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An Assessment of Teaching Strategies used in Private Pesticide Applicator Education

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For many years, state cooperative extension systems have provided educational programming focused on the safe handling, use and storage of pesticides. These programs were heavily information-based (Pearson, 1987). The initial intent of this training and education program was to provide information on pesticides that would enable participants to apply and handle them correctly and safely. but these programs quickly became sessions to provide information for passing mandatory certification tests (Pearson, 1987). Training was primarily through the use of an illustrated lecture-discussion format.

Some individuals and organizations have questioned just how well these programs were training private applicators. Survey research has indicated that pesticide training programs were too repetitive, and people were getting tired of them (Mueller, 1988a.). Agricultural officials and state legislators have been concerned that farmers, although certified, have received inadequate training relative to the use of agricultural chemicals listed as being restricted by the United States Environmental Protection Agency (Fruhling, 1987). Additionally, many extension programs have been evaluated on subject matter content. Very few extension programs have been studied with a focus on teaching strategies. The process should be as critical as the product of education and training (Cole, 1987). Martin and Omer (1990, p. 2) contend that while there is general recognition that educational practice is important to the education of adults, few studies have been conducted that have placed an emphasis on instructional methods used in adult education in agriculture. Most studies in adult education in agriculture have focused on the need for adult education. Those studies which have focused on instructional methods recommended further study was needed on the appropriate methods and tools to use in adult education programs in agriculture (Bouare & Bowen, 1990; Martin and Sajilan, 1989; Martin, 1987).

The theory of adult learning was explained by Knowles (1980) when he stated the following four assumptions:

> Adults both desire and enact a tendency toward self-directedness as they mature.
>
> An adult's experiences are a rich resource for learning.
>
> Adults are aware of specific learning needs generated by real-life tasks or problems.
>
> Adults are competency-based learners in that they wish to apply newly acquired skills or knowledge to their immediate circumstances.

Successful adult educators employ a variety of instructional techniques and strategies, depending on program content, expected outcomes, the learning environment, and

available educational resources. Instructional techniques and strategies often evolve naturally from what has to be taught (Knox, 1987). No one teaching technique is suited to every situation. but how many Extension educators have ventured beyond use of a few tried and true teaching methods? How many Extension educators first analyze a teaching situation before selecting the appropriate teaching method or methods? Extension studies have shown that increasing the teaching methods used in a program will increase the desired behavioral change of learners. A teacher must structure a learning situation so that students can learn (Cole, 1981).

If Extension programs tend to be subject matter-centered, what emphasis is put on the teaching strategies used by the Extension educator? What perceptions do these educators have regarding the principles of teaching/learning? What methods and tools are perceived to be the most effective by Extension educators conducting educational programs?

Purpose and Objectives

The purpose of this study was to identify and assess the teaching strategies used in the training of pesticide applicators by county extension agriculturalists in selected states. The specific objectives of the study were as follows: (1) Identify the demographic characteristics of county agricultural Extension professionals; (2) Identify the perceptions held by county agricultural extension professionals regarding principles of teaching and learning related to training pesticide applicators; (3) Identify teaching methods and tools used and perceived to be effective by county agriculturalists in training pesticide applicators.

Methods and Procedures

The descriptive survey method, sometimes called the normative survey method was used to collect data for this study. This method can be used to process data received by the researcher through observation; whether these data are actually physically observed or observed through benefit of questionnaire or poll techniques (Leedy, 1985). A self-administered mail questionnaire was used in this study. The sources of information used in developing this questionnaire included the instrument used in a study by Martin and Omer (1986) on instructional methods used in adult education and extension programs in agriculture; the instrument used by Odubiyi (1988) on instructional methods used by vocational agriculture instructors in Iowa; input from the Department of Agricultural Education and Studies and Iowa State University, and the researcher's personal experience. The instrument used a Likert-type scale to collect data on perceptions. To improve the clarity and ease of completion of the survey instrument, the questionnaire was field-tested by ten county Extension agriculturists not included in the study. The instrument was reviewed and its content verified by a panel of experts in agricultural and extension education who were familiar with adult education methodology.

County Extension agriculturists (153 of 306) in four of the twelve states with the Central Region of the United States were asked to participate in the study. Limited financial resources allowed the study to be conducted in only four states. To ensure at least a minimum response by participants in the study, one-half of the Extension agriculturalists in the four states were selected to participate (Borg & Gall, 1983; Hinkle et. al., 1988).

States selected for this study were Iowa, Nebraska, North Dakota, and Wisconsin. Iowa was automatically selected to be included in this study because: (1) the researcher was employed by the Iowa Cooperative Extension Service and was familiar with its mission and, (2) Iowa Cooperative Extension Service Administration requested that Iowa by included in this study. The other eleven states were randomly ranked, from one to eleven by drawing state names from a box. The first three states drawn (Nebraska, North Dakota, and Wisconsin) were included in this study.permission to conduct this study was received from state Extension administrators in Iowa, Nebraska, North Dakota, and Wisconsin. The states were randomly selected to participate in the study and were limited to four due to availability of funds and approval of administrators at the institution authorizing the study.

A systematic sampling plan in which a selection of every other name and address of county extension agriculturalists from the 1989-90 County Agents Directory was used to determine who would receive the questionnaire. There was a 98% return rate (i.e., 150 out of 153). Data were statistically analyzed using SPSS/PC+tm, The statistical package for the IBM Personal Computer. The .05 level of significance was set a priori as the critical value of analysis. Means, standard deviations, correlations, and analysis of variance were used in this study. The reliability test for the entire instrument indicated a Cronbach's alpha coefficient of .91. The alpha coefficient values for the subgroups within the instrument ranged from .85 to .88 (principles=.85; methods and tools used=.88; effectiveness=.88). Several of the respondents chose to respond only to selected items on the methods and tools lists. This approach accounted for some missing data. It was concluded that a lack of familiarity with a method or tool may have caused some respondents to not respond to selected items.

Findings

Demographics

The following demographic data provides a clear picture of who the respondents were and what were some of their major characteristics.

County Extension agriculturalists in the four states surveyed were mostly male (97.0%).

A majority of those surveyed were 40 years old or older (66.2%) and one-third (33.8%) were 50 years old or older.

Fifty-five of the survey participants (40.1%) reported having from one to ten years of formal teaching experience. Only 26.3% reported having no formal teaching experience prior to employment with the Extension Service.

Eighty-one county Extension agriculturalists (58.3%) reported having from one to fifteen years of employment with the Extension Service. Twenty-nine (20.9%) listed 26 years plus of Extension Service employment In this area, Iowa had the highest percentage (27.1%) and Wisconsin the lowest (9.6%).

Ninety-five county Extension agriculturalists (68.8%) reported having a master's degree and three (22.2%) had a doctorate. Wisconsin had the highest number of county Extension agriculturists with advanced degrees (master's and/or doctorate) (93.3%), followed by Nebraska (91.7%), Iowa (63.8%), and North Dakota (28.0%).

The demographic data indicates that the Extension system as it relates to agriculture in these four states is one that is traditionally male-oriented, highly experienced in agriculture technology, with moderate levels of formal training in education and high levels of advanced education beyond the baccalaureate degree.

Principles

The respondents in this study perceived that several teaching/learning principles were considered highly important. Among those were the following: comfortable and

Table 1. Perceptions of Selected County Extension Agriculturalists Regarding Principles of Teaching-Learning

In teaching proper pesticide use, etc., county Extension agriculturalists should:	Valid cases	Mean	SD
In teaching proper pesticide use, county Extension agriculturalists should:			
Prepare a comfortable and nonthreatening teaching-learning environment	136	4.65	.49
Use a variety of instructional methods	137	4.53	.62
Recognize that individual differences exist among learners	136	4.51	.57
Possess the relevant and required teaching ability and skills	137	4.39	.61
Clarify the program objectives to learners	137	4.33	.65
Identify and use educational principles and procedures in teaching	136	4.29	.63
Use decision making situations in teaching	136	4.21	.69
Develop and use a definite and specific interest approach to enhance the learner's motivation	137	4.15	.75
Evaluate the product of the teaching-learning situation (i.e., subject matter learned)	136	4.05	.72
Evaluate the teaching-learning process	137	4.04	.73
Be knowledgeable in each subject matter area taught	137	3.99	.96
Prepare instructional plans designed to enhance the teaching-learning process	136	3.90	.86
Use a variety of evaluation procedures	119	3.75	.89
Use group instruction in dealing with specific problems	137	3.65	.98
Prepare and use self-directed teaching-learning aids	135	3.42	.85
Use individualized instruction to help learners solve problems.	135	3.37	1.03
Involve learners in the program planning process	137	3.36	.92

Scale: 1=Strongly Disagree, 2= Disagree, 3=Uncertain, 4=Agree, 5=Strongly Agree

nonthreatening teaching-learning environment (Mean = 4.65; on a scale where 5 = Strongly Agree and 1 = Strongly Disagree): use a variety of instructional methods (Mean = 4.39); clarify objectives (Mean = 4.33); identify and use educational principles and procedures (Mean = 4.29); use decision-making situations in teaching (mean = 4.15). Table 1 indicates the data on the perceptions regarding the principles of teaching and learning.

Methods and Tools

County extension agriculturalists indicated that 35 mm slides were the most frequently used teaching tool. The highest-rated methods used were lecture/discussion, questioning, and lecture. Perceived effectiveness for these three methods was rated lower than perceived use. A low to moderate positive correlation was found between extent of use and perceived effectiveness for 25 teaching methods and instructional tools. The wide variation in mean scores under "extent of use" indicated a number of different approaches were being used by some individuals but the majority seemed to be using a few traditional strategies. Perceived effectiveness did not vary to a great extent from state to state or respondent to respondent. Table 2 summarizes the data on extent of use and perceived effectiveness of methods and tools of instruction.

Conclusions, Recommendations and Implications

The following conclusions were made as a result of this study: (1) The principles of teaching/learning were important to the participants in this study; (2) The respondents as a whole were not using a variety of teaching methods and tools in pesticide training; (3) The lecture, discussion and questioning methods were the predominant methods of instruction in pesticide applicator training; (4) The high regard for selected principles of teaching/learning is not borne out in use of a variety of methods even when the use of a variety of methods/tools was thought by the respondents to be effective; (5) Demographic information indicates that tradition-bound extension systems in agriculture are male-oriented and technology focused even in the era of the need for a more client-centered, process-oriented approach to extension and life-long learning.

Based on the findings of this study and the supporting literature, it is recommended that extension educators who conduct pesticide training should receive instruction focused on appropriate delivery techniques. Believing selected methods and tools to be effective and actually putting them into practice are obviously two different things. Inservice education programs need to address this issue if pesticide applicator training and education is to be effective in changing attitudes and behaviors that affect personal safety and environmental protection.

The major implication to educational practice drawn from this study is that extension education professionals have a need to spend more time with the processes of education. Findings in this study support the general need, as evidenced by the literature (Knox, 1986; Pucel, et al, 1988; Martin & Omer, 1990), for enhancing the use of appropriate and effective instructional methods and tools in conducting specific adult education programs in agriculture - particularly pesticide applicator training.

Table 2. Perceived Effectiveness of Teaching Methods and Instructional Tools

Methods and Tools	Column A Extent of Use		Column B Perceived Effectiveness		
	Mean	SD	Mean	SD	Corr
35mm slides	4.52	.80	4.04	.71	.52
Overhead projector	3.67	1.06	3.65	.82	.54
Lecture-discussion	3.55	.87	3.79	.73	.54
Questioning	3.43	.82	3.79	.73	.54
Lecture	3.49	1.02	3.20	.94	.61
News stories	3.29	.93	3.28	.73	.47
Problem solving	3.28	1.03	3.87	.76	.55
Self study	3.21	1.06	3.41	.93	.51
Tape recorder	3.14	1.50	3.09	.95	.70
Group discussion	3.03	.91	3.74	.81	.48
Individual instruction	2.93	1.05	3.98	.85	.29
Workshops	2.93	1.40	3.57	.98	.52
Demonstration	2.91	.98	4.08	.71	.42
Newsletters	2.84	1.23	3.24	.94	.40
Video tape programs	2.50	1.19	3.70	.86	.25
Case study	2.48	1.20	3.42	1.02	.58
Radio	2.41	1.27	2.83	.90	.54
Exhibits	2.27	1.01	3.07	.97	.31
Pest specimens	2.20	1.14	3.71	.90	.35
Tours	2.11	1.11	3.57	1.00	.11
Instructional posters	2.10	1.02	2.83	.92	.45
Chalkboard	2.09	1.03	2.88	.97	.54
Flip chart	1.95	1.03	2.99	.92	.51
Motion pictures	1.79	1.04	3.29	.99	.24
Television	1.73	1.02	3.03	.93	.25
Brainstorming	1.62	1.06	2.62	1.17	.51
Computer-aided instruction	1.53	.84	2.99	.97	.30
Satellite	1.53	.98	3.05	1.03	.11
Buzz groups	1.46	.89	2.48	1.12	.46
Role playing	1.34	.75	2.35	1.08	.45
Flannel board	1.30	.62	2.54	1.04	.25

Column A scale: 1=not used, 2=rarely used, 3=sometimes used, 4=frequently used, 5=heavily used. Column B scale: 1=not effective, 2=of little effectiveness, 3=somewhat effective, 4=effective, 5=very effective.

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