	4.28	0.68
Best management practices for livestock waste management protect air quality	200	3.77	0.86
Best management practices for livestock waste management have not protected soil quality	200	3.77†	0.81
Not all best management practices are acceptable agricultural practices	200	2.86†	0.88
A single set of best management practices applies in all situations of livestock waste management	200	4.29†	0.75
Efficient livestock waste management practices require regular waste analysis	200	3.70	0.90
State regulations are adequate for sustainable livestock waste management	198	3.25	0.94
Federal regulations are adequate for sustainable livestock waste management	198	3.08	0.93
Biosecurity is irrelevant to livestock waste management	199	4.05†	0.74
The highest risk with livestock waste management is nonpoint source pollution	200	3.05	0.97

Statements were rated on a Likert-type scale of 1 to 5, where 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree.

†Statements were reverse coded for analysis, where 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.

The distribution of county extension educators' responses to statements related to general perceptions about livestock waste management are presented in Table 11.

Table 11. Frequency distribution of county extension educators' responses to statements about general perceptions regarding livestock waste management (N=201)

Statement	Frequency				
	1	2	3	4	5
Livestock waste management means different things to different people	2	2	4	124	69
Livestock waste management is a controversial issue	0	5	17	94	85
Livestock waste management is a complex environmental issue	1	7	24	98	71
Livestock waste management is essential to human health	0	8	40	100	53
Best management practices for livestock waste management are easy to understand	15	74	80	47	4
Best management practices for livestock waste management include riparian buffers	2	11	34	129	25
Best management practices for livestock waste management do not improve the value of livestock waste as fertilizer	61	99	30	7	3
State plans for livestock waste management must exceed the federal national pollutant discharge elimination	23	67	84	22	3
Best management practices for livestock waste management protect water quality	1	2	3	4	5
Best management practices for livestock waste management protect air quality	0	5	11	107	77
Best management practices for livestock waste management protect soil quality†	2	12	53	96	37
Best management practices for livestock waste management have not protected soil quality†	20	113	42	15	1
Not all best management practices are acceptable agricultural practices†	4	47	72	71	6

Table 11. (continued)

	Frequency				
	1	2	3	4	5
A single set of best management practices applies in all situations of livestock waste management†	83	101	9	5	2
Efficient livestock waste management practices require regular waste analysis	4	23	26	123	24
State regulations are adequate for sustainable livestock waste management	7	36	68	75	12
Federal regulations are adequate for sustainable livestock waste management	9	44	81	55	9
Biosecurity is irrelevant to livestock waste management†	50	116	26	6	1
The highest risk with livestock waste management is nonpoint source pollution	10	54	57	74	5

Statements were rated on a Likert-type scale of 1 to 5, where 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree.

†Statements were reverse coded for analysis, where 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.

Perceptions of county extension educators about education regarding livestock waste management

The means and standard deviations of the responses of county extension educators to statements related to perceptions about education regarding livestock waste management are presented in Table 12. The following statements related to perceptions about education regarding livestock waste management had means equal to four or greater than four.

“Extension professionals should have some knowledge about how adults learn” (mean =

4.42). “Extension professionals should have some knowledge about how to teach adults”

(mean = 4.49) (Table 12). “Extension professionals should involve learners in planning

educational programs” (mean = 4.16). Extension professionals should involve learners in the

delivery of educational programs” (mean = 3.80). “Extension professionals should recognize individual client’s differences” (mean = 4.42). Extension professionals should offer a variety of programs to meet the needs of their clients” (mean = 4.42). “Extension professionals should facilitate participants’ learning processes” (mean = 4.30). On the other hand, the mean score of county extension educators’ responses to the statement “extension professionals should be experts in livestock waste management was 2.88 (Table 12).

Table 12. Means and standard deviations of the perceptions of county extension educators about education regarding livestock waste management (N=201).

Statement	n	Mean	SD
Extension professionals should be experts in livestock waste management	200	2.88	0.97
Extension professionals should have some knowledge about how adults learn	200	4.42	0.52
Extension professionals should have some knowledge about how to teach adults	199	4.49	0.52
Extension professional should involve learners in planning of educational programs	199	4.16	0.62
Extension professional should involve learners in the delivery of educational programs	199	3.80	0.69
Extension professionals should recognize individual client’s differences	200	4.42	0.53
Extension professionals should offer a variety of programs to meet the needs of their clients	200	4.42	0.56
Extension professionals should facilitate participants’ learning processes	200	4.30	0.58

Statements were rated on a Likert-type scale of 1 to 5, where 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree.

The frequency distribution of county extension educators’ responses to statements about perceptions regarding livestock waste management education is presented in Table 13.

Table 13. Frequency distribution of county extension educators' responses to statements about perceptions regarding livestock waste management education (N=201)

Statement	Frequency				
	1	2	3	4	5
Extension professionals should be experts in livestock waste management	11	69	59	56	5
Extension professionals should have some knowledge about how adults learn	0	0	2	112	86
Extension professionals should have some knowledge about how to teach adults	0	0	2	98	99
Extension professional should involve learners in planning of educational programs	1	2	13	132	51
Extension professional should involve learners in the delivery of educational programs	0	5	55	113	26
Extension professionals should recognize individual client's differences	0	0	2	109	88
Extension professionals should offer a variety of programs to meet the needs of their clients	0	1	4	106	89
Extension professionals should facilitate participants' learning processes	0	1	0	118	72

Statements were rated on a Likert-type scale of 1 to 5, where 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree.

Perceptions of county extension educators about the extent of use of teaching methods and tools used in livestock waste management education

The means and standard deviations of responses provided by county extension educators regarding the extent of use of selected teaching methods and tools used in livestock waste management education are presented in Table 14. There were no means equal to four or greater than four on a five-point Likert-type scale regarding the extent of use of methods or tools used in livestock waste management education by county extension educators (Table 14). However, the following methods and tools had means approximately equal to 3.50 or

greater than 3.50 for responses provided by county extension educators regarding their extent of use in livestock waste management education. Lecturing (mean = 3.48), discussions (mean = 3.78), lecture-discussion (mean = 3.90), demonstrations (mean = 3.49), individualized instruction (mean = 3.62), meetings (mean = 3.97), field days (mean = 3.53), field days (mean = 3.53), workshops (mean = 3.71), print/broadcast media (mean = 3.57) and newsletters (mean = 3.60) (Table 14). On the other hand the following methods and tools had means approximately equal to two or less than two for responses provided by county extension educators regarding their extent of use in livestock waste management education. Quizzes (mean = 1.92), interactive white board (mean = 1.62), Elmo (mean = 1.27), textbooks (mean = 1.77), fiber optics network (mean = 1.82), micromedia breeze (means = 1.68) and satellite (1.81) (Table 14).

Table 14. Means and standard deviations regarding the extent to which selected teaching methods and tools are used in livestock waste management education (N=201).

Educational methods/tools	n	Mean	SD
Method			
Lecturing	195	3.48	0.82
Discussion	195	3.78	0.71
Lecture-Discussion	194	3.90	0.77
Case Study	194	2.65	0.97
Demonstrations	194	3.49	0.82
Individualized Instruction	195	3.62	0.97
Meetings	196	3.97	0.66
Brainstorming	191	2.27	0.95
Questioning	191	3.06	0.98
Field Days	194	3.53	0.86
Workshops	195	3.71	0.74
Problem Solving	191	2.91	0.99
Small Group Work	193	2.84	0.98
Testing	192	2.21	0.94
Distance Education	195	2.28	1.04
Quizzes	192	1.92	0.93
Tool			
Interactive White Board	185	1.65	0.95

Table 14. (continued)

	n	Mean	SD
Posters	192	2.41	0.95
Flip Charts	190	2.52	0.95
Elmo	161	1.27	0.64
Video Tapes	190	2.39	0.94
Websites	191	3.28	0.91
Worksheets	191	2.88	0.95
Computers	189	3.32	0.98
Internet	189	3.40	0.99
Compact disks	188	2.66	1.00
Print/broadcast Media	191	3.57	0.90
Pamphlets	192	3.39	0.86
Research Publications	194	3.38	0.96
Textbooks	189	1.77	0.89
Fiber Optics Network	180	1.82	1.02
Micromedia Breeze	175	1.68	1.02
Satellite	184	1.81	0.99
Newsletters	194	3.60	0.99

The extent of use of an educational method or tool was rated on a Likert-type scale of 1 to 5, where 1=Not Used; 2=Rarely Used; 3=Sometimes Used; 4=Frequently Used; 5=Always Used.

The frequency distribution of county extension educators' responses to the extent of use of selected teaching methods and tools used in livestock waste management education is presented in Table 15.

Table 15. Frequency regarding the extent to which selected methods and tools are used in livestock waste management education (N=201).

Educational methods/tools	Frequency				
	1	2	3	4	5
Method					
Lecturing	5	15	67	97	11
Discussion	1	7	55	112	20
Lecture-Discussion	3	3	40	112	36
Case Study	24	60	73	33	4
Demonstrations	0	23	71	82	18
Individualized Instruction	4	20	58	77	36
Meetings	0	5	30	126	35
Brainstorming	21	51	78	38	3
Questioning	15	34	73	62	7
Field Days	4	15	69	86	20
Workshops	1	11	50	114	19
Problem Solving	13	56	67	46	9

Table 15. (continued)

	Frequency				
	1	2	3	4	5
Small Group Work	17	56	65	51	4
Testing	45	83	45	17	2
Distance Education	54	63	48	29	1
Quizzes	76	68	36	11	1
Tool					
Interactive White Board	116	27	32	10	0
Posters	36	65	69	20	2
Flip Charts	32	56	76	24	2
Elmo	131	19	8	3	0
Video Tapes	35	70	60	25	0
Websites	6	32	65	78	10
Worksheets	17	43	80	47	4
Computers	8	26	73	62	20
Internet	11	19	62	78	19
Compact disks	29	45	78	32	4
Print/broadcast Media	4	19	55	91	22
Pamphlets	6	20	69	88	9
Research Publications	7	30	56	85	16
Textbooks	91	62	25	11	0
Fiber Optics Network	95	38	31	16	0
Micromedia Breeze	112	22	28	11	2
Satellite	96	41	35	10	2
Newsletters	7	21	45	91	30

The extent of use of an educational method or tool was rated on a Likert-type scale of 1 to 5, where 1=Not Used; 2=Rarely Used; 3=Sometimes Used; 4=Frequently Used; 5=Always Used.

Perceptions of county extension educators about the effectiveness of teaching methods and tools used in livestock waste management education

The means and standard deviations of responses provided by county extension educators regarding the effectiveness of selected teaching methods and tools used in livestock waste management education are presented in Table 16. The following teaching methods or tools had means approximately equal to four or greater than four on a five-point Likert-type scale regarding their effectiveness when used by county extension educators in livestock waste management education. Discussion (mean = 4.09), lecture-discussion (mean

= 4.09), demonstrations (mean = 4.45), field days (mean = 4.06), workshops (mean = 3.99) (Table 16). On the other hand, the following methods or tools had means approximately equal to three or greater than three regarding their effectiveness when used by county extension educators in livestock waste management education. Case study (mean = 3.55), meetings (mean = 3.54), problem solving (mean = 3.63) and small group work (mean = 3.59), lecturing (mean = 3.29), brainstorming (mean = 3.26), questioning (mean = 3.39), testing (mean= 2.58), computers (mean = 3.57) and the internet (mean = 3.61) (Table 16). Finally, the Elmo (mean = 1.91), distance education (mean = 2.86) and quizzes (mean = 2.48) had means approximately equal to two or greater than two regarding their effectiveness when used by county extension educators in livestock waste management education (Table 16).

Table 16. Means and standard deviations regarding the effectiveness of selected teaching methods and tools used in livestock waste management education (N=201).

Educational methods/tools	n	Mean	SD
Method			
Lecturing	191	3.29	0.73
Discussion	195	4.09	0.68
Lecture-Discussion	192	4.09	0.74
Case Study	184	3.55	0.87
Demonstrations	192	4.45	0.58
Individualized Instruction	194	4.42	0.62
Meetings	196	3.54	0.71
Brainstorming	189	3.26	0.88
Questioning	185	3.39	0.85
Field Days	194	4.06	0.70
Workshops	195	3.99	0.70
Problem Solving	189	3.63	0.80
Small Group Work	189	3.59	0.83
Testing	183	2.58	0.99
Distance Education	184	2.86	0.90
Quizzes	182	2.48	1.03
Tool			
Interactive White Board	140	2.63	1.03

Table 16. (continued)

	n	Mean	SD
Posters	178	2.85	0.78
Flip Charts	175	2.90	0.78
Elmo	99	1.91	0.95
Video Tapes	173	2.92	0.84
Websites	186	3.38	0.74
Worksheets	183	3.39	0.84
Computers	182	3.57	0.80
Internet	177	3.61	0.77
Compact disks	172	3.08	0.86
Print/broadcast Media	189	3.40	0.84
Pamphlets	188	3.35	0.84
Research Publications	191	3.41	0.90
Textbooks	157	2.41	1.01
Fiber Optics Network	130	2.65	1.01
Micromedia Breeze	125	2.47	1.15
Satellite	141	2.60	0.99
Newsletters	186	3.44	0.79

The effectiveness of an educational method or tool was rated on a Likert-type scale of 1 to 5, where 1=Not Effective; 2=Of little Effectiveness; 3=Somewhat Effective; 4=Effective; 5=Very Effective.

The frequency distribution of county extension educators' responses to the effectiveness of selected teaching methods and tools used in livestock waste management is presented in Table 17.

Table 17. Frequency regarding the effectiveness of selected teaching methods and tools used in livestock waste management education (N=201).

Educational methods/tools	Frequency				
	1	2	3	4	5
Method					
Lecturing	4	16	94	74	3
Discussion	1	1	28	115	50
Lecture-Discussion	1	4	26	107	54
Case Study	5	12	63	84	20
Demonstrations	0	1	5	93	93
Individualized Instruction	0	0	14	85	95
Meetings	0	12	80	91	13
Brainstorming	7	24	81	67	10
Questioning	5	19	71	79	11
Field Days	0	2	36	104	52
Workshops	0	4	37	111	43
Problem Solving	1	11	69	84	24

Table 17. (continued)

	Frequency				
	1	2	3	4	5
Small Group Work	4	12	59	96	18
Testing	23	69	58	28	5
Distance Education	16	39	86	41	2
Quizzes	35	59	56	29	3
Tool					
Interactive White Board	26	30	55	28	1
Posters	10	37	102	27	2
Flip Charts	9	35	97	33	1
Elmo	44	25	25	5	0
Video Tapes	9	39	84	39	2
Websites	1	20	79	80	6
Worksheets	6	18	65	87	7
Computers	1	11	74	75	21
Internet	0	10	70	76	21
Compact disks	6	34	77	50	5
Print/broadcast Media	2	24	73	77	13
Pamphlets	5	20	78	75	10
Research Publications	6	23	62	87	13
Textbooks	33	52	49	21	2
Fiber Optics Network	21	33	48	27	1
Micromedia Breeze	35	24	41	22	3
Satellite	25	32	58	26	0
Newsletters	2	14	86	69	15

The effectiveness of an educational method or tool was rated on a Likert-type scale of 1 to 5, where 1=Not Effective; 2=Of little Effectiveness; 3=Somewhat Effective; 4=Effective; 5=Very Effective.

Visual summaries of the extent of use and effectiveness of selected teaching methods and tools used in livestock waste management education

Visual summaries of the extent of use and effectiveness of selected teaching methods and tools used in livestock waste management education by county extension educators are presented in Tables 18 and 19.

The teaching methods of discussion, lecture-discussion, demonstrations, individualized instructions and field days were frequently used by county extension educators in livestock waste management education (Tables 18). The teaching methods of

lecturing, questioning, small group work, problem solving and case studies were sometimes used (Table 18). Quizzes, distant education, testing and brain storming were rarely used by county extension educators in livestock waste management education (Table 19). The teaching tools of newsletters and print/broadcast media were frequently used by county extension educators (Table 18). Pamphlets, research publications, websites, computers, Internet and flip charts were sometimes used and posters, Elmo, textbooks and satellite were rarely used by county extension educators in livestock waste management education (Table 18).

Table 18. Summary of the extent of use of selected methods and tools used in livestock waste management education (N=201)

Educational method/tool	Extent of Use		
	Frequently Used	Sometimes Used	Rarely Used
Method			
Discussion			
Lecture-Discussion			
Demonstrations			
Individualized Instruction			
Field Days			
Lecturing			
Questioning			
Small Group Work			
Problem Solving			
Case Study			
Quizzes			
Distance Education			
Testing			
Brainstorming			
Tool			
Newsletters			
Print/broadcast Media			
Pamphlets			
Research Publication			
Websites			
Computers			
Internet			

Table 18. (continued)

	Extent of Use		
	Frequently Used	Sometimes Used	Rarely Used
Flip Charts			
Interactive White Board			
Posters			
Elmo			
Textbooks			
Fiber Optics Network			
Micromedia Breeze			
Satellite			

The teaching methods of discussion, lecture-discussion, demonstrations, individualized instructions and field days, meetings, problem solving, small group work, case study and workshops were indicated by county extension educators as effective, whereas the methods of lecturing, quizzes, distance education, testing brainstorming and questioning were indicated as somewhat effective when used in livestock waste management education by county extension educators (Table 19). The teaching tools of computers and the internet were identified as effective, whereas newsletters, pamphlets, print/broadcast media and research publication were identified as somewhat effective by county extension educators when used in livestock waste management education. The Elmo was identified as of little effectiveness when used in livestock waste management education (Table 19).

Table 19. Summary of the effectiveness of selected methods and tools used in livestock waste management education (N=201)

Educational method/tool	Effectiveness		
	Effective	Somewhat Effective	Of Little Effectiveness
Method			
Discussion			
Lecture-Discussion			
Demonstrations			
Individualized Instruction			
Field Days			

Table 19. (continued)

	Effectiveness		
	Effective	Somewhat Effective	Of Little Effectiveness
Meetings			
Problem Solving			
Small Group Work			
Case Study			
Workshops			
Lecturing			
Quizzes			
Distance Education			
Testing			
Brainstorming			
Questioning			
Tool			
Computers			
Internet			
Newsletters			
Pamphlets			
Print/broadcast Media			
Compact disks			
Research Publication			
Worksheets			
Websites			
Video Tapes			
Flip Charts			
Interactive White Board			
Posters			
Textbooks			
Fiber Optics Network			
Micromedia Breeze			
Satellite			
Elmo			

Comparison of perceptions based on demographic characteristics of county extension educators

The comparison of perceptions of county extension educators based on demographic characteristics is presented as intercorrelations in Table 20. Overall, 41.2% of

intercorrelations were low, in the range of .10 to .20 and 23.6% were negligible, in the range of .01 to .09. The magnitudes of intercorrelations were interpreted after Davis (1971). The intercorrelations between gender and general perceptions regarding livestock waste management ($r = .102$); gender and perceptions regarding the use of teaching tools ($r = -.149$) were low (Table 20).

The intercorrelations between age and perceptions regarding livestock waste management education ($r = .102$); age and perceptions regarding the extent of use of teaching methods ($r = .239$); age and perceptions regarding the effectiveness of teaching methods ($r = .172$); age and perceptions regarding the effectiveness of teaching tools ($r = .114$) were also found to be low (Table 20). The intercorrelations between the level of educational qualification and perceptions regarding livestock waste management education ($r = .199$); level of educational qualification and perceptions regarding the effectiveness of teaching methods ($r = .158$); level of educational qualification and perceptions regarding the effectiveness of teaching tools ($r = .147$) were low (Table 20).

The intercorrelations between years of work experience as extension professionals and perceptions regarding livestock waste management education ($r = .167$); years of work experience as extension professionals and perceptions regarding the extent of use of teaching methods ($r = .159$); years of work experience as extension professionals and perceptions regarding the effectiveness of teaching tools ($r = .167$) were found to be low (Table 20).

All other intercorrelations were found to be negligible. However, intercorrelations between perceptions regarding the effectiveness of teaching tools and perceptions regarding the extent of use of teaching methods ($r = .478$); perceptions regarding the effectiveness of teaching tools and the general perceptions regarding livestock waste management ($r = .297$)

were moderate according to Davis (1971) (Table 20). The intercorrelations between age and years of work experience as extension professionals ($r = .515$); perceptions regarding the extent of use of teaching methods and perceptions regarding the extent of use of teaching tools ($r = .593$); perceptions regarding the extent of use of teaching methods and perceptions regarding the effectiveness of teaching methods ($r = .579$) were found to be substantial (Table 20).

Finally, the intercorrelation between perceptions regarding the effectiveness of teaching methods and perceptions regarding the effectiveness of teaching tools ($r = .706$) were found to be very high (Table 20).

Table 20. Intercorrelations among perceptions of county extension educators and selected demographic characteristics

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀
X ₁	1.00	.159	-.059	.131	.102	-.041	-.007	-.149	-.017	-.052
X ₂		1.00	.139	.515	.057	.102	.239	.039	.172	.114
X ₃			1.00	.129	.091	.199	.022	-.046	.158	.147
X ₄				1.00	.090	.167	.159	.021	.092	.167
X ₅					1.00	.294	.183	.137	.207	.297
X ₆						1.00	.056	.111	.207	.209
X ₇							1.00	.593	.579	.478
X ₈								1.00	.458	.683
X ₉									1.00	.706
X ₁₀										1.00

X₁ = Gender, X₂ = Age, X₃ = Level of educational qualification, X₄ = Years worked as extension professional, X₅ = General perception regarding livestock waste management, X₆ = Perceptions regarding livestock waste management education, X₇ = Perceptions regarding the extent of use of teaching method, X₈ = Perceptions regarding the extent of use of teaching tools, X₉ = Perceptions regarding the effectiveness of teaching methods, X₁₀ = Perception regarding the effectiveness of teaching tools.

Themes from additional comments by extension educators regarding livestock waste management education

Comments that were written on the questionnaires by county extension educators regarding livestock waste management education are presented in Appendix F. Major themes from these comments are presented as Table 21.

Two county extension educators (3.4%) made comments about awareness of the need for livestock waste management education by extension educators (Table 21). Twenty (33.9%) and three (5.1%) county extension educators made comments about farmer education regarding livestock waste management and farmers education regarding alternative livestock waste management, respectively (Table 21). Five (8.5%) and three (5.1%) county extension educators made comments about farmer education regarding livestock waste management regulations and the enforcement of regulations regarding livestock waste management, respectively. Four (6.8%) and six (10.2%) county extension educators made comments about educational and technical support for livestock waste management education and effective livestock waste management educational methods and tools for best management practices, respectively (Table 21).

Two county extension educators (3.4%) made comments about environmental advocates' education regarding livestock waste management (Table 21). One county extension educator (1.7%) made comments about information dissemination regarding livestock waste management education for rural non-agricultural residents. Three (5.1%) county extension educators made comments about multidisciplinary and collaborative approaches to livestock waste management education. Two county extension educators

(3.4%) made comments about power and control regarding livestock waste management (Table 21).

Table 21. Themes derived from additional comments by extension educators regarding livestock waste management education (N=59).

Description of Theme	Respondents	%
Farmer education regarding livestock waste management.	17	28.8
Small-scale farmer education regarding livestock waste management.	3	5.1
Farmer education regarding livestock waste management regulations.	5	8.5
Framer education regarding alternative livestock waste management systems.	3	5.1
Environmental advocates' education regarding livestock waste management.	2	3.4
Information dissemination regarding livestock waste management and education for rural non-agricultural residents.	1	1.7
Multidisciplinary and collaborative approaches to livestock waste management education.	3	5.1
Regulation enforcement regarding livestock waste management.	3	5.1
Power and control regarding livestock waste management.	2	3.4
Economic, social and technical challenges facing livestock waste management education.	6	10.2
Capacity building and specialized training for extension educators in livestock waste management education.	2	3.4
Educational and technical support systems for livestock waste management education.	4	6.8
Awareness of the need for livestock waste management education by extension educators.	2	3.4
Effective livestock waste management educational methods and tools for best management practices (BMPs).	6	10.2

CHAPTER 5

DISCUSSION

The main purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. The study sought to answer three research questions based on the specific objectives of the study with implications to design a relevant educational model to meet the needs of county extension educators in the North Central region regarding livestock waste management education. 1) What are the perceptions of county extension educators regarding livestock waste management? 2) What are the perceptions of county extension educators regarding education about livestock waste management? 3) What are the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management?

The target population of the study was county extension educators in the 12 states of the North Central region of the United States. With the sample size of 360 county extension educators randomly selected from the target population, 76% of those who returned questionnaires were male with an average age 47.2 years. Findings regarding gender distribution and mean age of county extension educators in this study appeared to be consistent with the findings of Camara (2006) and Jayaratne (2001). According to Jayaratne (2001), 89.5% of extension agents in the North Central region were males with a mean age of 45 years. In the study by Camara (2006), 86.3% of agricultural extension educators in the North Central region were male with a mean age of 47.07 years. The findings of Jayaratne (2001) and Camara (2006) regarding gender distribution and mean age of county extension

educators in the North Central region confirm the trend found in this study regarding gender distribution and mean age of county extension educators. The slight differences in the percentages of gender distribution and mean ages of county extension educators in this study and the studies of Camara (2006), Jayaratne (2001) are attributable to sampling method for potential participants in each study. In each study, the simple random sampling method (Ary et al., 2006) was used to select potential participants. According to Ary et al (2006) “the basic characteristic of simple random sampling is that all members of the population (*target group*) have an equal and independent chance of being included in the random sample” (p. 169). Therefore depending on the sample size desired, it is more likely that the most occurring characteristic in a population may have a higher frequency of occurrence (Spiegel, 1961). Therefore, based on the characteristic of the simple random sampling method (Ary et al., 2006), empirical probability, which is the relative frequency of occurrence of an event (Spiegel, 1961) and the findings of Camara (2006) and Jayaratne (2001), it can be concluded that the findings of this study regarding gender distribution and mean age of county extension educators in the North Central region of the United States are confirmed. There appears to be more male county extension educators than female in the North Central region.

County extension educators in the North Central region appeared to be well educated with diverse academic backgrounds. The findings of this study did show that 69.7% of county extension educators in the North central region have master’s degrees, whereas 19.4 and 8.5% have bachelors and doctorate degrees, respectively. These findings are consistent with the findings of past studies (Camara, 2006; Jayaratne, 2001; Creswell, 1990). Creswell (1990) reported that 63.6% of extension professionals in his study in the North Central region had master’s degrees, whereas, 23.3 and 2.0 % had bachelors and doctorate degrees,

respectively. The diverse academic background of county extension educators in the North Central region includes those with degrees in political science, ministerial leadership and biology besides the major disciplines of agronomy, animal science, agricultural education, agricultural engineering, agricultural economics and horticulture. Additionally, county extension educators in this study appeared to have a wide range of work experience as extension professionals. Seventy-five percent of county extension educators had worked from 5 to 34 years as extension professionals and 3.5% had worked for 35 to 45 years. The studies of Camara (2006), Jayaratne (2001) and Creswell (1990) further confirmed this finding.

Experience of county extension educators was considered from the standpoint of formal teaching and number of years worked as extension professionals. Approximately 78.6% of county extension educators did not have any formal secondary school teaching experience. However, the mean number of years county extension educators had worked as extension professionals was 16.9 years. This finding indicates that although the majority of county extension educators in the North Central region did not have formal teaching experience, they have valuable professional experience as extension educators. The simple random sampling method (Ary et al., 2006) used to select county extension educators in this study population precluded any selection biases regarding prior knowledge of the background of potential participants of this study. Therefore, based on years of work experience, the diverse educational qualifications and backgrounds and the main county extension responsibilities of county extension educators, it is presumed that county extension educators in the North Central region are well experienced and resourceful. The experience and resourcefulness of county extension educators in the North Central region can serve as

the foundation for success and versatility regarding their job functions, particularly regarding livestock waste management education.

General perceptions regarding livestock waste management

Perceptions have been defined as processes by which individuals receive information or stimuli from their environment and transform the information or stimuli into psychological awareness (van den Bans & Hawkins, 1996). Perceptions are essential for individuals to arrive at beliefs about their environments (Coates, 1998; van den Bans & Hawkins, 1996; Ajzek & Fishbein, 1980). Additionally, perceptions are directional (van den Bans & Hawkins, 1996) and therefore influence specific attitudes, intentions and behaviors (Ajzek & Fishbein, 1980). Intentions based on positive perceptions promote positive attitudes and behaviors (Knobloch & Martin, 2000). The purpose of this study was to identify perceptions of county extension educators in the North Central region regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management. In order to achieve the purpose of this study, the perceptions of county extension educators regarding the concepts and practices of livestock waste management based on their knowledge and understandings were identified. This was done because perceptions influence beliefs; attitudes and behaviors (Ajzek & Fishbein, 1980) and would potentially influence how county extension educators may educate communities about livestock waste management. Favorable perceptions regarding livestock waste management concepts and practices would imply positive assertiveness and motivation of county extension educators to educate farmers and communities about livestock waste management (Knobloch & Martin, 2000).

The findings of this study showed that county extension educators in the North Central region appeared to have favorable perceptions regarding livestock waste management concepts and practices. However, they perceived the concept of livestock waste management as meaning different things to different people. Therefore, it is logical that county extension educators involved in livestock waste management in the North Central region would more likely respond positively to any in-service training and educational programs aimed at developing a working definition of livestock waste management. The foregoing assertion is supported by Knobloch & Martin (2000) that positive perceptions influence positive behaviors. Similar to the above conclusion, science teachers in Oregon had positive perceptions regarding educational reform and as a result integrated science in agricultural education to help student meet state standards (Warnick et al., 2004). In the Riyadh region of Saudi Arabia, positive perceptions of extension agents regarding sustainable agriculture provided the basis for the development of sustainable agricultural programs by extension agents in that region (Al-Subaiee et al., 2005).

Perceptions regarding livestock waste management education

Organizational beliefs define the cultural identity, work roles, perceptions and behaviors of employees (Labedo, 2004; Bolman & Deal, 2003; Schaubert, 2001). Extension educators in the United States are professional employees of the state extension service of the land-grant institutions and the extension service of the United States Department of Agriculture (Seevers, et al., 1997). Extension educators therefore have a unique cultural identity and work roles as change agents. Rogers (1995) described a change agent as “an individual who influences clients’ innovation-decision in a direction deemed desirable by a change agency” (p. 27). Extension was described as a form of conscious social influence (van

den Ban & Hawkins, 1996). It is the conscious communication of information to help people form sound opinions and make good decisions according to van den Ban & Hawkins (1996). Therefore, extension education is about individual and community empowerment (Seevers et al., 1997). According to Seevers et al (1997), the extension educational process consists of actions by extension educators to conduct situational analysis of individuals or community needs, establish specific learner objectives, implement a plan of work and evaluate the outcomes of instruction to determine if behavioral changes have occurred. Adult learning that leads to changed perceptions and behavior based on changed assumptions and basic beliefs is called transformative learning (Cranton, 2006). Positive perceptions engender positive behaviors (Knobloch & Martin, 2000). Therefore, in order for county extension educators in the North Central region to be successful at empowering individuals and their communities through livestock waste management education, their perceptions regarding their relevance to the educational process and their perceptions regarding the methods and tools used in livestock management education are essential.

In the Macedonia region of Greece, extension professionals perceived themselves as more relevant professionally, and as a result, were motivated to execute extension programs in response to clientele requests (Androulidaks & Sardis, 1994). Generally, county extension educators in the North Central region involved in livestock waste management education appeared to have favorable perceptions regarding livestock waste management education and this could be the foundation for effective education of individuals and communities about livestock waste management, similar to the findings of Androulidaks & Sardis (1994). Furthermore, the perceptions of county extension educators regarding the effectiveness of teaching methods and tools used in livestock waste management education in the North

Central region also appeared to be favorable. County extension educators were more inclined to use discussion, lecture-discussion, demonstrations, individualized instruction and field days as teaching methods in livestock waste management education. These findings were similar to the findings of Bruening & Martin (1992), where the instructional methods of discussion, field demonstrations and on-farm evaluation were identified by extension professionals as useful for farmer-extension education. Similarly, when producers initiated the request, meeting extension educators on an individual basis was a very effective instructional method for farmer education (Koelsch et al., 2000). However, the perceptions of extension educators regarding the usefulness and effectiveness of teaching methods influence their choices of instructional methods and tools (Creswell & Martin, 1993; Martin & Omer, 1990).

Comparison of perceptions based on demographic characteristics

Correlation analysis regarding county extension educators' perceptions and demographic characteristics generally revealed negligible to low correlations based on standard convention (Davis, 1971). This observation appeared to follow the trend of correlation results in research in agricultural education (Miller, 1994). According to Miller (1994), correlations of negligible to low magnitude tend to be more frequent compared with correlations of very high magnitude in research in agricultural education, especially in descriptive studies.

In descriptive studies, the following two questions always arise; a) the correlation question "do two variables vary together?" and b) the prediction question "how well can a dependent variable be predicted from the knowledge of an independent variable?" (Miller, 1994). There are no cause-and-effect relationships in descriptive studies. Therefore,

independent variables (causes) are not under the control of the researcher but are naturally occurring or self-selected by the subjects (Miller, 1994). In this study, the researcher had no control over the demographic characteristics of respondents (the independent variables), which were used to predict perceptions of the respondents. Lack of control over independent variables in descriptive studies weakens the potential for predictable relationships between dependent and independent variables (Miller, 1994). Therefore, any correlation analysis in such situations may depict negligible to low results as it was observed in this study regarding selected demographic characteristics, which the researcher did not control and the perceptions of county extension educators. The magnitude of correlations between perceptions and demographic characteristics of county extension educators in this study were similar to those observed in studies by Camara (2006). According to Camara (2006), correlations between age and perceptions of extension educators in the North Central region regarding water quality or perceptions regarding teaching and learning processes were negligible. In this study, the only correlations that were found to be either substantial or very high were related to the use and effectiveness of teaching methods and tools. The more frequent county extension educators used particular teaching methods or tools, the more favorable were their perceptions. However, the findings of this study showed that county extension educators rarely used distance education as a teaching method. Furthermore, county extension educators rarely used the Elmo, the interactive white board, posters, the macromedia breeze, satellite and the fiber optics network as teaching tools for livestock waste management education.

Extension practitioners advocated for interactive communications and printed media as means of information transfer in agriculture (Riesenberg & Gor, 1989). The use of mass

media technologies for information transfer in agriculture has the potential to greatly improve the efficiency of individual extension practitioners. However, it may be of little use if extension educators do not prefer those methods or are unable to utilize those advanced sources. In this study, county extension educators in the North Central region rarely used distance education as a teaching method or the interactive white board, macromedia breeze, satellite and the fiber optics network and posters as teaching tools for farmer education in livestock waste management. There were no reasons assigned to the rare use of those teaching methods and tools. However, the potential of such educational methods and tools to increase the efficiency of county extension educators most particularly through distance education will be beneficial to extension educators. The use of such educational methods and tools seems appropriate, especially in this era of technological advancement and the increasing need for adult learning at a distance.

Major comments by county extension educators regarding livestock waste management education

Comments written on the survey questionnaires by county extension educators and themes that were derived from those comments are presented in Appendix F and Table 23, respectively. Approximately 29.0% county extension educators wrote comments about farmer education in livestock waste management. Specially, extension educators commented on the need to increase farmer education regarding livestock waste management for rural non-farming residents and small-scale livestock producers including county and area cattlemen. According to county extension educators in this study, large-scale livestock producers appeared to receive more attention from extension educators regarding livestock waste management than from other sources and they are aware of livestock waste

management practices, rules and regulations because of it. However, small-scale livestock producers appeared to have been marginalized in the educational process. There were no reasons given for this observation. However, according to Bauer (1995) in other places outside the North Central region, livestock waste management education is lacking. In the state of Oregon Bauer (1995) reported, county extension faculty rated the need for livestock waste management programs as medium to urgent but rated livestock waste management education as a medium to low priority. This finding may appear ironic. However, Oregon county faculty in the same study indicated that the interests of their clientele regarding waste management were in recycling and household hazardous waste. Therefore, although clientele were aware and interested in livestock waste management, they sometimes had difficulty eventually adopting waste management practices (Bauer, 1995). The difficulty with the clientele adopting livestock waste management practices may be the reason why county extension faculty were less motivated to educate farmers about livestock waste management and subsequently rated the priority of livestock waste management as medium to low.

Extension educators in this study identified in their written comments the teaching methods of demonstration, field days and tours, small group discussions, hands-on teaching and learning, individualized (one-on-one) instruction and case studies as effective for livestock waste management education. In Ohio, extension educators successfully used field demonstrations to educate farmers about manure calibration (Manel & Slates, 2005). On the other hand, county extension educators in this study indicated that although the lecture method of information delivery has its place in livestock waste management education, it is less effective as a teaching method with farmers compared with the methods mentioned earlier including field demonstrations. From the written comments, it is important for county

extension educators to provide livestock waste management education to livestock farmers, yet county extension educators indicated that there is need for more training for agents in any form in order for them to be effective. These comments by county extension educators are consistent with the findings of Chizari et al (1998) that extension agents perceived demonstrations, formal group meetings and informal discussions the most appropriate teaching methods, yet they needed training in identifying and organizing training content, various teaching methods and conducting needs analysis. Field demonstrations have been successfully used to conduct educational and informational programs on livestock waste utilization with best management practices to avoid groundwater pollution (Alam et al., 2003). Gamon, Harrold & Creswell (1994) also recommended the use of increased field demonstrations by extension educators to assist farmers who are at the trial stage of adoption of practices. However, Gamon et al. (1994) recommended the need for extension educators to shift from meetings and conferences as information delivery methods to new educational approaches including the use of unbiased research-based information published in farm magazines and other publications.

County extension educators also provided comments regarding best management practices for livestock waste management. According to these extension educators, best management practices for livestock waste management appear easy to understand but are actually not easily understood and also keep changing. Some best management practices including the incorporation or injection of livestock waste into the soil, reduced nitrogen loss and odor, but also increased soil erosion and contradicted some sustainable practices. Another major comment written by county extension educators was related to comprehensive

nutrient management plans, which, according to them, were not attainable for all livestock operations.

Other written comments were about livestock waste management regulations. These county extension educators were of the opinion that livestock waste management regulations are important for local programming. However, these county extension educators were also of the opinion that changes in the national, state and local regulations regarding livestock waste management are not easy to keep up with. Furthermore, livestock waste management regulations and laws at the local level were difficult to find and interpret. In their comments, county extension educators in this study recommended that some education regarding the search for regulations and the interpretation of regulations should be offered to county extension educators. Additionally, regulatory policies were perceived as based on political pandering for votes, money and pressure by the vocal majority. These county extension educators were of the opinion that such pressure groups should be regulated and educated. Finally, about 5.1% of the county extension educators indicated that collaborative and multi-disciplinary program areas and educational programs should be designed with expertise in animal nutrition, water quality, soil fertility, human health, country and township zoning, economic development and engineering. Based on the findings of this study, county extension educators appeared to have an overall positive opinion regarding selected statements about livestock waste management education. However, livestock waste management as a concept did not appear to be easily defined by these county extension educators. Furthermore, best management practices for livestock waste management are not easily understood by county extension educators. Additional comments by county extension educators suggested that collaborative and multi-disciplinary program areas and educational

programs should be designed with expertise in animal nutrition, water quality, soil fertility, human health, county and township zoning, economic development, engineering and delivered to county extension educators. Although the theory of reasoned action (TRA) model postulates intentions as the strongest predictors of behaviors, the TRA, however does not specify the relationship between intention and behavior (Ajzen and Fishbein, 1980). The assumption of the TRA is that if an individual has or states an intention, the corresponding behavior may not differ from the intention. However, an intention may not always be translated into a behavioral outcome (Dibonaventura & Chapman, 2005). According to Dibonaventura & Chapman (2005), individuals may have unstable intentions and, secondly, some unforeseen barriers could arise after an intention has been formed. However, if the strength of the intention to perform a behavior is high, then intention has the potential to be translated into a behavioral outcome (Gillholm, Erdeus & Gärling, 2000; Gillholm, Ettema, Selart & Gärling, 1999). According to Gillholm et al (1999) unless intention is measured as an expectation with a rated likelihood that the behavioral outcome would be achieved, the relationship of intention to behavior is weak. The strength of intention is the attitude towards the envisaged behavior, which is also the positive function of the expected value of the outcomes of the envisaged behavior (Fishbein & Ajzen, 1975). An individual with an intended goal is most likely to pursue that goal; however, having a goal intention does not necessarily guarantee that the goal will be achieved (Gillholm, Erdeus & Gärling, 2000). Gillholm et al. (1999) therefore, indicated that an intended activity will more likely be translated into a behavioral outcome if the strength of the intention for the activity increases, if the memory of the intention is improved and if there is planning for the implementation of the intention.

Overall, the county extension educators in this study appeared to have positive perceptions regarding selected statements about livestock waste management education. Positive perceptions influence positive behavior (Knobloch & Martin, 2000). Furthermore, additional comments by county extension educators suggested a collaborative and multi-disciplinary program areas and educational programs designed by experts and delivered to county extension educators regarding livestock waste management concepts, practices and education. Such comments by county extension educators indicate potentially stronger intentions to respond to in-service educational programs, which result in increased learning about livestock waste management (a behavioral outcome), which could enhance the effectiveness of county extension educators in educating farmers and community members about livestock waste management. Based on this observation from the study, a modified behavioral intention model was proposed with a relationship established between intention and behavior (Figure 3). This attempted modification of the behavioral intention model based on the findings of this study is consistent with previous attempts made by researchers to improve predictability of the model. According to Gillholm et al (2000), the TRA has received strong empirical support. However, several attempts have been made to improve its predictability. Such attempts have been aimed at either including new variables to the model or by changing its internal structure (Bagozzi, 1992). The modification of the behavioral intention model in this study was done to the internal structure of the original model and as well to indicating a relationship between intention and behavior (Figure 3).

The Modified Behavioral Intention Model

The original behavioral intention model (Ajzen & Fishbein, 1980 and Ajzen, 1988) shows a gap between intention and behavior without any direction of influence (Figure 1).

However, the TRA, which is the foundation of the behavioral intention model, postulates a relationship between intentions and behavior and further espouses that intentions are the major predictors of human behavior (Gillholm et al., 2000; Ajzek & Fishbein, 1980).

Amireault, Godin, Vohl & Pérusse (2008) attempted to explain the gap between intention and behavior in the behavioral intention model by identifying moderators of the intention-behavior and perceived behavioral control-behavior relationships for leisure-time physical activity. The study of Amireault et al (2008) concluded that physical activity promotion programs would benefit individuals with increased or stronger intentions to participate in such programs. Amireault et al (2008) further concluded that age was found to moderate the intention-behavior relationship, where a lower or weaker intention-behavior relationship was observed among younger participants compared with older participants. The reasons for this observation were that younger individuals may have unstable intentions and or may lack direct experience with the behavior compared with older individuals.

The mean age of county extension educators in this study was 47.2 years with the majority in the age group of 50 to 60 years. Additionally, county extension educators in this study had worked for 5 to 34 years on educators. Age and experience appear to be two important factors for stable intentions in individuals (Amireault et al., 2008). Overall, county extension educators in this study appeared to have positive perceptions regarding selected statements about livestock waste management concepts and practices. However, it was apparent from this study that the concept of livestock waste management meant different things to different people. Furthermore, county extension educators appeared not to easily understand best management practices for livestock waste management. County extension educators also perceived livestock waste management as a controversial issue but appeared

neutral regarding nonpoint source pollution as a high risk with regard to livestock waste management. Regarding the use and effectiveness of specific teaching tools, the ratings of county extension educators were low especially, the use of the Elmo as an educational tool, which the majority of county extension educators appeared not to know what it was. There is need for in-service training and education to help county extension educators resolve these perceptions. Based on the overall positive perceptions of county extension educators in this study regarding livestock waste management education, it is likely that their intentions to participate in in-service educational programs would be potentially strong. Strong intentions lead to behavioral outcomes. Therefore, those strong intentions of these county extension educators may lead to positive responses to in-service training and educational programs to improve their understanding of the concepts and practices related to livestock waste management. Therefore, the behavioral intention model was modified to show (an arrow with broken lines) that an intention potentially influences behavior (Figure 3) just as positive perceptions have been shown to influence positive behavior (Knobloch & Martin, 2000).

The modified behavioral intention model (Figure 3) has eight components as originally proposed by Ajzen and Fishbein (1980) and Ajzen (1988). In this modified model, an individual's belief that behavior leads to certain outcomes and his or her judgment of the outcomes of those behaviors influence the individual's normative norm described as the "relative importance of attitudinal and normative consideration by Ajzen and Fishbein (1980 and Ajzen (1988). Similarly, an individual's normative norm influences self-efficacy and intention for a behavior, as self-efficacy also influences intentions and vice versa (Figure 3). Self-efficacy may influence the outcomes of human behavior. Therefore, the direction of influence of self-efficacy on behavior is depicted by the broken-line and arrow, similar to

that depicted by Ajzen and Fishbein (1980) and Ajzen (1988) in the original model.

Furthermore, an individual's intentions may influence his or her attitude towards a behavior (Figure 3).

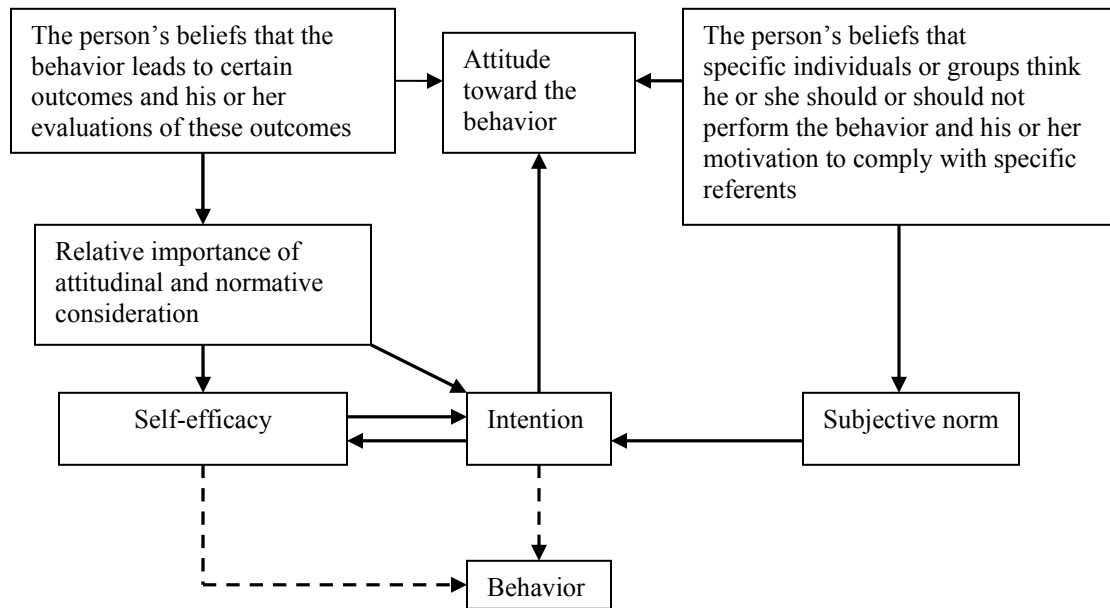


Figure 3. The Modified behavioral intention model based on Ajzen and Fishbein (1980) and Ajzen (1988). *Arrows indicate the direction of influence.*

On the other hand, an individual's beliefs that specific persons or groups of people in his or her social environment think he or she should or should not perform the behavior and his or her motivation to comply with the thoughts of those people, influence his or her attitude towards the behavior. That is described as the subjective norm (Figure 3). The subjective norm of an individual influences his or her intention for a particular behavior and the intention further influences the individual's attitude towards the behavior (Figure 3). Nonetheless, depending on the strength of an intention for a particular behavior, that intention may not necessarily be translated into a behavioral outcome (Fishbein & Ajzen, 1975). For this reason, the direction of influence of intention on behavior is indicated as an

arrow with a broken line (Figure 3). In the original model there was no link between intention and behavior, possibly because of the above given reason that an intention may be translated into a behavioral outcome depending on the strength of the intention towards the particular behavior. An in-service educational model was subsequently proposed to educate county extension educators about livestock waste management concepts, practices and education.

In-service educational model for county extension educators focused on livestock waste management education

Based on the findings of this study and written comments by county extension educators on the survey questionnaires, an in-service educational model (Figure 4) was proposed for county extension educators involved in livestock waste management education in the North Central region. The model (Figure 4) includes needs assessment and analysis, the development and delivery of appropriate in-service educational programs, the evaluation and feedback on programs. The objective of this educational model is to contribute to the process of in-service education of extension educators in the North Central region and to further assist county extension educators involved in livestock waste management education in the North Central region to increase their efficiency and productivity.

The structure of the in-service educational model (Figure 4) includes the land-grant university research, education and extension system as a major stakeholder in the planning, development, delivery and evaluation of in-service educational programs for county extension educators. The university system would conduct needs assessment of county extension educators involved in livestock waste management education, develop and deliver relevant in-service educational programs to county extension educators, evaluate programs

and provide a long-term feedback to the land-grant university, which may further conduct more needs assessment, develop and deliver more relevant programs based on follow-up information. Otherwise, the feedback may in the short-term involve further program delivery to county extension educators or the development of additional educational programs (Figure 4).

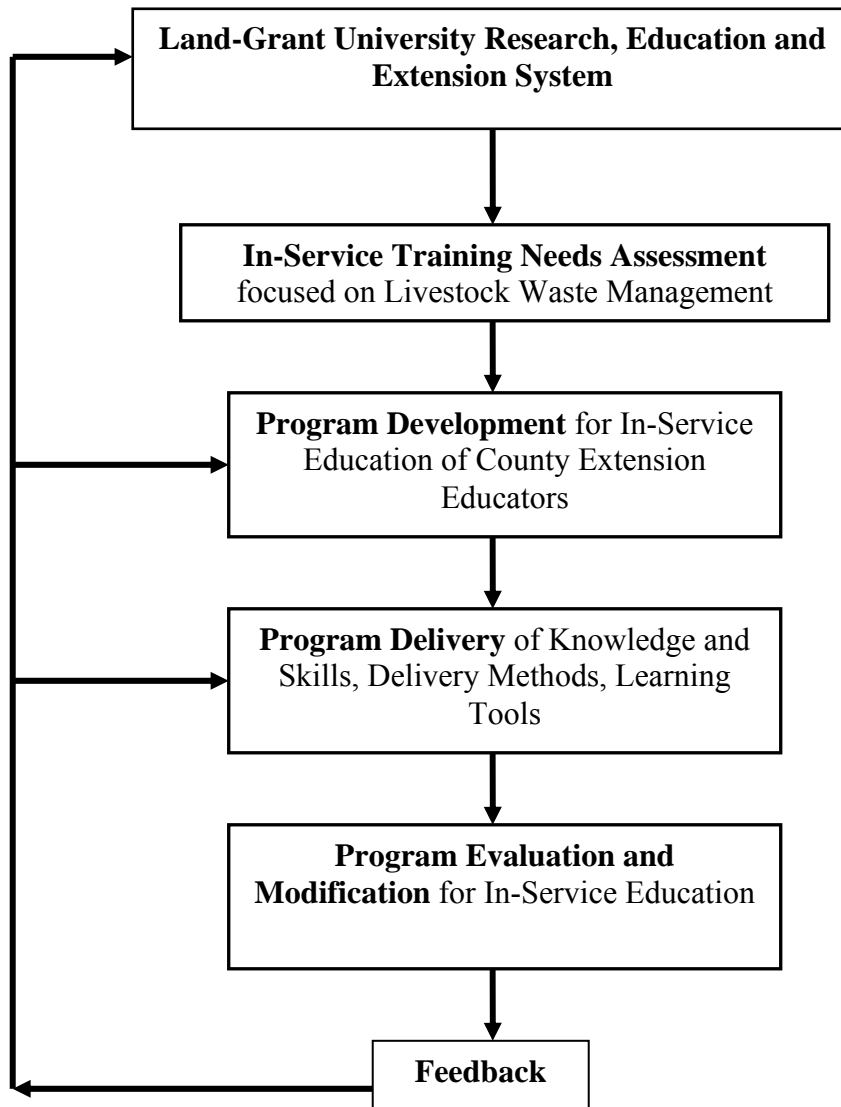


Figure 4. In-service educational model for county extension educators focused on livestock waste management education

The model represents an interconnected cycle, which continues until relevance and sustainability of education of county extension educators is achieved. The following includes an in-depth discussion of the components of the in-service training and educational model in Figure 4.

Needs Assessment

A team of agricultural education faculty and extension faculty in animal science, soil science, agronomy and agricultural engineering at land-grant universities should conduct a needs assessment and analysis of county extension educators involved in livestock waste management education. Needs assessment and analysis are relevant to the identification of specific needs of county extension educators and the definition of specific objective for in-service education of county extension educators. The needs assessment and analysis phase of the model is the foundation for determining all needs including knowledge and skills shortfalls of county extension educators to be addressed. Furthermore, the needs assessment phase assists with need organization by topic and in a chronologic manner; the identification of potential educators and educational resources, the creation of an evaluation plan and the establishment of a reporting system for feedback to the planning team for programs. Need assessment and analysis would ensure appropriate in-service education of county extension educators (Chizari, Karbasioun & Lindner, 1998).

The assessment and analysis of needs can be conducted with a variety of methods including personal interviews, survey questionnaires, focus groups (such as state agriculture and cooperative extension service management teams), or a combination of methods (Caravella, 2006; Etling, 1995; Rouda & Kusy, Jr., 1995) According to Etling (1995) group techniques for needs assessment are effective and efficient. Other needs assessment

techniques, which include radio call in, Delphi questionnaires, group discussion force field analysis, simulation games and teleconferencing are not as effective and are unpopular with extension agents (Etling, 1995). However, the Delphi technique was successfully used to determine the educational needs, major obstacles and support of secondary agriculture teachers in the planning and delivery of adult education programs in agricultural production in the Southern region of the United States (Chizari & Taylor, 1991). It is suggested that needs assessment of county extension educators regarding livestock waste management education in the North Central region should be categorized into short-term (immediate needs), medium-term and long-term needs.

This study revealed that useful adult teaching methods such as small group work; case studies, brainstorming and problem solving were either sometimes or rarely used by extension educators involved in livestock waste management education. County extension educators did not assign specific reasons for this observation. However, through needs assessment and analysis it is more likely that the potential setbacks for this observation may be revealed and appropriately rectified with the relevant in-service educational programs. Furthermore, conducting needs assessment leads to the determination whether in-service educational programs would make any difference in the efficiency of county extension educators regarding the delivery of educational programs in livestock waste management education.

Program Development

Programs for adult education vary in nature and may range from information and skill sessions lasting about an hour or workshops and conferences lasting for a day or two days to highly residential studies at corporate training centers and universities (Caffarella, 2002).

Regardless of its nature, the orientation of planning adult learning programs may be developmental, institutional or information (Cookson, 1980).

Developmental program planning is directed towards the definition and solution of individual, group or community problems with the educational agent acting as the facilitator of the learning process in cooperation with the learners (Cookson, 1980). The institutional program planning is directed towards growth and improvement of an individual's basic abilities, skill, knowledge and competencies with the educational agent system originating objectives primarily on the basis of the discipline or field of knowledge rather than on emerging patterns of relationships with the clientele system (Cookson, 1980). The informational program planning is directed towards the exchange or dissemination of information, where the educational agent system designates objectives and procedures in accordance with predetermined objectives for information dissemination and usually independent of interactions with target audiences (Cookson, 1980). It is suggested, that the developmental and institutional orientations of program planning should be adopted with this in-service educational model. These two program planning orientations have the potential for collaboration with and the participation of county extension educators in the determination of specific program objectives for the program planning, development and delivery.

Specific objectives of programs should be categorized as short-term, medium-term and long-term objectives. County extension educators in this study indicated that livestock waste management means different things to different people and best management practices for livestock waste management are not easily understood. As a short-term educational objective, a program may be focused on developing a working definition of livestock waste management. A medium-term in-service training or educational program may be related to

learning about curriculum development and the evaluation of educational programs. The long-term objective should be aimed at transformative learning to achieve changed attitudes and behaviors of county extension educators towards livestock waste management education. Furthermore, in-service educational programs should be developed with alternatives within the limits of available resources aimed at the welfare of the broader community. Finally, in-service training and education programs should win the support of local and state levels stakeholders and have adequate resources for sustainability.

In planning and developing relevant educational programs, this model recommends the application of any appropriate program development model including the principles of the Program Action-Logic Model (UW Extension, 2002) and the Critical Events Model (Nadler, 1994). The Program Action-Logic Model displays a sequence of actions that describes what the program is and what the program will do and how benefits are linked to results. The logical sequence of actions includes situation analysis, inputs, outputs (activities and participation), outcomes (short-term, medium-term and long-term impacts) assessment and projection; and evaluation. The Critical Events Model includes key steps such as curriculum building, the selection of instructional strategies and resources, conducting the training, evaluation and feedback. Notwithstanding this suggestion to apply the principles of the Program Action-Logic Model and the Critical Events Model in program planning and development, there is need for flexibility and creativity because of the artsy nature of program planning and development for adult learners (Caffarella, 2002).

Program Delivery

When needs have been carefully assessed and relevant programs have been developed, the next logical step is the selection of appropriate program delivery methods and

learning tools based on knowledge and skill. The selection of appropriate training and education delivery mechanism is essential to effective learning. In some studies, result demonstrations (the processes of showing farmers the impact of using or not using particular agricultural practices), method demonstrations (the processes of showing farmers how to implement or perform particular agricultural practices) and formal group meetings were perceived by extension agents as the most effective extension education teaching methods (Chizari et al., 1998). Gamon et al. (1994) recommended increased use of field demonstrations to teach clientele and a shift from meetings and conferences traditionally used by extension educators as methods of reaching clientele to providing unbiased research-based information to farm magazines and other publications.

There is no single method or tool of teaching that may be considered as appropriate for the success of all in-service educational programs. Therefore, this model suggests a systems or holistic approach to the selection of appropriate teaching methods and tools based on the needs assessment. From the systems perspective, program developers should have a variety of options regarding information delivery methods and learning tools and subsequently combine as many methods and tools as found appropriate to meet the educative objectives of in-service programs.

Program Evaluation

The purpose of program evaluation is to assess the impact of programs and subsequently make recommendations for program modification aimed to achieving program objectives and meeting program participants' needs (Fitzpatrick, Sanders & Worthen (2004). Program evaluation uses inquiry and judgment methods to determine the value, quality, utility, effectiveness or significance of programs (Fitzpatrick et al., 2004). Fitzpatrick et al.

(2004) described formative and summative evaluations as the two basic types of evaluation. Formative evaluation is an ongoing process, which provides information for program improvement. In a study to evaluate a producer training program for manure use planning, it was recommended that training primarily was to be focused on operational and maintenance skills (Wortmann, Koelsch, Shapiro, Deloughery & Tarkalson, 2005). Summative evaluations occur at the end of program delivery and provide information for decisions to adopt, continue, expand or terminate programs (Fitzpatrick et al., 2004).

The program evaluation stage in this model appears to be summative because of its logical position in the model after program delivery. However, this model proposes a combination of both formative and summative evaluation for in-service educational programs. Formative evaluation should include the evaluation of objectives, program management, expertise and participants. Stufflebeam (1983) developed the CIPP model as an alternative approach to program evaluation, which could be adopted with the model in Figure 2. The CIPP model focuses on context (C), input (I), process (P) and product (P) evaluation and adopts a holistic or systems view of education with the purpose to improve and not to prove programs (Stufflebeam, 1983).

Feedback

Subsequent to the evaluation of in-service educational programs, evaluation findings should be shared with county extension educators and used as a follow-up for more program development and delivery in the short-term. In the long-term, feedback information in the form of a report, should be sent to the land-grant university research, education and extension system, for further needs analysis, program development and delivery (Figure 2).

CHAPTER 6

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

Summary

Traditionally, nutrients from livestock waste are recycled in agriculture when applied to crop and pasture land to promote plant growth (Kellogg et al., 2000). Environmental concerns have been raised by researchers, agricultural educators and policy makers regarding soil, surface and groundwater quality degradation through runoff and leaching of excess nitrogen and phosphorous from over-applying livestock waste to crop and pasture lands (Goolsby et al., 2001; Rabalais et al., 2001; Rowe 2001; Sweeten, 1998).

Livestock waste best management practices have been developed as technical interventions for the potential problems associated with livestock waste pollution of the environment (Fukumoto, 2005; Alam et al., 2003; Tyson, 1995). However, research findings regarding the educational component of livestock waste management is lacking. Lack of research information about the educational component of livestock waste management makes it unclear what extension educators are doing regarding livestock waste management education and their perceptions regarding the educational processes involved in livestock waste management. Some studies have shown that positive perceptions lead to specific intentions and attitudes that foster positive behavior (Al-Subaiee et al., 2005; Knobloch & Martin, 2000).

The purpose of this study was to identify the perceptions of county extension educators in the North Central region of the United States regarding livestock waste management education and the related educational processes used in educational programs focused on livestock waste management education.

The specific objectives of the study were the following:

1. Describe the demographic characteristics of county extension educators.
2. Identify the general perceptions of county extension educators regarding livestock waste management concepts and practices.
3. Identify the perceptions of county extension educators regarding education about livestock waste management.
4. Identify the perceptions of county extension educators regarding the teaching methods and tools used for education about livestock waste management.
5. Compare perceptions based on demographic characteristics of the participants.

The target population for the data source of this study was county extension educators in the North Central region of the United States, which included Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. A sample size of 360 county extension educators was randomly drawn from the target population as potential participants of the study. Survey instruments each consisting of four parts related to the specific objectives of the study were mailed to 360 potential participants to collect data for the study. The response rate was 56.0%. Prior to collecting research data, content and face validity of the instrument was established by a panel of five experts from the Departments of Agricultural Education and Studies, Agronomy and Agricultural and Biosystems Engineering at Iowa State University, Ames, Iowa. Additionally, the reliability of the instrument was established through a pilot study with county extension educators in the North Central region who were not included in the actual study. The reliability coefficient (Cronbach's α) was .75.

Data analysis for this study was carried out by using the SPSS 15.0 for Windows software. Means, standard deviations, frequencies, percentages and correlations were generated using the SPSS software to meet the objectives of the study.

Demographic data showed that 76% of the respondents were male. The mean age of respondents and the mean number of years respondents had worked as extension professionals were 47.2 and 16.9 years, respectively. The majority (78.6%) of respondents did not have any formal teaching experience. The majority (69.7%) of respondent had master's degrees, 19.4% had bachelor's degrees and 8.5% had doctorate degrees. The majority (68.2%) of respondents had agriculture and natural resources as their main county extension responsibility, whereas 9.5% had 4-H and Youth development and 8.5% had administration as their county extension responsibilities.

The perceptions of county extension educators regarding livestock management concepts and practices; livestock waste management education; the teaching methods and tools used in livestock waste management education were identified using five-point Likert-type scale statements. The five-point Likert-type scales ranged from 1 = strongly disagree to 5 = strongly agree for statements regarding livestock waste management concepts and practices and livestock waste management education; Perceptions of county extension educators regarding statements on the extent of use and effectiveness of teaching methods and tools used in livestock waste management education were identified using five-points Likert-type scales that ranged from 1 = Not used to 5 = Always used and from 1 = Not Effective to 5 = Very Effective, respectively. Negative statements in the instrument were reverse coded on the five-point Likert-type scale to appropriately address responses regarding each specific objective of the study.

Mean values greater than three on the five-point Likert-type scale for specific statements indicated intentions of agreement or favorable perceptions of county extension educators regarding those statements.

Overall, the findings of this study indicated that county extension educators appeared to have favorable perceptions regarding livestock waste management concepts and practices; livestock waste management education and the effectiveness of teaching methods and tools used in livestock waste management education. On the other hand, the perceptions of county extension educators about the extent of use of teaching methods and tools and their effectiveness appeared to be neutral. Correlations between selected demographic characteristics of county extension educators and perceptions regarding livestock waste management concepts and practice and livestock waste management education showed negligible to low magnitudes.

Conclusions

The following conclusions were made based on the findings of this study:

1. County extension educators in the North Central region are predominantly middle-aged males who are well-educated with extensive work experiences as extension professionals.
2. The majority of county extension educators in the North Central region have agriculture and natural resources as their county extension responsibility.
3. County extension educators generally had high ratings on selected statements about livestock waste management concepts and practices and livestock waste management education.

4. Livestock waste management appeared to be a controversial environmental issue and a complex concept not easily defined by county extension educators.
5. County extension educators tended to disagree that best management practices for livestock are easy to understand.
6. County extension educators appeared to be neutral about nonpoint source pollution as a high risk with regard to livestock waste management.
7. County extension educators frequently used discussion, lecture-discussion, demonstrations, individualized instruction and field days as teaching methods and had higher ratings regarding their effectiveness.
8. County extension educators frequently used newsletters and print/broadcast as teaching tools for livestock waste management education and rated them as somewhat effective.
9. County extension educators rarely used the Elmo and other communication technologies including the macromedia breeze, satellite and fiber optics network for livestock waste management education.
10. County extension educators appeared to need research information and educational materials regarding livestock waste management for clients and the public.
11. There seemed to be no strong correlations between selected demographic characteristics and perceptions of county extension educators.

Recommendations

Based on the conclusions of this study the following recommendations were made:

1. Acceptable working definitions of livestock waste management and best management practices should be explored and identified as essential educational activities for county extension educators.
2. Appropriate in-service educational programs focused on helping county extension educators better understand the risks of nonpoint source pollution and best management practices for livestock wastes should be developed and delivered to county extension educators and used where appropriate.
3. In-service training and educational programs appropriate to the situation should be developed and delivered to county extension educators to help county extension educators better utilize communication technologies.
4. In-service educational programs should be matched with research data and appropriate delivery system.
5. The experiential learning approach to adult education should be adopted for in-service training of county extension educators regarding the use of computers, the Internet, websites, interactive whiteboards and the Elmo.

Recommendations for Further Research

This study identified perceptions of county extension educators regarding livestock waste management and the educational processes used for livestock waste management and correlations between demographic characteristics and perceptions.

Information regarding the perceptions of county extension educators about motivation and level of professional competence regarding livestock waste management education were not part of this study. Furthermore, this study did not determine the availability of in-service

training programs for livestock waste management education and how often such programs are provided to county extension educators. Further research is therefore needed to:

1. Identify perceptions of county extension educators about motivation and professional competence regarding livestock waste management education.
2. Identify available in-service training and educational programs and perceptions of county extension educators regarding the effectiveness of such programs.

Implications and Educational Significance of the Study

Perceptions enable individuals to arrive at beliefs about their environments (Coates, 1998; van den Ban & Hawkins, 1996; Ajzek & Fishbein, 1980) and influence specific attitudes, intentions, and behaviors (Ajzek & Fishbein, 1980). Though beliefs, attitudes and intentions influence human behavior, intentions are the major predictors of human behavior (Ajzek & Fishbein, 1980). However, intentions are not always fulfilled by humans (Ajzek & Fishbein, 1980). Therefore, Ajzek & Fishbein (1980) included the concept of self-efficacy in the TRA model (Figure 1), which independently influences the intentions of human attitudes and social norms and also directly influences human behavior. Self-efficacy was described as the perception people have regarding their ability to perform certain tasks well (Ajzek & Fishbein, 1980). Therefore, intentions based on positive perceptions or high-self-efficacy foster positive attitudes and behaviors (Knobloch & Martin, 2000).

Overall, county extension educators in this study appeared to have positive perceptions regarding selected statements about livestock waste management concepts and practices. However, it was apparent from this study that the concept of livestock waste management meant different things to different people. Furthermore, county extension educators appeared not to easily understand best management practices for livestock waste

management. County extension educators perceived livestock waste management as a controversial issue but appeared neutral regarding nonpoint source pollution as a high risk with regard to livestock waste management. Regarding the use and effectiveness of specific teaching tools, the ratings of county extension educators were low especially, the use of the Elmo as an educational tool, which the majority of county extension educators appeared not to know what it was. There is need for in-service training and education to help county extension educators resolve these perceptions.

Based on the overall positive perceptions of county extension educators regarding livestock management education and the relevance of positive perceptions to positive human behavior (Knobloch & Martin, 2000), it is logical that county extension educators would more likely respond positively to in-service training and educational programs aimed at improving their understanding of the concepts and practices related to livestock waste management. Therefore, this study primarily has implications for in-service training and education of county extension educators focused on livestock waste management education in the North Central region. The study has further implications for agricultural educators regarding the development and delivery of appropriate in-service training and educational programs for county extension educators in the same region.

APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office of Research Assurances
Vice Provost for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

DATE: April 16, 2007
TO: David Kwaw-Mensah
223 Curtiss Hall
CC: Robert A. Martin
201 Curtiss Hall
FROM: Jan Canny, IRB Administrator
Office of Research Assurances

IRB ID: 07-206 **Study Review Date:** 16 April 2007

The Institutional Review Board (IRB) Chair has reviewed the project, "Perceptions of agricultural extension professionals in the North Central Region regarding livestock waste management education" (IRB ID 07-206) and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b), Exempt Category (2). A description of this exemption category can be found in the list on the next page. Please note that you must submit all research involving human participants for review by the IRB. Only the IRB may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

The IRB determination of exemption means that this project does not need to meet the requirements from the Department of Health and Human Service (DHHS) regulations for the protection of human subjects, unless required by the IRB. We do, however, urge you to protect the rights of your participants in the same ways that you would if the project was required to follow the regulations. This includes providing relevant information about the research to the participants.

Because your project is exempt, you do not need to submit an application for continuing review. However, you must carry out the research as proposed in the IRB application, including obtaining and documenting (signed) informed consent if you have stated in your application that you will do so or if required by the IRB.

Any modification of this research should be submitted to the IRB on a Continuation and/or Modification form, prior to making any changes, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

For IRB Use Only	Review Date: _____	IRB ID: <u>07-206</u>	IRB
	Approval Date: _____	Length of Approval: _____	MAR 29 2007
	Approval Expiration Date: _____	FULL Committee Review: _____	
	EXEMPT per 45 CFR 46.101(b): <u>2</u> Date: <u>1-16-07</u>	Minimal Risk: _____	
	EXPEDITED per 45 CFR 46.110(b) _____	More than Minimal Risk: _____	
	Category _____, Letter _____	Project Closed Date: _____	

ISU NEW HUMAN SUBJECTS REVIEW FORM

ORIGINAL

SECTION I: GENERAL INFORMATION

Principal Investigator (PI): David Kwaw-Mensah	Phone: 515-2948363	Fax: 515-2940530
Degrees: MS	Correspondence Address: 223 Curtiss Hall, Iowa State University Ames, IA	
Department: Agricultural Education and Studies	Email Address: dkwaw@iastate.edu	
Center/Institute: Iowa State University, Ames, IA	College: College of Agriculture	
PI Level: <input type="checkbox"/> Faculty <input type="checkbox"/> Staff <input type="checkbox"/> Postdoctoral <input checked="" type="checkbox"/> Graduate Student <input type="checkbox"/> Undergraduate Student		

Title of Project: Perceptions of agricultural extension professionals in the North Central Region regarding livestock waste management education.
Project Period (Include Start and End Date): [mm/dd/yy][March 01, 2007] to [mm/yy/dd][July 31, 2007]

FOR STUDENT PROJECTS

Name of Major Professor/Supervising Faculty: Dr. Robert A. Martin	Signature of Major Professor/Supervising Faculty:
Phone: 515-2940896	Campus Address: 201 Curiss Hall
Department: Agricultural Education and Studies	Email Address: drmartin@iastate.edu
Type of Project: (check all that apply)	
<input type="checkbox"/> Research <input type="checkbox"/> Thesis <input checked="" type="checkbox"/> Dissertation <input type="checkbox"/> Class project <input type="checkbox"/> Independent Study (490, 590, Honors project) <input type="checkbox"/> Other. Please specify: _____	

KEY PERSONNEL

List all members and relevant experience of the project personnel. This information is intended to inform the committee of the training and background related to the specific procedures that the each person will perform on the project.

NAME & DEGREE(S)	SPECIFIC DUTIES ON PROJECT	TRAINING & EXPERIENCE RELATED TO PROCEDURES PERFORMED, DATE OF TRAINING
David Kwaw-Mensah, M.S.	Write Proposal, prepare survey questionnaire, conduct research and write dissertation.	Fall 2005
✓ Robert A. Martin <u>10-20-05</u>	Supervise research process.	July 2000
✓ <u>7-20-00</u>		

Add New Row

FUNDING INFORMATION

Research Assurances 12/01/2005

SECTION II: APPLICATION FOR INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

Yes No Does this project involve human research participants? If the answer "no" is checked, you will automatically move to a question regarding the involvement of radiation producing devices in your project.

SECTION III: ENVIRONMENTAL HEALTH AND SAFETY INFORMATION (EH&S)

Yes No Does this project involve laboratory chemicals, human cell lines or tissue culture (primary OR immortalized), or human blood components, body fluid or tissues? If the answer is "no" is checked you will automatically move to a question regarding the involvement of human research participants in your project.

ASSURANCE

- I certify that the information provided in this application is complete and accurate and consistent with any proposal(s) submitted to external funding agencies.
- I agree to provide proper surveillance of this project to ensure that the rights and welfare of the human subject or welfare of animal subjects are protected. I will report any problems to the appropriate assurance review committee(s).
- I agree that I will not begin this project until receipt of official approval from all appropriate committee(s).
- I agree that modifications to the originally approved project will not take place without prior review and approval by the appropriate committee(s), and that all activities will be performed in accordance with all applicable federal, state, local and Iowa State University policies.

CONFLICT OF INTEREST

A conflict of interest can be defined as a set of conditions in which an investigator's or key personnel's judgment regarding a project (including human or animal subject welfare, integrity of the research) may be influenced by a secondary interest (e.g., the proposed project and/or a relationship with the sponsor). ISU's Conflict of Interest Policy requires that investigators and key personnel disclose any significant financial interests or relationships that may present an actual or potential conflict of interest. By signing this form below, you are certifying that all members of the research team, including yourself, have read and understand ISU's Conflict of Interest policy as addressed by the ISU Faculty Handbook (<http://www.provost.iastate.edu/faculty> .) and have made all required disclosures.

Yes No Do you or any member of your research team have an actual or potential conflict of interest?
 Yes No If yes, have the appropriate disclosure form(s) been completed?

Signature of Principal Investigator _____ *March 23, 2007* _____
 Date
 Signature of Department Chair _____ *3/23/07* _____
 Date

PLEASE NOTE: Any changes to an approved protocol must be submitted to the appropriate committee(s) before the changes may be implemented.

Please proceed to SECTION II.

Yes No Does this project establish a registry?

If "yes," please provide the registry name below.

Checklist for Attachments

The following are attached (please check ones that are applicable):

- A copy of the informed consent document OR Letter of introduction to subjects containing the elements of consent
- A copy of the assent form if minors will be enrolled
- Letter of approval from cooperating organizations or institutions allowing you to conduct research at their facility
- Data-gathering instruments (including surveys)
- Recruitment fliers, phone scripts, or any other documents or materials the subjects will see

Two sets of materials should be submitted for each project – the original signed copy of the application form and one copy and two sets of accompanying materials. **Federal regulations require that one copy of the grant application or proposal be submitted for comparison with the application for approval.**

FOR IRB USE ONLY:

Initial action by the Institutional Review Board (IRB):

- Project approved. Date: _____
- Pending further review. Date: _____
- Project not approved. Date: _____

Follow-up action by the IRB:



IRB Approval Signature

16 April 2007
Date

SECTION III: ENVIRONMENTAL HEALTH AND SAFETY INFORMATION

Yes No Does this project involve human cell or tissue cultures (primary OR immortalized), or human blood components, body fluids or tissues? If the answer is "no", please proceed to SECTION III: APPLICATION FOR IRB APPROVAL. If the answer is "yes," please proceed to Part A: Human Cell Lines.

PART A: HUMAN CELL LINES

Yes No Does this project involve human cell or tissue cultures (primary OR immortalized cell lines/strains) that have been documented to be free of bloodborne pathogens? If the answer is "yes," please attach copies of the documentation. If the answer is "no," please answer question 1 below.

1) Please list the specific cell lines/strains to be used, their source and description of use.

APPENDIX B. APPROVED SURVEY QUESTIONNAIRE

Perceptions of agricultural extension professionals regarding livestock waste management education in the North Central Region

PART I – General Perceptions regarding livestock waste management

The following statements are related to general perceptions regarding livestock waste management. Please indicate your level of agreement with each statement by circling the appropriate number on the 5-point Likert-type scale provided (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

STATEMENT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Livestock waste management means different things to different people.	1	2	3	4	5
2. Livestock waste management is a controversial issue.	1	2	3	4	5
3. Livestock waste management is a complex environmental issue.	1	2	3	4	5
4. Livestock waste management is essential to human health.	1	2	3	4	5
5. Best management practices for livestock waste management are easy to understand.	1	2	3	4	5
6. Best management practices for livestock waste management include riparian buffers.	1	2	3	4	5
7. Best management practices for livestock waste management do not improve the value of livestock waste as fertilizer.	1	2	3	4	5
8. State plans for livestock waste management must exceed the federal national pollutant discharge elimination system.	1	2	3	4	5

ISU IRB # 1	07-206
EXEMPT DATE:	16 April 2007
Initial By:	Jc

PART I. (Continued)

Please indicate your level of agreement with each statement by circling the appropriate number on the 5-point Likert-type scale provided (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

STATEMENT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9. Best management practices for livestock waste management protect water quality.	1	2	3	4	5
10. Best management practices for livestock waste management protect air quality.	1	2	3	4	5
11. Best management practices for livestock waste management have not protected soil quality.	1	2	3	4	5
12. Not all best management practices are acceptable agricultural practices.	1	2	3	4	5
13. A single set of best management practices applies in all situations of livestock waste management.	1	2	3	4	5
14. Efficient livestock waste management practices require regular waste analysis.	1	2	3	4	5
15. State regulations are adequate for sustainable livestock waste management.	1	2	3	4	5
16. Federal regulations are adequate for sustainable livestock waste management.	1	2	3	4	5
17. Biosecurity is irrelevant to livestock waste management.	1	2	3	4	5
18. The highest risk with livestock waste management is nonpoint source pollution.	1	2	3	4	5

PART II – Perceptions about education regarding livestock waste management

We are interested in your perceptions regarding the following statements. Please indicate your level of agreement with each statement by circling the appropriate number on the 5-point Likert-type scale provided (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

In educating farmers about livestock waste management,

STATEMENT	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Extension professionals should be experts in livestock waste management.	1	2	3	4	5
2. Extension professionals should have some knowledge about how adults learn.	1	2	3	4	5
3. Extension professionals should have some knowledge about how to teach adults.	1	2	3	4	5
4. Extension professionals should involve learners in planning of educational programs.	1	2	3	4	5
5. Extension professionals should involve learners in the delivery of educational programs.	1	2	3	4	5
6. Extension professionals should recognize individual client's differences.	1	2	3	4	5
7. Extension professionals should offer a variety of programs to meet the needs of their clients.	1	2	3	4	5
8. Extension professionals should facilitate participants' learning processes.	1	2	3	4	5

PART III- Teaching Methods and Tools

The following is a list of teaching methods and tools. Please indicate the extent to which you use each method or tool and its effectiveness by circling the appropriate number on the 5-point Likert-type scales provided. **Column A represents the extent of current use** - (1=Not used, 2=Rarely Used, 3= Sometimes Used, 4=Frequently Used, 5=Always Used). **Column B represents the perceived effectiveness** - (1=Not Effective, 2=Of little effectiveness, 3=Somewhat Effective, 4=Effective, 5=Very Effective).

A					METHODS/TOOLS	B				
EXTENT OF USE						EFFECTIVENESS				
1	2	3	4	5	Lecturing	1	2	3	4	5
1	2	3	4	5	Discussion	1	2	3	4	5
1	2	3	4	5	Lecture-Discussion	1	2	3	4	5
1	2	3	4	5	Case Studies	1	2	3	4	5
1	2	3	4	5	Demonstrations	1	2	3	4	5
1	2	3	4	5	Individualized Instruction	1	2	3	4	5
1	2	3	4	5	Meetings	1	2	3	4	5
1	2	3	4	5	Brainstorming	1	2	3	4	5
1	2	3	4	5	Questioning	1	2	3	4	5
1	2	3	4	5	Field days	1	2	3	4	5
1	2	3	4	5	Workshops	1	2	3	4	5
1	2	3	4	5	Problem Solving	1	2	3	4	5
1	2	3	4	5	Small group work	1	2	3	4	5
1	2	3	4	5	Testing	1	2	3	4	5
1	2	3	4	5	Distance Education	1	2	3	4	5
1	2	3	4	5	Quizzes	1	2	3	4	5

PART III. (Continued)

EXTENT OF USE - (1=Not used, 2=Rarely Used, 3=Sometimes Used, 4=Frequently Used, 5= Always Used). **EFFECTIVENESS** - (1=Not Effective, 2=Of little effectiveness, 3=Somewhat Effective, 4=Effective, 5=Very Effective).

EXTENT OF USE					METHODS/TOOLS	EFFECTIVENESS				
1	2	3	4	5		1	2	3	4	5
					Interactive whiteboard					
					Posters					
					Flip Charts					
					Elmo					
					Video tapes					
					Websites					
					Worksheets					
					Computers					
					Internet					
					Compact disks					
					Print/broadcast Media					
					Pamphlets					
					Research Publications					
					Textbooks					
					Fiber Optics Network					5
					Macromedia Breeze					
					Satellite					
					Newsletters					

ISU IRB # 1	07-206
EXEMPT DATE:	16 April 2007
Initial By:	Jc

PART IV- Demographics

Please respond to each of the following questions by circling your most appropriate answer to each question or by writing your answer on the line provided after the question.

1. What is your gender?

(a) Female

(b) Male

2. What is your age?

_____ years.

3. How many years have you worked as an Extension professional?

_____ years.

4. How many years of formal teaching experience do you have at the following?

(a) High School _____ years.

(b) Community College _____ years.

(c) University Campus _____ years.

(d) I do not have any formal teaching experience.

5. What is your highest educational qualification?

(a) Bachelor's degree

(b) Master's degree

(c) Doctorate

6. What is your undergraduate area of study?

(a) Agronomy/Soil Science

(c) Agricultural Education

(b) Animal Science

(f) Other (Please Specify) _____

(c) Horticulture

(d) Agricultural Engineering

PART IV. (Continued)

7. What is your area of study for your highest educational degree if any, beyond Bachelor's degree?

- (a) Agronomy
- (b) Soil Science
- (c) Animal Science
- (d) Horticulture
- (e) Agricultural Engineering
- (f) Agricultural Education
- (g) Other (Please Specify) _____

8. What is your main county extension responsibility?

- (a) Agriculture and Natural Resources
- (b) Community Development
- (c) Family Development
- (d) 4H and Youth Development
- (e) Administration

**APPENDIX C. REQUEST LETTER TO STATE AGRICULTURE AND NATURAL
RESOURCES LEADERS**

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Graduate Programs 515 294-5872
Undergraduate Programs 515 294-6924
Extension Programs 515 294-6924
FAX 515 294-0530

May 3, 2007

Mr. DeLynn Hay
Program Leader
Cooperative Extension
211 Admin Building
Lincoln, NE 68583-0703.

Dear Dr. DeLynn Hay,

Management of livestock manure is a major issue in the North Central Region of the U.S.A. There is a considerable amount of research being conducted to find answers to a number of key questions.

Despite the amount of research regarding manure management, very little information is available concerning the role of extension education in improving the management of livestock manure in the North Central Region.

We need your help. We are about to conduct a study in the North Central Region using survey methodology with County Extension Educators as the data source. The data collected from this study will be used to complete a PhD dissertation. Furthermore, the results of this study will be shared with all State Agricultural and Natural Resources Leaders in the region.

The purpose of this letter is to request a list of names of County Extension Educators in your state, from which research participants will be randomly selected for this study. Selected Extension Educators will be informed in writing about their selection and potential participation in this study. The list of your County Extension Educators may be sent electronically via email attachment to the email address of dkwaw@iastate.edu or by regular mail with the enclosed stamped and self-addressed envelope.

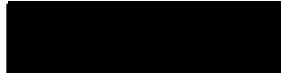
It is our hope that you approve this request and are willing to cooperate in conducting this study. Attached is a description of the purpose and objectives of the study.

Your assistance in this matter will be greatly appreciated.

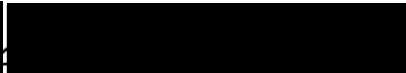
Sincerely,



David Kwaw-Mensah
Graduate Assistant



Robert A. Martin
Professor & Head
Major Professor



Gerald Miller
Director, Extension to
Agricultural & Natural
Resources, Associate Dean,
College of Agriculture, ISU

APPENDIX D. COVER LETTER TO QUESTIONNAIRE

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Graduate Programs 515 294-5872
Undergraduate Programs 515 294-6924
Extension Programs 515 294-6924
FAX 515 294-0530

September 3, 2007

Dear Extension Professional,

There is a considerable amount of effort and resources allocated for use in conducting research and educational programs on environmental issues and management. There are many of such research and educational programs focused specifically on livestock waste management and environmental quality through out the North Central Region. Nonetheless, very little information is available concerning the role of extension education regarding livestock waste management.


The purpose of this study is to identify perceptions regarding livestock waste management and the teaching methods and tools used for the delivery of educational programs about livestock waste management.

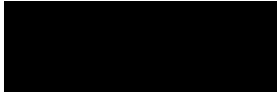
We are collecting information from agricultural Extension Professionals within the North Central Region of the U.S.A. We hope to identify important information related to the teaching methods and tools used for education about livestock waste management and environmental quality.

Your response will be held in strict confidence and only used for statistical purposes. Since we are only interested in group data, code numbers assigned to the questionnaire will be used only to identify non-respondents so that we can request them to return the survey form. All numbers are removed upon receipt of the questionnaire. It is important to consider your participation in this study as voluntary and you are welcome to withdraw your participation at any time during the study. Furthermore, respondents may skip any questions that they do not feel comfortable answering. All questionnaires will be shredded after data has been recorded and analyzed. Data from this study will be used to write a PhD dissertation. Your help to conduct this survey is therefore very important. The questionnaire will take 15-20 minutes to complete. Please complete the enclosed questionnaire and return the completed questionnaire in the enclosed stamped and self-addressed envelope by September 24, 2007.

We greatly appreciate your assistance.

Sincerely,


David Kwaw-Mensah
Graduate Student


Robert A. Martin
Major Professor and Chair

APPENDIX E. FOLLOWUP LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Graduate Programs 515 294-5872
Undergraduate Programs 515 294-6924
Extension Programs 515 294-6924
FAX 515 294-0530

October 2, 2007

Dear County Extension Educator,

Recently, a questionnaire regarding the perceptions of County Extension Educators in the North Central Region about livestock waste management education was mailed to you. We have not yet received your responses to the questionnaire.

If you have already completed and mailed the questionnaire to us prior to receiving this letter, please accept our sincere thanks. Otherwise, please complete the questionnaire and mail it to us with the stamped and self addressed envelope, which was mailed with the questionnaire.

Alternatively, if you did not receive the questionnaire, or if it was misplaced, please send an email message to David Kwaw-Mensah at dkwaw@iastate.edu or call (515)-294 8363 and we will mail another questionnaire to you.

Your assistance is greatly appreciated.

Sincerely,



David Kwaw-Mensah
Graduate Student



Robert Martin
Major Professor and Chair

APPENDIX F. ADDITIONAL COMMENTS BY EXTENSION EDUCATORS

Iowa

1. In Iowa, the whole waste management rules, regulations and training are very structured. Extension trains producers for confinement site management and also provides commercial applicator training.
2. Conflict resolution is a huge part of this - just teaching best management practices (BMPs) to those who “produce” or handle animal waste is only half of the equation. Education aimed at the general public is important. What is the economic impact of animal fertilizer? How does the energy cost to produce and deliver animal manure compare with commercial sources? The Departments of Natural Resources (DNR) and Natural Resource Conservation Service (NRCS) employees seem to only focus on a single aspect- water protection - very important – but also needs to understand impacts of commercial fertilizers on environment and trade-offs.
3. Livestock waste management education is done primarily by field specialists serving multiple counties in South West Iowa. Campus staff and area field specialists provide required training. County directors like me are not involved with this program.
4. Important issue. Iowa State University and Iowa State University Extension research and dissemination is very important in policy development for resource protection and economic viability of livestock operations.
5. We continue to need good research in this area and good education materials to pass the facts along to both livestock clients and the public.
6. There is need to review the whole issue of local control of placement of sites.

Illinois

7. Regulations and laws at the local level are hard to find and interpret. I think this is a good spot to educate county officials as well as extension educators about where to look for regulations at the local level.
8. I think large producers are very aware of livestock waste management practices, rules and regulations, but small producers are not. I think small producers need to be part of the educational audience just like large producers.

Indiana

9. I have used manure application versus urea for stockpiling. Demonstration seemed effective when producers could see ‘tonnage’ was comparable to urea. Have used manure spreaders to demonstrate “calibration” to determine amount of manure applied. Have also used computers for manure management planner program- somewhat frustrating for ‘students’.
10. All too often regulatory policy is based on the vocal majority, political pandering for votes and money (developers, realtors etc.). A road separates two governing entities: different rules apply for each side of the road. We need to think regionally, geographically (i.e. watersheds) and make decisions based on past experiences, common sense and research. Vocal pressure groups need to be educated and regulated.

11. Organizational groups (Farm Bureau) want you (the extension educators) to be an advocate. We are not. Helping farmers to easily deal with environmental paper work was the key to expansion in our county. We have the largest number of CAFD in the state. Also number one in net profit. We do not have rich farmland. We deal on both side of the issue. I develop a six page reference to demonstrate regulations from a 128-page long document. I had to develop my own educational materials.
12. I believe there is enough data at the university regarding new technology and best management practices (BMPs) to make waste management a “routine chore”, but our role in extension is to make sure the farmers have access to that information and to facilitate the implementation. Our second biggest job in this area is to educate the non-agricultural sector (i.e. rural non-farming residents) about the safety and environmental stewardship aspects of livestock waste management and to dispel many of their fears and fallacies about livestock farms.
13. Livestock waste management education should run similar to Indiana Private Pest Applicators Recertification Program (PARP) education. Owners, managers and applicators should all attend and be licensed. Site inspection should be included to ensure proper procedures are followed. There are producers doing a great job in manure management and some that are disregarding all environmentally safe practices. If extension has to do this, then we need to collect higher fees than the PARP fees. We are not covering our cost for the PARP and our budgets are cut significantly each year by the county.
14. Partnerships between educators and large livestock companies that do contract finishing or have multiple large owners in various locations could prove very beneficial. Livestock waste management education is much about producers using the correct practices as educating producers about how to effectively work with neighbors and communities about their waste management practices. This is often much overlooked.
15. The most effective means of educating farmers was to demonstrate nutrient benefits of manure as a resource by physically collecting manure samples from farmers’ manure pits or stocks, getting them analyzed for nutrients content, then inviting the farmers to a workshop and getting them to work through examples of the cost savings they could realize by properly applying manure to fields that could use the nutrients. Also, with a “captive” audience, other best management practices (BMPs) could be demonstrated with slides and examples. Also negative impacts and their consequences (water quality impairment, EPA penalties, etc) could be illustrated. The results of the workshop were a group of farmers forming a network to “exchange” manure (actually, those with excess made the manure available to those who could use it).
16. Less concentration of animals with greater space per animal. More emphasis on less corporate takeover.
17. It is a problem that we need to educate the public about.
18. In my county, I find I have very little asked of me in this area. Therefore, I usually don’t try to keep up. Also it keeps changing based on current law suits. So I pay little attention. Once they say what they need then it can be taught.

Kansas

19. It is a diverse subject and does not vary from farm to farm. Some farmers will not think about changing livestock handling methods/system until health department says something.
20. This is most likely the hottest issue and producers will need to pay attention to these issues. I continue to get interest in small lots, renovations, etc. The public is slowly changing their perception about quality of water etc.
21. The larger operations are pretty well regulated but many small farms could do a much better job managing waste.
22. It is a critical part of livestock production that will have an ever increasing impact on producers and the viability of livestock production, especially as the urban population continues to grow and move into rural areas. Nutrient management is going to be real issue, along with water quality, especially concerning larger operations with “confined” feeding.
23. Working one-to-one on each farm is probably the most effective. Cost sharing programs through the natural resources conservation service (NRCS) or grants will get most done.

Michigan

24. It is a difficult subject to program for, as most farmers do not want to deal with the topic and hear the bad news. However, if you can show economic benefits to the farmer by using livestock waste agronomically, producers will follow best management practices (BMPs) and be spokes persons to other farmers that they should do the same. It takes hard work and time to build support for this type of program but if a successful effort can be put together, the rewards are worth it.
25. I want to point out that in section three a low score in the “extent” column does not mean it is an ineffective method or tool. We do not use the internet more, for example, because most farmers in my area still have dial-up connection. Case studies should be used more but aren’t because it takes a lot of work to put together. Case studies are effective teaching tools. Manure management is the biggest issue facing Michigan livestock and poultry producers today. More resources should be put into extension and research to better support farmers. The environmentalists seem to be making many great inroads to stymie growth in the livestock industry. Science can solve many, if not all the problems facing the industry given enough time and resources. However, without this support we may lose the livestock industry. We cannot afford nor can we depend on getting our food from other countries.
26. I think that the use of the term “livestock waste management” leads a person (producer, nonfarm neighbor etc.) to have a negative imagine. Manure nutrient management suggests positive value. I realize that “waste” includes more than manure (e.g. dairy center, waste water, etc.). I personally do not use the phrase waste.
27. I do believe that some extension professionals should be experts on livestock waste management issues, but not all of us need to be. These experts provide the resources for those who have not made livestock waste management their specialty.

28. It seems more and more that pasture-based farming wins in the public eye. How many in the general public enjoy visiting a feedlot? Can we feed the world on a pasture based system?
29. Livestock waste management is an ongoing science that should incorporate best management practices (BMPs) of today but recognizing may be appropriate today, but could be different tomorrow.
30. Important for extension to educate/inform. Specialists are good for this purpose and to include in programming. However, it is not necessary to write comprehensive nutrient management plans (CNMPs) etc. for producers but to assist producers in finding resources and understanding producer differences among states due to different legislations.
31. Most management issues are a system that must work on the farm. Some issues actually contradict sustainable practices- incorporation/injection manure increased soil erosion yet reduced N losses and odor. Nothing is perfect in this area but needs to address specific issues at a farm level, work for that producer and be economical. There are trade offs and the cost/benefit needs to be addressed and hopefully the best possible decision made.
32. Best management practices (BMPs) for livestock waste management can be easy to understand, but often they are not. Our job as extension professionals should be to work with all livestock producers to help raise their waste management practices to a level that is higher than what it is right now. A comprehensive nutrient management plan (CNMP) is not attainable for all operations, but a higher level of management is attainable for all operations. There seems to be “all or nothing” mentality among some regarding CNMPs. In practice I think most extension educators do strive to raise the level of management for producers. You might be interested in checking out my Journal articles based on my master’s thesis research. They are in the Journal of Extension. Check out the August 2005 issue and the June 2006 issue at JOE.org.

Minnesota

33. I write the manure management plans for new construction and remodeling for two counties. There are a lot of misconceptions out there regarding manure management. Extension fills an important niche in this information gap.

Missouri

34. There are many misconceptions by the public. Some of this has been caused by mismanagement by some producers.
35. Agriculture faculty is spread too thin. Must focus on areas where there is more demand from clients for help. Integrators are telling us what to do (Don’t need us???). Clients want to cooperate with government mandates. “Too many hoops to jump through.”
36. The challenge is getting producers to the program but if it is done right you can have a successful learning event. Most producers want to protect the environment in which they live.

37. We have two areas of need. The producer and the rural non-farm resident. Our area is a large broiler turkey and layer contract growers with a few company owned plants. Ultra conservative views have prevented zoning in area counties. Zoning could have prevented some of the air quality issues.
38. Taking control of waste management away from the states and giving it to the Environmental Protection Agency (EPA) would be a big mistake. Also environmental “advocates need to realize that business other than farming are involved in polluting our waters. They also need to realize that best management practices (BMPs) are based on sound science not “factoids” and have undergone rigorous research in their development.
39. This is an area that will take time as most producers have been slow to accept changes here. The other issue is, waste management is generally very costly and many of our producers are reluctant to put out large sums of money.

Nebraska

40. Provide educational programming for county/area cattlemen’s organizations.
41. Tough to get an audience of producers at a conference.
42. It is important for us as extension educators to provide livestock waste management education to producers so that they can manage their livestock wastes in a manner that is environmentally sound. Many times, this is best done by demonstrations, field days and tours of livestock operations that are using best management practices (BMPs) and doing it right. Also there is need to demonstrate variability of manure/compost application in the field and variability of nutrient composition of manure/compost and how this impacts the nutrient application level to the land.

North Dakota

43. Producers do not always get accurate information. Producers will not do much about livestock waste until they are forced to do so by the health department. Hands-on training and workshops seem to work the best, although not everyone learns best this way.
44. There is need for more training for agents in any form.
45. Producers learn the most when they do hands-on things, go to tours, see demonstrations and discuss with other producers. They do not learn much when they sit through day long lectures.
46. We are just getting started in this area.
47. We have a few area livestock waste management specialists here so generally, we leave program planning to their areas and include them when feasible.
48. This is an area of study that will have a major impact on future livestock production. The environmental movement will and is using this to fight livestock production on a commercial scale.
49. The question I always hear is “When are they going to make me do something.” This is with regard to producers changing operation. My question is “Is there more

- management issues that can be worked on before spending thousands of dollars on dirt work, especially for some small producers”?
50. The effectiveness of many of the teaching tools in this survey depends on how they are used.
 51. I feel more non-threatening education, needs to be offered, so people understand why it is important to include waste management in their agricultural practices. Forcing people to comply or holding meetings with information to scare them is not the answer.
 52. I utilize area and state people with more expertise in waste management.
 53. Field demonstrations seem to be very effective in livestock waste management education.
 54. I believe that this is a multi-disciplinary program area and educational programs should be designed with expertise from areas including animal nutrition, water quality, soil fertility, human health, county and township zoning, economic development, engineering and perhaps others. I believe that too much of the educational focus in this area to date has been on the regulatory side.
 55. Animal feeding operations (AFOs) are expected to comply with the federal regulations regarding the Clean Water and Clear Air Acts. Eventually this will impact all livestock producers.

Ohio

56. We have fewer livestock than ever, so there is little programming in the area.
57. Use a team approach in livestock waste management education.

South Dakota

58. Not much of an issue in my part of South Dakota.
59. In the open range and small feedlots county, the subject is not of high priority - but it is coming.
60. Grazing is best way to manage waste. Put it right back on the land this way. Reduce feedlot confinements.
61. Animal waste management plans tend to be too complicated for the planners and the implementers. Keep it simple to have better implementation across the board.

Wisconsin

62. Extension should not be put in a position by regulators as being the fall guy. Too often it is the messenger who is blamed for the regulations.
63. The key is having all information multipliers with the correct information - agronomists, nutritionists, manure producers, veterinary officials etc.
64. Very important in local programming, but difficult to keep up with changes in regulations at the national, state and local levels.

65. Very important that extension education be done in collaboration with other agencies (Natural Resources Conservation Service, Land Conservation (NRCS), Vocational, Technical and Adult Education-VTAE) and with producer involvement.
66. Extension educators often try to present information to groups on waste management. However, individual producers of livestock often have unique problems regarding waste that require unique solutions. One-on-one education often works best. That being said, there is more education needed on waste management to the general public. The public perception of livestock waste is often in opposition to that of livestock producers.
67. Like most farmer educational programs they need to be practical, real-world, hands-on and relatively straight forward. While the lecture-style classroom instruction has a place, the best impact from my experience has been with small group discussion (farmer panel) and one-on-one, hands-on demonstrations. Farmers may respect and appreciate a “specialists” research and opinion. However, I think they really value opinions that are supported by other farmers and industry. Farmers need to hear a consistent message regarding waste management from multiple sources, i.e. other farmers, extension (university), consultants and government agencies. All for one and one for all. Unlike other extension education programs, waste management education is being tied more and more to regulation standards. If farmers are going to take best management practices (BMPs) serious they need to be practical, “real-world” and consistent. As an extension agent I feel waste management education needs to focus on the agronomics, first, public relations (good neighbor), second and regulations third.
68. The greatest challenge that I see is convincing producers to take the leap and sign for cost-sharing to implement a nutrient management plan when the nutrient management restriction goes on the land deed for perpetuity. That scares away many producers from taking the step. Many farms and acres are under a nutrient management plan, but not reported to the state in an effort to keep below the “radar” of state regulators.

REFERENCES

- Alam, M., Thompson, C., Trooien, T. & Schlegel, A. (2003). Demonstration of best management practices to avoid groundwater pollution from application of livestock manure to cropland. *Project Report KDHE Project- NPS 99-004*. Kansas State University Research and Extension. Garden City, KS.
- Al-Subaiee, S. S. F., Yoder, E. P. & Thompson, J. S. (2005). Extension agents' perceptions of sustainable agriculture in the Riyadh region of Saudi Arabia. *Journal of International Agricultural and Extension Education* 12(1), 5-14.
- Amireault, S., Godin, G., Vohl, M-C. & Pérusse, L. (2008). Moderators of the intention-behavior and perceived behavioural control-behaviour relationships for leisure-time physical activity. *International Journal of Behavioral Nutrition and Physical Activity* 5(7), doi: 10.1186/147-5868-5-7.
- Androulidakis, S. I. & Siardos, G. C. (1994). Agricultural extension agents' perceptions regarding their relevance and competence in certain professional task areas. *Journal of Agricultural Education and Extension*, 1(3), 1-14.
- Ajzek, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliff, NJ: Prentice-Hall Inc.
- Ary, D., Jacobs, L. C., Razavieh, A. & Sorensen, C. (2006). *Introduction to research in education* (7th ed.). Thomson Wadsworth. Belmont, CA.
- Bagozzi, R. P. (1992). The self-regulation of attitudes, intentions, and behavior. *Social Psychology Quarterly* 55(2), 178-204.

- Baker, M. & Villalobos. (1997). Perceptions of county faculty of the professional development needs of specialists. *Journal of Extension* 35(4). Retrieved October 31, 2007 from <http://www.joe.org/joe/1997august/al.html>.
- Bauer, M. E. (1995). A waste management needs assessment of Oregon county extension offices. *Journal of Extension* 33(1).
- Behrens, J. H. & Evans, J. F. (1984). Using mass media for extension education. In Burton E. Swanson (Ed.), *Agricultural Extension: A reference manual*. Second Edition (pp. 144-160). Food and Agricultural Organization, Rome.
- Blezek, A. G. & Dillon, R. D. (1991). Perceptions of agribusiness leaders toward agricultural education in Nebraska. *Journal of Agricultural Education*. Summer 1991, 34-39.
- Boesch, D. F., Brinsfield, R. B. & Magnien, R. B. (2001). Chesapeake Bay eutrophication: scientific understanding, ecosystem restoration and challenges for agriculture. *Journal of Environmental Quality* 30, 303-320.
- Bolman, L. G & Deal, T. E. (2003). *Reframing organizations: Artistry, Choice, and Leadership*. San Francisco, CA: Jossey-Bass.
- Bouldin, D. R. & Klausner, S. D. (1998). Managing nutrients in manure: General principles and applications to dairy manure in New York. In J. L. Hatfield and B. A. Stewart (Eds.) *Animal waste utilization: Effective use of manure as a soil resource* (pp.65-88). Ann Arbor Press, Ann Arbor, MI.
- Boyd, R. D. & Apps, J. W. (1980). The conceptual model for adult education. In William S. Griffith & Howard Y. McClusky (Eds.), *Redefining the discipline of adult education*. (pp.1-15). San Francisco: Jossey-Bass.

- Bruening, T. & Martin, R. A. (1992). Farmers perceptions of soil and water conservation issues: Implications for agricultural and extension education. *Journal of Agricultural Education*. Winter 1992, 48-54.
- Bruening, T. H., Radhakrishna, R. B. & Rollins, T. J. (1992). Environmental Issues: Farmers' perceptions about usefulness of information and organizational sources. *Journal of Agricultural Education*. Summer 1992, 34-42.
- Brumm, M. C. (1998). Sources of manure: Swine. In J. L. Hatfield and B. A. Stewart (Eds.) *Animal waste utilization: Effective use of manure as a soil resource* (pp.49-63). Ann Arbor Press, Ann Arbor, MI.
- Caffarella, R. S. 2002. *Planning programs for adult: A practical guide for educators, teachers, and staff developers* (2nd ed.). San Francisco, CA: Jossey-Bass.
- Camara, M. (2006). Agricultural extension educators' perceptions regarding the teaching and learning process related to water quality issues in the North Central Region of the United States. PhD Dissertation. Iowa State University, Ames.
- Caravella, J. (2006). A needs assessment method for extension educators. *Journal of Extension*, 44(1). Article number 1T0T2.
- Chatzisarantis, N. L. D. & Biddle, S. J. H. (1998). Functional significance of psychological variables that are included in the Theory of Planned Behaviour: A self-determination theory approach to the study of attitudes, subjective norms, perceptions of control and intentions. *European Journal of Social psychology* 28, 303-322.
- Chizari, M., Karbasioun, M. & Lindner, J. R. (1998). Obstacles facing extension agents in the development and delivery of extension educational programs for adult farmers in the province of Esfahan, Iran. *Journal of Agricultural Education*, 39(1): 48-54.

- Chizari, M., Lindner, J. R. & Lashkarara, F. (2001). Perceptions of Lorestan Province, Iran wheat farmers with respect to sustainable agricultural practices. *Journal of International Agricultural and Extension Education*. Fall 2001, 65-71.
- Chizari, M., Lindner, J. R., Zoghie, M. (1999). Perceptions of extension agents' educational needs regarding sustainable agriculture in the Khorasan Province, Iran. *Journal of Agricultural Education* 40(4), 20-27.
- Chizari, M. & Taylor, W. N. (1991). Agriculture teachers' perceptions of adult education programs: An examination of critical educational needs, obstacles faced and support needed. *Journal of Agricultural Education*. Summer 1991, 23-28.
- Clark, A. (1994). Contemporary problems in the philosophy of perception. *American Journal of Psychology*, 107(4), 613-622. Retrieved May 2, 2007 from <http://vm.uconn.edu/~wwwphil/crane.html>.
- Clark, M. S., Horwath, W. R. Shennan, C & Scow, K. M. (1998). Changes in soil chemical properties resulting from organic and low-input farming practices. *Agronomy Journal* 90, 662-671.
- Coates, P. (1998). Perception and metaphysical skepticism. *Proceedings of the Aristotelian Society*, Supplementary Volume, 1-28.
- Conti, G. J & Kolody, R. C. (2004). Guidelines for selecting methods and techniques. In Michael W. Galbraith. *Adult learning methods: A guide for effective instruction* (3rd ed.) (pp. 181-192). Malabar: Krieger Publishing.
- Cookson, P. S. (1998). *Program planning for the training and continuing education of adults: North American perspectives*. Malabar: Krieger Publishing.

- Cranton, P. (2006). *Understanding and promoting transformative learning: A guide for educators of adults* (2nd ed.). San Francisco: Jossey-Bass.
- Creswell, J. L. (1990). An identification and assessment of extension educational delivery systems for training of private pesticide applicators. PhD. Dissertation. Iowa State University. Ames.
- Creswell, J. L. & Martin, R. A. (1993). An assessment of teaching strategies used in private pesticide applicator education. *Journal of Agricultural Education, Summer 1993*, 18-24.
- Crotty, M. (2005). *The foundations of social research: Meaning and perspective in the research process*. London: SAGE. (Original work published 1998).
- Davis, J. A. (1971). *Elementary survey analysis*. Englewood, NJ: Prentice-Hall.
- Dibonaventura, M. D. & Chapman, G. B. (2005). Moderators of the intention-behavior relationship in influenza vaccinations: Intention stability and unforeseen barriers. *Psychology and Health* 20(6), 761-774.
- Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Dollisso, A. D. & Martin, R. A. (1999). Perceptions regarding adult learners motivation to participate in educational programs. *Journal of Agricultural Education* 40(4), 38-46.
- Dooley, K. E. & Murphy, T. H. (2001). College of agriculture faculty perceptions of electronic technologies in teaching. *Journal of Agricultural Education*, 42(2), 1-10.
- Environmental Protection Agency (EPA). (1994). What is Nonpoint Source (NPS) Pollution? Questions and Answers. EPA brochure EPA-841-F-94-005, 1994. Retrieved June 12, 2007, from <http://www.epa.gov/cgi-bin/epaprintonly.cgi>.

- Etling, A. (1995). Needs Assessment: A Handbook. *Journal of Extension*, 33(1).
- Etling, A. (1993). What is nonformal education? *Journal of Agricultural Education*. Winter 1993, 72-76.
- Farouque, Md. G. & Takeya, H. (2007). Framers' perception of integrated soil fertility and nutrient management for sustainable crop production: A study of rural areas in Bangladesh. *Journal of Agricultural Education* 48(3), 111-122.
- Fishbein, M., & Azjen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, Massachusetts: Addison-Wesley.
- Fitzpatrick, J. L., Sanders, J. R. & Worthen, B. R. (2004). *Program evaluation: Alternative approaches and practical guidelines* (3rd ed.). Boston: Allyn and Bacon
- Foster, D. L. (1998). Economic issues in animal waste management. In J. L. Hatfield and B. A. Stewart (Eds.) *Animal waste utilization: Effective use of manure as a soil resource* (pp.33-48). Ann Arbor Press, Ann Arbor, MI.
- Fukumoto, G. F. (2005). Animal waste management strategies. EPA PIEC Pre-Conference Working Session June 21, 2005, Guam. Cooperative Extension Service. CTAHR, University of Hawaii at Manoa. Retrieved December 04, 2007 from <http://www.epa.gov/region09/islands/conf05/present/fukumoto.pdf>
- Furneaux, B. (2005). Theories used in IS research: Theory of reasoned action. Retrieved October 23, 2007 from <http://www.istheory.yorku.ca/theoryofreasonedaction.htm>
- Galbraith, M. W. (2004). The teacher of adults. In Michael W. Galbraith. *Adult learning methods: A guide for effective instruction* (3rd ed.) (pp. 3-21). Malabar: Krieger Publishing.

- Gamon, J., Harrold, N. & Creswell, J. (1994). Educational delivery methods to encourage adoption of sustainable agricultural practices. *Journal of Agricultural Education* 35(1), 38-42.
- Gangbazo, G., Pesant, A. R., Barnett, G. M., Charuest, J. P. & Cluis, D. (1995). Water contamination by ammonium nitrogen following the spread of hog manure and mineral fertilizer. *Journal of Environmental Quality* 24, 420-425.
- Gast, R. G., Nelson, W. W. & Randall, G. W. (1978.) Nitrate accumulation in soils and loss in tile drainage following nitrogen applications to continuous corn. *Journal of Environmental Quality* 7, 256-261.
- George, D. & Mallery, P. (2008). *SPSS for Windows step by step: A simple guide and reference 15.0 update* (8th ed.). Boston, MA: Allyn & Bacon.
- Gillholm, R., Ettema, D., Selart, M. & Gärling, T. (1999). The role of planning for intention-behavior consistency. *Scandinavian Journal of Psychology* 40, 241-250.
- Gillholm, R., Erdeus, J. & Gärling, T. (2000). The effect of choice on intention-behavior consistency. *Scandinavian Journal of Psychology* 41(1), 1-8.
- Goldberg, V. M. (1989). Groundwater pollution by nitrates from livestock wastes. *Environmental Health Perspectives* 88, 25-29.
- Goolsby, D. A., Battaglin, W. A., Aulenbach, B. T. & Hooper, R. P. (2001). Nitrogen input to the Gulf of Mexico. *Journal of Environmental Quality* 30, 329-336.
- Goolsby, D.A., Battaglin, W. A., Lawrence, G. B., Artz, R. S., Aulenbach, B. T., Hooper, R. P., D. Keeney, R. & Stensland, G. J. (1999). Flux and sources of nutrients in the Mississippi-Atchafalaya River Basin-topic 3 report for the integrated assessment on

- hypoxia in the Gulf of Mexico: Silver Spring, Md., NOAA Coastal Ocean Office, NOAA Coastal Ocean Program Decision Analysis Series No. 17, 130 p.
- Grandy, A. S., Porter, G. A & Erich, M. S. (2002). Organic amendment and rotation crop effects on the recovery of soil organic matter and aggregation in potato cropping systems. *Soil Science Society of America Journal* 66, 1311-1319.
- Hao, X., Chang, C., Larney, F. J. & Travis, G. R. (2001). Greenhouse gas emission during cattle feedlot manure composting. *Journal of Environmental Quality* 30(2), 376-386.
- Hubbard, R. K., Newton, G. L. & Hill, G. M. (2004). Water quality and the grazing animal. *Journal of Animal Science* 82 (E. Suppl.), E255-E263.
- Ikeoji, C. N., Agwubike, C. C. & Disi, J. O. (2007). Perceptions of head agricultural science teachers regarding problems and challenges of vocational agricultural delivery in secondary schools in the Delta State, Nigeria. *Electronic Journal of Science Education* 11(2). Retrieved October 31, 2007 from <http://ejse.southwestern.edu>.
- Illinois Environmental Protection Agency (EPA) (2001). Livestock waste regulations. Section 506.103 Definitions [510ILCS77/10.35]. 35 Illinois Administrative Code. p. 4.
- Iowa State University Extension. (2003). Managing manure nutrients for crop production. PM 1811 Revised November 2003.
- Jayaratne, K. S. U. (2001). Agricultural extension educators' perceptions regarding the teaching and learning processes as related to sustainable agriculture: Implications for agricultural extension education. PhD Dissertation. Iowa State University. Ames.
- Jayaratne, K.S. U., Martin, R. A. & Dewitt, J. R. (2001). Perceptions regarding sustainable agriculture: emerging trends for educating extension educators. *Proceedings of the*

- 17th Annual conference April 4-7, 2001. Association for International Agricultural and Extension Education. (pp.191-197).
- Joung, C. P. (1983). Data acquisition and evaluation of groundwater pollution by nitrates, pesticides and disease producing bacteria. *Environmental Geology* 5(1):11-18.
- Kang, J. T. & Song, H. K. (1984). Individual and group extension teaching methods. In Burton E. Swanson (Ed.), *Agricultural Extension: A reference manual*. Second Edition (pp. 130-143). Food and Agricultural Organization, Rome.
- Kellogg, R. L., Lander, C. H., Moffitt, D. C. & Gollehon, N. (2000). Manure nutrients relative to the capacity of cropland and pastureland to assimilate nutrients: Spatial and temporal trends for the United States. *United States Department of Agriculture, Natural Resource Conservation, Economic Research Service* Publication No. nps00-0579. Retrieved July 19, 2007 from <http://www.nrcs.usda.gov/technical/land/pubs/mannttr.pdf>.
- Kelly, G. A. (1955). *The psychology of personal constructs: A theory of personality* (Vol. 1). New York: Norton.
- Knobloch, N. A. & Martin, R. A. (2000). Agricultural awareness activities and their integration into the curriculum as perceived by elementary teachers. *Journal of Agricultural Education* 41(4), 15-26.
- Koelsch, R., Howard, L., Pritchard, S. & Hay, P. (2000). Implementation of a livestock system environmental assessment tool. *Journal of Extension* 38(1), 21-28. Retrieved March 24, 2006 from <http://joe.org/joe/2000february/a3.html>.
- Ladebo, O. J. (2004). Job behavior and attitudes of agricultural faculty; Beyond the influence of biological factors. *Journal of Extension Systems* 20(2), 89-103.

- Lindner, J. R. (1998). Understanding employee motivation. *Journal of Extension* 36(3).
Retrieved October 29, 2007 from <http://www.joe.org/joe/1998june/rb3.html>.
- Lindner, J. R., Murphy, T. H. & Briers, G. E. (2001). Handling nonresponse in social science research. *Journal of Agricultural Education* 42 (4), 43-53.
- Loecke, T. D., Liebman, M., Camberdella, C. A. & Richard, T. L. (2004). Corn response to composting and time of application of solid swine manure. *Agronomy Journal* 96, 214-223.
- Long, H. B. (2004). Understanding adult learners. In Michael W. Galbraith (Ed.), *Adult learning methods: A guide for effective instruction*. Third Edition. (pp.23-37).
Malabar: Krieger.
- Lowrance, R. & Hubbard, R. K. H. (2000). Denitrification from a swine lagoon overflow treatment system at a pasture-riparian zone interface. *Journal of Environmental Quality* 30, 617-624.
- Manel, K. M. & Slates, J. D. (2005). Demonstrating manure spreader calibration at field days. *Journal of Extension* 43(4), Article Number 4IAW5.
- Martin, R. A. & Omer, M. H. (1990). Perceptions regarding instructional methods used in adult agricultural education programs. *Journal of Agricultural Education*, summer 1990, 2-6.
- Mattila, T. E. A., Kaustell, K. O., Leppälä, J., Hurme, T. & Suutarinen, J. (2007). Farmers' perceptions of necessary management skills in Finland. *Journal of Agricultural Education and Extension* 13(4), 287-300.

- McAndrew, G. M., Liebman, M., Cambardella, C. A. & Richard, T. L. (2006). Residual effects of composted and fresh solid swine manure (*Sus scrofa* L.) manure on soybean [*Glycine max* (L.) Merr.] growth and yield. *Agronomy Journal* 98, 873-882.
- McCann, L. M. J., Nowak, P & Nunez, J. T. (2006). Barriers to adoption of animal waste management strategies. In J. M. Rice, D. F. Caldwell, F. J. Humenik (Eds.), *Animal Agriculture and the Environment National Center for Manure and Animal Waste management*. White Paper. (pp109-134). St. Joseph, Michigan. ASABE Publication number 913C0306.
- McNeil, J. D. (2006). *Contemporary Curriculum in thought and action* (6th ed.), Indianapolis: John Willey & Sons, Inc., Jossey-Bass.
- Minnesota Institute for Sustainable Agriculture. (1998). Hog manure boosts corn yield more than fertilizer in U of m study. *Minnesota Institute for Sustainable Agriculture Newsletter*. University of Minnesota, College of Agriculture, Food and Environmental Sciences, Volume 6, Issue 3.
- Merriam, S. B. & Caffarella, R. S. (1999). *Learning in adulthood*. (2nd ed.). San Francisco: Jossey-Bass.
- Miller, G. (1997). Agricultural education at a distance: Attitudes and perceptions of secondary teachers. *Journal of Agricultural Education* 38(1), 54-60.
- Miller, L. E. (1994). Correlations: Description or Inference? *Journal of Agricultural Education* 35(1), 5-7.
- Nadler, L. (1994). *Designing training programs: The critical events model* (2nd ed.) Houston: Gulf.

- Newsome, L. A., Wardlow, G. W. & Johnson, D. M. (2005). Effects of lecture versus experiential teaching methods on cognitive achievement, retention and attitude among high school agriscience students. *National AAAE Research Conference* pp.146-156.
- Ozor, N., Agwu, A. E. Chuckwuone, N. A., Madukwe, M. C. & Garforth, C. J. (2007). Cost-sharing of agricultural technology transfer in Nigeria: Perceptions of farmers and extension professionals. *Journal of Agricultural and Extension Education* 13(1), 23-37.
- Park, D-B, Cho, Y-B & Lee, M. (2007). The use of an e-learning system for agricultural extension: A case study of the rural development administration, Korea. *Journal of Agricultural and Extension Education* 13(4), 273-285.
- Park, H. S. (2000). Relationships among attitudes and subjective norms: Testing the theory of reasoned action across cultures. Central States Speech Association. ProQuest Information and Learning Company. Retrieved October 23, 2007 from http://findarticles.com/p/articles/mi_qa3669/is_200007/ai_n8888791/print.
- Pickering, D. C. (1987). An overview of agricultural extension and its linkages with agricultural research: The World Bank experience. In William M. Rivera & Susan G. Schram (Eds.), *Agricultural Extension Worldwide: Issues, practices and emerging priorities* (pp. 66-74). New York: Croom Helm with Methuen Inc.
- Powers, W. J. & Horn, H. H. (2001). Nutritional implications for manure nutrient management planning. *Applied Engineering in Agriculture, American Society of Agricultural Engineers* 17(1), 27-39.
- Rabalais, N. N., Turner, R. E. & Wiseman, Jr. W. J. (2001). Hypoxia in the Gulf of Mexico. *Journal of Environmental Quality* 30, 320-329.

- Richardson, J. G. & Mustain, D. (1993). Waste management education. *Journal of Extension*. Spring 1993, 31(1). Retrieved July 17, 2007 from <http://www.joe.org/joe/1993spring/a3.html>.
- Riesenberg, L. E. & Gor, C. O. (1989). Farmers' preferences for methods of receiving information on new or innovative farming practices. *Journal of Agricultural Education* Fall 1989:7-13.
- Rogers, E. M. (2003). *Diffusion of innovations*. (5th ed.), New York: Free Press.
- Rollins, T. J & Yoder, E. P. (1993). Adult learning preferences: A profile of extension educators. *Journal of Agricultural Education* Spring 1993, 18-25.
- Rouda, R. H. & Kusy, M. E., Jr. (1995). Need Assessment: The first step. The technical Association of the Pulp and Paper Industry. Retrieved February 18, 2008 from http://alumnus.caltech.edu/~rouda/T2_NA.html
- Rowe, G. T. (2001). Seasonal hypoxia in the bottom water off the Mississippi river delta. *Journal of Environmental Quality* 30, 281-290.
- Schauber, A. C. (2001). Effecting extension organizational change toward cultural diversity: A conceptual framework. *Journal of Extension* 39(3). Retrieved November 21, 2007 from <http://www.joe.org/2001june/al.html>.
- Seevers, B, Graham, D., Gamon, J. & Conklin, N. (1997). *Education through cooperative extension*. Albany: Delmar.
- Shao, X. & Bruening, T. (2005). Teacher's perceptions of curriculum reforms and teacher training programs in Chinese agricultural schools. *Journal of International Agricultural and Extension Education* 12(1), 37-46.

- Sharpley, A., Meisinger, J. J., Breeuwsma, A., Sims, J. T., Daniel, T. C. & Schepers, J. S. (1998). Impacts of animal manure management on ground and surface water quality. In J. L. Hatfield and B. A. Stewart (Eds.) *Animal waste utilization: Effective use of manure as a soil resource* (pp.173-242).Ann Arbor Press, Ann Arbor, MI.
- Spiegel, M. R. (1961). *Schaum's outline of theory and problems of statistics*. New York: Schaum Publishing.
- Sproule, J. M. (1991). *Speechmaking: An introduction to rhetorical competence*. Wim C. Brown Publishers. Dubuque, IA.
- Stufflebeam, D. L. (1983). The CIPP model for program evaluation. In Madaus, G. F., Scriven, M. S. & Stufflebeam, D. L. (Eds.), *Evaluation models* (pp. 117-141). Boston: Kluwer-Nijoff Publishing.
- Sund, J. L., Evenson, C. J. Strevett, K. A., Nairn, R. W., Athay, D & Trawinski, E. (2001). Nutrient conversions by photosynthetic bacteria in a concentrated animal feeding operation lagoon system. *Journal of Environmental Quality* 30(2), 648-655.
- Sweeten, J. M. (1998). Cattle feedlot manure and wastewater management practices. In J. L. Hatfield and B. A. Stewart (Eds.) *Animal waste utilization: Effective use of manure as a soil resource* (pp.125-155).Ann Arbor Press, Ann Arbor, MI.
- Taylor, B. (2001). Theory of Reasoned Action-Created by Brent Taylor for Dr. Leckenby Fall 01 Adv 382j. Retrieved October 23, 2007 from http://www.ciadvertising.org/student_account/fall_01/adv382j/brent/yes.html.
- The Kansas Department of Health and Environment. (2007). Animal and Related Waste Control. Article 18. *Bureau of Water*. Retrieved July 24, 2007 from http://www.kdheks.gov/feedlots/reg28_18.htm.

- Trede, L. & Russell, D. (1999). Perceptions of stakeholders towards linkages and curriculum in urban agricultural education. *Proceedings of the 26th Annual national Agricultural Education Research Conference*. pp. 240-250.
- Tyson, T. W. (1995). Best management practices to handle dairy wastes. Alabama Cooperative Extension System Publication ANR-970.
- Udoto, M. & Flowers, J. (2001). Perceptions of agricultural education teachers towards sustainable agricultural practices. *28th Annual National Agricultural Education Research Conference, December 12, 2001*. pp. 433-444.
- University of Wisconsin Extension. (2002). The Program Action-Logic Model. Board of Regents of the University of Wisconsin.
- USDA. (2002). Census of agriculture state and county profiles. *National Agricultural Statistics Service 2002*. Retrieved November 25, 2007 from <http://www.nass.usda.gov/census02/profiles/index.htm>.
- van den Ban, A.W. & Hawkins, H. S. (1996). *Agricultural Extension* (2nd ed.), Malden: Blackwell Science.
- Varel, V. H. & Miller, D. N. (2001). Plant-derived oils reduce pathogens and gaseous emissions from stored cattle waste. *Applied and Environmental Microbiology* 67(3), 1366-1370.
- Varel, V. H., Nienaber, J. A. & Freetly, H. C. (1999). Conservation of nitrogen in cattle feedlot waste with urease inhibitors. *Journal of Animal Science* 77, 1162-1168.
- Warnick, B. K. & Thompson, G. W. & Gummer, E. S. (2004). Perceptions of science teachers regarding the integration of science into the agricultural education curriculum. *Journal of Agricultural Education* 45(1), 62-73.

- Westerman, P. W. & Overcash, M. R. (1980). Dairy Open Lot and Lagoon-Irrigated Pasture Runoff Quantity and Quality. *Transactions of the ASAE* 23(5), 1157-1164.
- White, B. A. & Brockett, R. G. (1987). Putting philosophy into practice: Developing a working philosophy. *Journal of Extension* 25(2). Retrieved November 21, 2007 from <http://www.joe.org/joe/1987summer/a3.html>.
- Wikipedia (2007). Agricultural Extension. *Wikipedia, the free encyclopedia*. Retrieved December 4, 2007 from http://en.wikipedia.org/wiki/Agricultural_extension.
- Wikipedia. (2007). Livestock. *Wikipedia, the free encyclopedia*. Retrieved July 24, 2007 from <http://en.wikipedia.org/wiki/Livestock>.
- Wikipedia. (2007). Theory of reasoned action. *Wikipedia, the free encyclopedia*. Retrieved November 6, 2007 from http://en.wikipedia.org/wiki/Theory_of_reasoned_action.
- William, D. L. & Wise, K. L. (1997). Perceptions of Iowa secondary school agriculture education teachers and students regarding sustainable agriculture. *Journal of Agricultural Education* 38(2), 15-20.
- Wlodkowski, R. J. (2004). Creating motivating learning environments. In Michael W. Galbraith. *Adult learning methods: A guide for effective instruction* (3rd ed.) (pp. 141-164). Malabar: Krieger Publishing.
- Wortmann, C. S., Koelsch, R. K., Shapiro, C. A., Deloughery, R. L. & Tarkalson, D. (2005). Manure use planning: An evaluation of a producer training program. *Journal of Extension* 43(4) Article Number 4RIB5.
- Zahn, J. A., Dispirito, A. A., Do, Y. S., Brooks, B. E., Cooper, E. E. & Hatfield, J. (2001). Correlation of Human olfactory responses to airborne concentrations of malodorous

- volatile organic compounds emitted from swine effluent. *Journal of Environmental Quality* 30(2), 635-647.
- Zebarth, B. J., Paul, J. W. & Van Kleeck, R. (1999). The effect of nitrogen management in agricultural production on water quality: Evaluation on a regional scale. *Agriculture, Ecosystem & Environment* 72, 35-52.
- Zilberman, D. Metcalfe, M. & Ogishi, A. (2006). Creative solutions to the animal waste problem. In J. M. Rice, D. F. Caldwell, F. J. Humenik (Eds.), *Animal Agriculture and the Environment National Center for Manure and Animal Waste management*. White Paper. (pp161-180). St. Joseph, Michigan. ASABE Publication Number 913C0306.
- Zilberman, D., Ogishi, A. & Metcalfe, M. (2001). Innovative policies for addressing livestock waste problems. *National Center for Manure and Animal waste management*. White Paper Summaries. pp 1-3.