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To Enhance Technical Specialist Adult
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VALIDATION OF A SET OF INSTRUCTIONAL MATERIALS TO ENHANCE TECHNICAL SPECIALIST ADULT EDUCATOR COMPETENCIES

By

M. Yusuf Maamun

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ABSTRACT

VALIDATION OF A SET OF INSTRUCTIONAL MATERIALS TO ENHANCE TECHNICAL SPECIALIST ADULT EDUCATOR COMPETENCIES

By

M. Yusuf Maamun

This study examines whether the participation of a group of technical specialists in an instructional program is effective or not in terms of increasing competencies in teaching and learning.

The respondents were technical specialists from Michigan who were involved with the training of pesticide application and who were attending a one day training program. A total of 102 participants, who completed pre-, post-, and follow-up instruments, comprised the sample for this study. Five types of data were collected. This included a cognitive knowledge score, an educational orientation score, a teaching techniques score, an indication of confidence, and personal information.

The data were collected at three different times: before training, immediately following training, and two to three months after training. Findings indicate that participation in the instructional program was effective in increasing the cognitive teaching-learning knowledge of the technical specialists. Findings also showed that technical specialists had moderate to strong andragogical educational orientation.

No significant relationships were found between the personal

characteristics of age, gender, level of schooling completed, experience in the pesticide field, years as a commercial pesticide applicator, years as pesticide applicator trainer, number of training programs conducted about pesticide application, number of training programs conducted about other topics, and confidence in training others with respect to educational orientation. Similar results were found regarding the the relationship between personal characteristics and cognitive knowledge scores. An exception was that technical specialists with graduate degrees scored significantly higher in cognitive knowledge than those who held associate degrees.

'Demonstration' was ranked as the most useful teaching technique. Two of the nine listed techniques were ranked very useful, five were useful, and 'newsletter' was ranked the least useful technique. Technical specialists felt they needed less information about adult teaching after participation in the instructional program. This result was the very good of the training program.

It is recommended that the educator identify group differences and the information needed by the training participants while conducting the program.

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TABLE OF CONTENTS

APPENDIX

LIST OF TABLES

CHAPTER I

INTRODUCTION

The effectiveness of using instructional materials by educators to enhance teaching and learning situations is a concern of many adult educators. Education for competence involves not only the acquisition of knowledge, but also mastery of the ways of discovering knowledge. As the world continues to change, there will be a continuing needs for new ways of acquiring knowledge as well as new knowledge.

Technical specialists as adult educators, in general, are concerned mostly with technical information rather than with the learners. The instructional materials developed for this study are designed to help adult educators become more aware of the learners they are trying to teach. Education for competency is a process of knowing, feeling, doing, and sharing knowledge.

The validation of a set of instructional materials designed to enhance the adult educators' competencies of a group of technical specialists is a focus of this study. Technical specialists in the framework of community development hold a very important and pioneering role. Their job is primarily concerned with educational activities in the field. They train others to perform better jobs, and as a change agent and implementer in the field of agricultural education, their success will inevitably affect community development.

This study deals with increasing the competencies of technical specialists regarding the effective sharing of technical information with adult learners through participation in instructional programs. The instructional materials that this study attempts to validate are in Appendix A.

Michigan state legislation requires that every pesticide applicator have a license. In order to get a license, an applicator must pass a licensing test. This training program, initiated by the Pesticide Education Coordinator of the Michigan Cooperative Extension Service in cooperation with the Michigan Department of Agriculture, will facilitate state regulation by providing a vehicle for education to help applicators pass this licensing test. The training program also considers the importance of training trainers, and does not use tax dollars or government money. The results of this study can assist in validating the instructional materials for future development of similar training programs for technical specialists.

Theoretical Background of the Study

Contemporary theory of adult learning and teaching suggests that adult learners are independent and self-directed, have considerable experience to draw upon, and are interested in topics that relate to the developmental stages of their lives. Adult learners are problem-oriented and problem-centered toward immediate application (Knowles and Associates, 1984; Brookfield, 1986; Laird, 1985; Levine, 1991). As a person matures, his self-concept moves from a dependent personality toward a more self-directed human

being; his orientation to learning shifts from subject-centered to problem-centered; his readiness to learn becomes oriented to the developmental tasks of his social roles (Knowles, 1983).

The effectiveness of such an educational program is largely determined by agents whose job responsibilities place them in direct contact with local people, the learners. Technical specialists need to know and understand the principles of teaching and learning. In order to teach, they must understand the basic fundamentals and principles of the teaching and learning of adults, as well as teaching strategies (Levine, 1991). Knowledge alone is not enough to stimulate desired action. Getting people to understand, accept, and apply knowledge is a difficult task. Understanding the basic concepts of teaching and learning can facilitate and enhance our efforts in planning and affecting change among people (Hyatt, 1966).

Levine (1991) described the single most important concern for the teacher of technical information to adult learners as thorough understanding of the learner. Through such an understanding, it is possible to direct teaching to the specific needs and interests of the adult.

Statement of the Problem

This study is concerned with the validation of a set of instructional materials designed to enhance the adult educator competencies of a group of technical specialists. To validate means to prove the effectiveness of the instructional materials. This study's intent is to find out the impact of the instructional program on the technical specialists and how they may have changed or benefited.

The particular technical specialists involved in this study all have a similar need - - to be able to share technical knowledge and understanding with other adults with whom they work. Because of this need, the instructional program that is being examined focuses on key concepts and ideas for the effective teaching of adults.

It is assumed that if it is possible to validate the efficacy of this instructional program it will be possible to use it in a variety of other situations where technical specialists must be able to share information with others effectively. This concern is based on the understanding that adult educators employ a variety of instructional techniques and strategies, depending on the content, learning environment, expected outcome, and availability of educational resources. Instructional techniques and strategies often evolve naturally from what has to be taught (Knox, 1987).

A survey of adult educators (Martin and Omer, 1988) indicated that the predominant instructional strategy was the lecture-discussion method, using overhead projectors and slide projectors as instructional tools. Extension studies have shown the effectiveness of using more than one teaching method to bring about desired behavioral change. Extension educators and administrators are concerned with how many extension agents have used and are currently using a variety of teaching techniques in their educational program (Cole, 1981).

Extension teaching techniques have tended to focus more on the content of the course than on the methodology used to teach the course. In-service training and support materials for agents usually have focused on what the agent was to teach, with little attention

spent on how to teach it. Many extension programs, including private pesticide applicator training programs, have been evaluated on the subject matter content. Very few extension programs have been evaluated in the area of teaching techniques and strategies. The teaching techniques and strategies used in program delivery should receive the same consideration by extension specialists as does subject matter content.

Research Questions

The research questions that this study attempts to answer are:

1. What educational orientation do the training participants (technical specialists) hold?
2. Does participation in the instructional program have an immediate effect on the participants in terms of an increase in their cognitive knowledge? (Achievement).
3. Does participation in the instructional program have a long term effect on the participants in terms of retaining the cognitive knowledge derived from the instructional program? (Retention).
4. Which teaching techniques are perceived by the participants as useful? How is their perception affected by participation in the instructional program?
5. Is there a relationship between the personal characteristics of the participants with respect to their andragogical educational orientation and cognitive teaching-learning knowledge before and after training?
6. Does participation in the instructional program have an effect on the participants' confidence and the information needed.

Research Hypotheses

The following research hypotheses are drawn from the research questions and serve as a frame of reference for this study:

1. There will not be a single educational orientation that is consistent with all technical specialists (Research Question # 1)
2. The instructional program is effective in increasing the cognitive skills (achievement) of the participants (Research Question # 2).
3. Participation in the instructional program has a long-term effect on the participants in terms of an increase in their cognitive skills (retention) (Research Question # 3).
4. Participation in the instructional program will increase the number of teaching techniques perceived as useful by the participants (Research Question # 4).
5. Participants with a more andragogical educational orientation and a higher level of formal education will demonstrate a greater increase in cognitive scores than those with a lower andragogical orientation and a lower level of education (Research Question # 5).
6. The instructional program is effective in increasing the confidence of the participants regarding training others in their technical specialty (Research Question # 6).

Assumptions

The assumptions underlining this study were:

1. It was assumed that there is a distribution of teaching-learning knowledge of the training participants. Some participants know a lot and others know only a little.

2. Andragogy, part of educational orientation, is a good foundation for technical specialists as adult educators.
3. The technical specialists know and are aware of some of the teaching techniques used for teaching adults.

Importance of the Study

It is essential that we become more effective at helping technical specialists become educators of adults. By so doing, necessary technical information will be passed to the adult learner in such a way that she/he will be more willing to use the information.

The methods used in this study can be used in other training programs involving technical specialists who are attempting to teach adult learners, such as fertilizer applicator training programs and other related fields. The results of this study can assist by providing a basis and direction for the future development of training programs for technical specialists.

Definition of Terms

The following terms are defined in the context of this study:

Adult Education describes a set of organized activities carried on by a wide variety of institutions for the accomplishment of specific educational objectives. It encompasses all the organized classes, study group, lecture series, planned reading programs, guided discussions, conferences, institutes, workshops, and correspondence courses.

Adult learner as opposed to a child learner is a mature person who is a self directing human being and problem-centered.

Andragogical Orientation focuses on adult perspectives of immediacy of application toward most of their learning. To adults, education is a process of improving their ability to cope with life problems which they face now. Therefore, they tend to enter educational activities in a problem-or performance-centered frame of mind.

Assessment : An ascertainment of the extent to which objectives have been attained by a learner. Assessment of objectives requires no value judgment as to their worthwhileness. It is a nonjudgemental checking as to whether or not certain purposes have been attained.

Competency : the capability of adult educators, with adequate and sufficient knowledge, to share with others.

Delivery system : A systematic procedure in which educational programs are conceived, planned, organized, presented, and evaluated which are based on clientele needs, situational constraints, technical inputs, and available learning process technologies.

Educational Orientation describes the process of managing external conditions that facilitate the internal change called learning. An educator would be one who deliberately manages external conditions of instruction in order to produce desired internal mental rearrangements.

Evaluation : A learning and action oriented management tool and process for determining, as systematically and objectively as possible, the relevance, effectiveness, and impact of activities in light of the objectives, in order to improve both current activities, and

future planning, programming and decision making. It is a value-judgment concept in which the normative associations are implied.

Formal education : A learning experience leading to a diploma or certificate. Time and place are structured, planned, and financed.

Program Impact : the extent to which a program has affected an audience. It refers to the change or benefit people received because they participated in the program.

Learning : Knowledge or skills acquired by an individual through instruction, study, or experience.

Non-formal education : is functional and considers needs of people. Time and place of meetings are less structured; it is deliberate, planned, staffed, financed and change oriented. Unlike formal education, NFE does not lead to a diploma or certificate.

Pesticide : A chemical used to control pest populations directly, or to prevent or reduce pest damage.

Pesticide education : Teaching that is more extensive than what is required for the producer to pass a pesticide certification examination.

Pesticide applicator : A producer or individual who applies any restricted use pesticides for production of an agricultural commodity on property owned or rented by themselves or their employers, or on the property of another person with whom they trade services.

Principles of teaching-learning : Methods used by educators to facilitate the learning process.

Program : Refers to the plan of work component, project, event, or activity which we have chosen to evaluate. It could be very simple or complex.

Program objectives or educational objectives : Refers to the objectives which a program is attempting to accomplished.

Short Term Training : A training program of short duration. For this study, short term training refers to a one day training program.

Teaching-learning process : The need for both the teacher and the learner to interact in learning activities with measurable objectives through instruction, inquiry and performance, and to receive constructive evaluation.

Teaching or instructional methods : Various strategies or methods used to facilitate the teaching-learning process.

Technical Specialists: Those who are responsible for training other people. In this case, the pesticide applicators in Michigan are technical specialists.

Trainer : Refers to the one who is responsible for training other technical specialists.

CHAPTER II

REVIEW OF LITERATURE

This study is concerned with the validation of a set of instructional materials designed to enhance the adult education competencies of a group of technical specialists in how they may effectively share technical information with adult learners. The theoretical foundation of this study was derived primarily from a review of literature on the principles and practices of adult learning in the development and operation of the Cooperative Extension Service and the Michigan Department of Agriculture. A review of literature on the evaluation of such programs is also included.

The review of literature related to this study focuses on three major topics. The first topic describes the adult as a learner as well as an educator. The second topic presents the function of training. An overview of the different views of educational evaluation is the third topic presented.

Adult Learner

Learning is part of the process of being human, by which a person, through his own activity, becomes changed in behavior (Rhode, 1950). Real-world problematic investigation is the key learning strategy in all of the programs. Problem-based learning can be construed as a special case of any learning from experience where

this, in turn, combines the activities of 'finding out' with 'taking action' or reflection with action (Kolb, 1984). Experiential theories provide a sound foundation for innovation in education which focus on the notion of learning as problem solving, as well as learning to develop competencies and capabilities through practice (Bawden, 1985). In terms of adult learning, Knowles (1983) defined andragogy as the body of theory and practice in which self-directed learning is based. He derived andragogy from the Greek word 'aner' meaning adult, the art and science of helping adults to learn.

The concept of adult learning, or andragogy, introduced by Knowles and Associates (1984), has changed the role of the learner in adult education and in human resource development programs. Andragogy values the learner's life experiences and needs to be self-directed, draws the learner into a commitment to learn by responding to the learner's needs, and involves the learner in directing the content and process. Learners in an andragogical program become more competent and confident. A new term, andragogy (Knowles, 1973) addresses the issue of how and when adults learn. The basic challenge of andragogy is more a philosophical position of concern for the need of adult learners than a theory.

Knowles (1983) further describes the characteristics of adult learners which are different from child learners. As a person matures, his self-concept moves from a dependent personality toward a more self-directing human being; his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles; his time perspective changes from one of postponed application of knowledge to immediacy of application, and his orientation toward

learning shifts from subject-centered to problem-centered.

Levine (1991) described that the single most important concern for the teacher of technical information to adult learners is a thorough understanding of the learner. Through such an understanding, it is possible to direct teaching to the specific needs and interests of the adult. He provided six characteristics of adult learners and the implications for teaching technical information:

1. The adult learner is primarily independent/self-directed in what she/he learns. The implication for teaching is that the adult should not be treated like a child and it should not be assumed that the teacher is the only one with the answer, but she/he helps the adults provide answers to each other.

2. The adult learner has considerable experience to draw upon. This implies that the educator should provide opportunities for the adults to work together and share their ideas/experiences in small groups.

3. The adult learner is most apt to be interested in topics that relate to the developmental stage of their life. The implication for teaching is that we should not assume that young adults and older adults are interested in the same things. We should provide opportunities for the learners to talk about why an idea/concept is or is not important to them.

4. The adult learner is most interested in information and ideas that solve problems that they are presently faced with. This implies that the presentation should be problem-focused rather than just information-focused, by identifying the problems that are being faced by the learners.

5. The adult learner is most interested in information that can be applied immediately. This means ideas should be focused the ideas so that the adults can put them to use immediately after teaching is finished.

6. The adult learner is motivated from within him/herself. Find out, recognize and respect those things that the adult places value on.

Brookfield (1986) emphasizes that andragogy is the most popular idea in the education and training of adults. This is due partly to the way in which it grants educators of adults a sense of distinct professional identity. He further argues that the notion of facilitating learning is a smooth voyage along a storm-free river of increasing self-actualization that excludes elements of conflict, anxiety, self-doubt, or challenge.

Andragogic learning designs involve a number of features which recognize the essential maturity of the learner (Laird, 1985). These concepts have tremendous implications for training and development:

1). Andragogic learning is problem-centered rather than content-centered.

2). It permits and encourages the active participation of the learner.

3). It encourages the learner to introduce past experiences into the learning process in order to reexamine that experience in the light of new data.....new problems.

4). The climate of the learning must be collaborative, instructor-to-learner and learner-to-learner, as opposed to authority-oriented.

5). Planning is a mutual activity between the learner and the instructor.

6). Evaluation is a mutual activity between the learner and the

instructor.

7). Evaluation leads to the reappraisal of needs and interests--and therefore to redesigning and generating brand-new learning activities.

8). Activities are experientially based, not 'transmitted and absorbed' as in standard pedagogy.

Groombridge (1983) points out the different usages of the term 'adult education' in Britain and other parts of the Western World. He puts forward a broader view of education for adults by categorizing different kinds of provisions and modes of study along a three-fold axis: (i) prescriptive (e.g. traditional schooling), (ii) personal or popular (individual or group control of the educational process), and (iii) partnership (where teachers and learners meet on an equal and cooperative basis).

Madfes (1989), in his study on meeting the needs of the teacher, found that the students were most interested in practical aspects; had less tolerance for bureaucracy; required more support during program preparation; and were proficient in the content of instruction. Feuer and Geber (1988) reviewed the concept of andragogy and the use of andragogical techniques in job training. They concluded that, despite some weaknesses, andragogy is important in that it makes the teacher sensitive to the needs and interests of the learner. In addition, a study of extension agents' and their supervisor's educational orientation toward their job performance (Suvedi, 1991) concluded that extension agents hold a stronger orientation toward andragogy than pedagogy. However, there was no significant differences regarding the level of job satisfaction between agents whose educational orientations were

similar to their immediate supervisor and those who had educational orientations different from their immediate supervisor. Andragogy is considered to be an appropriate orientation for adult educators as it was related to job satisfaction.

In a study on participation of the adult learner in program planning, McLoughlin (1971) focused on dual criteria for measuring method effectiveness: achievement and attitude. He concluded that adults who participate in program planning appear to have more positive attitudes about their educational experience than those who do not, even though no evidence was found to support the notion that participation in program planning affects achievement. The differences in achievement scores cannot be accounted for by knowledge of the participants' involvement in deciding what and how they will learn. No evidence was found to support the notion that sharing the decision on course content and design at the cost of increasing the complexity of the educator's task will produce a measurable increase in achievement. Significant differences in attitude were found in favor of groups that had the opportunity to share in the decisions on course content and design. In another study on effectiveness, Rao (1991) concluded that adult education can become a more effective means for achieving community development by planning and operating adult education programs as 'community based programs' rather than as mere 'learner based' programs.

Given the same methods of teaching during the training sessions, McLoughlin (1971) further noted that most of the teaching methods used in both phases permitted considerable participation during the instructional periods (during discussions, small group work

exercises, simulation games, and case studies). However, the opportunities to participate extensively during the instructional periods did not mask the attitude change resulting from the opportunities to participate during the course planning sessions. This fact suggests that the impact of participation in program planning on attitude change may be quite powerful. The influence of the methods used during the instructional periods on attitude change did not surpass the influence of the previous conditions experienced by the participants prior to training.

Blacklock (1985) stated that participation in educational endeavors by the older learner is generally not for credit or formal recognition, but primarily for immediate application, personal satisfaction, and socialization. He proposed that three types of barriers to educational participation exist in the older adult years - situational, dispositional, and institutional. Situational barriers arise from a situation in life at a given time, such as living costs, mobility, and lack of time. Dispositional barriers, such as feeling one is too old to learn, may stem from previous educational experiences or societal pressures that suggest one is incapable of learning. Institutional barriers are found within the educational system itself. These include complex course registration systems and requirements, inconvenient course scheduling, or inaccessible location.

Cole (1977) argued that if participants are successful in incorporating into their learning activities goals and experience which they feel are beneficial, then in all likelihood they will be more desirous of achieving these goals. The knowledge and skills acquired will be more appropriate to their needs; hence, the learners will tend

to retain and apply the new learning more readily than if the content and skills are viewed as irrelevant. In addition, Aslanian and Brickell (1990) found that adults seek out and engage in learning activities when they face a life-changing challenge of some kind.

The Function of Training

The principles for teaching adults.

The best place to start in planning a technical information teaching session is to realize that you and the adults are on the same side. The goal is not to fool or to confuse the adults but to help them learn by telling them what you are about to teach them. This is the first principle of six (Levine, 1991). The second principle is to organize your material for presentation in a logical order. The ways to organize material for presentation are: (i) Content Ordered: Look at your content and see how the concepts are built. Which ideas are foundational and which are built on the foundation. (ii) Experience Ordered: By knowing who the adults are you will also know what sorts of experiences they have had that relate to your technical information. Start planning by identifying their relevant experiences and then building upon them. Present content that links with their experiences. (iii) Interest Ordered: Identify the most interesting things you have to share, then organize your presentation in a way to allow these interesting aspects to emerge periodically.

Third principle: Do not tell them everything but tell them a bit and then create ways to let them tell you what else they need to know. This can be done by: (i) making a short presentation covering the

main points; (ii) giving the adults a chance to discuss what you have just said and to share their ideas in small groups; and (iii) bring them back together to discuss the questions and answers for further clarification, new ideas, and implications drawn from the ideas.

Fourth principle: Decide what you want the adults to do with your technical information. There are four levels to consider regarding the best way to teach information: (i) The learners should **know** the information in case they need it in the future; (ii) They should **understand** the information so that they may apply the ideas in other areas; (iii) They want to be able to **use** the information so they can put it to work for themselves, and (iv) They want to be able to **share** these ideas with others so that others can know about them.

Fifth principle: Know when to teach and when to learn. Most technical teachers assume that the reason they are up in front of the group is because they have got something to teach to others. The teacher knows something that she/he wants the learners to know, on the one hand, yet the learners know things that the teacher may also like to know, on the other hand. It is important for learning, almost essential, that the learner feel that he/she is an important part of the learning process.

Sixth principle: Help the adult transfer the concepts learned to their own situations. This concept 'transfer of learning' is the essence of what we are all about. A real challenge for the teacher of technical information is to get the adult to make the shift in his/her mind from the classroom to their own situation.

Nelson (1989), questioning the concepts of adult learning and training transfer, asks what can be done to insure that the skills

learned and practiced during training will result in behavior changes once the trainees return. In addition, Crapo (1989) states that agencies must switch from pedagogical methodology to an andragogically-based training operation. Although the switch will require major re-education of training staff, it is only through adult learning techniques that key personnel will become involved in development programs.

Teaching Strategies.

There are many different teaching strategies that can be used to help learners gain an understanding of how to teach technical information to adults. Levine (1991) suggested that there are 13 different teaching techniques/strategies to help people learn technical information:

1. Demonstration. Demonstrations are most effective when the learners are concerned with the issue or problem and are looking for an answer. Demonstrations can be classified in two ways: (a) Result Demonstration shows the results of some activity, practice or procedure through evidence that can be seen, heard, or felt, and (b) Method Demonstration illustrates how to do something in step-by-step fashion.

2. Lecture. The lecture is the most commonly used instructional strategy for working with groups of learners. The ideas for improving the effectiveness of lectures include: (a) Organization - lectures must be planned ahead of time and be logical in order. (b) Allowing for breaks during which the learners can relax and informally discuss the ideas that have been presented. (c) Using visual aids

which allow the learners to see what they have been hearing. (d) Time for Questions and Answers - responding to each question lets the learners know that teacher appreciates their questions. (e) Seating Arrangement - providing a less formal seating situation allows the learners to see each other thus facilitating more interaction between the learners and the instructor. (f) Small group discussions allow the groups to discuss the topic and then share the ideas with the whole group.

3. Note Taking Guide. An outline or guide at the beginning of the presentation is helpful to the learner so that s/he can follow the material presented. The note taking guide does not have to be detailed but should provide the structure of the presentation to help the learner progress through the content.

4. Group Discussion - Allows more of the learners to actively participate and can help increase learning.

5. Exhibit - is a collection of materials (objects, pictures, appropriate signs and written information) that is displayed to help learners gain new understanding without the necessity of a formal course or training program.

6. Field Trip - is usually a well planned visit by a group of learners to some place or organization that can provide new ideas to the learners. It is often used to show the learners the process and results of a certain practice.

7. Case Study - Allows the learners to examine or analyze a specific situation that they may face in the future. It is also helpful for allowing the learners to know how much they have learned and how comfortable they will be in using the information to solve problems in

the future.

8. Brainstorming - is used to encourage the learners to freely share their ideas. This includes the discussion and combination of ideas and the reinforcing of existing ideas. Brainstorming can help a group of learners think creatively and come up with new ideas to solve difficult problems.

9. Movies/Slides/Transparencies - Visual aids that can help learners better understand the ideas that are being presented.

10. Role Playing - is used when learners expect to interact with other people as a key part of effectively using the technical information. It can be done as a demonstration in front of the whole group. At the conclusion, the learners should be given an opportunity to talk about how they feel, what they observed, learned, and will do differently next time.

11. Independent Study - allows the learners to select the content that is most interesting to them and select the best time for learning. Learners can move through the content at their own pace.

12. Newsletter - reinforces the key ideas and concepts to be taught. It also introduces ideas that will be the focus of upcoming training sessions.

13. Tutorial - is a learning situation in which a single learner needs specific help. It focuses on a specific problem or concern of the learner and the instructor becomes a type of consultant helping the learner deal with the problem.

In a study on health education, Freeland (1989) suggested that training is needed to change health education from lecturing and other limited instructional modes to a more learner-centered

involvement mode of instruction. A study done by Hjorth (1987) to identify the educational needs of adult agriculturists and the optimum methods of instruction in Franklin County, Idaho, indicated that the agriculturists would like a practical adult education program that provides farm management courses. Quiroz (1987), in her study of the self-directed learning process of a select group of adult farmers in Michigan, noted that they were self-directed learners, they did not learn in isolation, and they learned from past experiences. Learning by doing was perceived as the most important learning method, but not necessarily the most efficient in terms of time and money.

Hadisoebroto (1980), in his study to determine whether significant differences exist between a participatory-based and lecture-based approach to short training, concluded that both approaches were equally effective in terms of increasing the cognitive skills of the participants. However, when job performance is the concern, the participatory-based approach was more effective than the lecture-based approach. The implications of the study suggest that the use of pretest-posttest experimental design in the area of nonformal education can be extremely useful in examining different aspects of teaching/learning.

Stefanou and Saxena (1988), in their study focusing on the impact of the training of operator decision making, developed a framework that links training variables with allocative efficiency. They indicated that various types of training methods can help the farm operator enhance profitability. Two types of training in particular are formal education, which can be viewed as formal training, and management experience, which can be viewed as

informal training. Both are substantive and play a significant role in the levels of farm efficiency.

Evaluation

Evaluation research, sometimes called program evaluation, refers to a research purpose rather than a specific research method. Babbie (1989) stated that the purpose of such evaluation research is to evaluate the impact of social interactions such as a new teaching method, innovation and a wide variety of such programs. Evaluation is a form of applied research - it is intended to have some real world effect. It will be useful, therefore, to consider whether or not or how the research will actually be applied.

Many reports on training innovations have sections on evaluations. According to Stufflebeam et al. (1971), evaluation can be defined in many ways. They argue that three particular definitions of evaluation that have gained common acceptance have certain utilities and certain disadvantages. First, the measurement definition equates evaluation with measurement. Second, the congruence definition determines the congruence between performance and objectives. And third, the judgment definition state that evaluation is a professional judgment.

Some reasons why an evaluation is conducted follow (Froke, 1980): First, to determine if program objectives were accomplished. Second, to discover what impact the program had on the audience. This includes the reaction of the audience, how they learn, what practice they have adopted or changed, and what effect the program has had on the person or family. Third, to provide information for

decisions concerning future programming including how the program objectives, delivery methods, or audience might be changed. And fourth, to obtain information about a program in order to present it to key individuals or groups who are concerned about the effectiveness of the program.

Evaluation is the process of making comparisons for the purpose of improving decisions. It consists of making judgments about programs based on established criteria. The meaning of evaluation involves the terms: (1) Description--a very subjective term, (2) Measurement--a scale that provides a unit of measure, (3) Assessment--the use of a scale that implies comparison between two measurements, and (4) Evaluation--making a judgment about how well it was done (Levine, 1990).

Brookfield (1986) argued that the general concept of evaluation puts emphasis on the value-judgment aspect, which is particularly important in distinguishing evaluation from assessment. The two terms are often used interchangeably, yet they are fundamentally different. The interchangeability lies in that the institutional mode of evaluation stresses a value-free checking, an assessment of whether or not certain previously specified objectives have been attained.

Evaluation of learning through examination and grading in terms of fixed standards are the typical characteristics of pedagogy (Brookfield, 1986). Curricula are organized around objectives and serve as the basis for planning instruction. A program can be judged as successful according to the extent to which these objectives have been attained. Andragogical evaluation of learning is based on the self- diagnosis of progress made toward achieving individual goals with

the assistance of a teacher and fellow students.

Evaluation is usually described as a formative evaluation of what is on-going during the training and a summative evaluation at the end of the training. These two forms of evaluation are usually done by resorting to comments made by students or participants and their responses on a questionnaire (Knowles and Associates, 1984).

Formative evaluation information is for those wanting to improve a program they have developed or are operating (Worthen and Sanders, 1987), or to gain information that will aid in decisions about the modification of the program (Wiley, 1970). Summative evaluation information is used by funders and potential consumers, including program staff, to verify a program's utility (Worthen and Sanders, 1987), and to accomplish goals (Wiley, 1970).

Wiley (1970) argues that there is a third type of evaluation that seems to be discussed very little. It is described as "making summative evaluation studies formative" by making the description of the objects a quantitative characterization of the relevant traits of those objects and then relating the description to the outcome.

Tuckman (1979) argues that in the formative approach to evaluation, results are fed back into the system in order to improve its function and quality. Hence, the purpose of the evaluation is not to judge but to improve or enhance program operations. Such evaluation primarily serves an internal function and is based on comparing program outcomes with program goals. Summative evaluation is the evaluation for demonstration and documentation purposes. Alternative ways to achieve program goals usually are compared on some systematic basis across a variety of outcomes in an effort to choose

among them, to select or reinforce use of the most effective.

Knox argues that educational programs for adults are continually evaluated informally (Knox, 1986). He argues that there are three main reasons for formalizing program evaluation as a part of the program planning process. First, you are more likely to accurately describe influences, performance, and expectations. Second, you are more likely to make sound judgments clearly based on pertinent evidence. Third, you are more likely to use an evaluation process that communicates findings in ways that encourage people associated with the program to use those findings for decision on program planning, improvement, and justification.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

The purpose of this chapter is to describe the procedure used to evaluate the effectiveness of the instructional materials for teaching adult learners. This study's aim is to provide data, draw conclusions, and generate knowledge that may contribute to the development of theories and future research activities. This section explains the research design and methodology used in the study. It describes the principle procedures used for collecting and analyzing the information, and it also includes a list of operational questions as well as the questionnaire.

Design of the Study

Formal schooling of technical specialists may not fulfill their conditions and needs. Non-formal education, or community education, is seen to be the most beneficial. The training program being evaluated in this study was designed primarily to strengthen the capability of a group of technical specialists in order for them to provide effective technical non-formal education programs to adults.

The descriptive survey method, which is sometimes called the normative survey method, was used as the data collection approach for this study. This method can be used to process data collected by the researcher through observation. In the field of education this method

is used for the development of knowledge (Best, 1981).

Three types of instruments were used in this study. First was a cognitive type of test which is concerned with the knowledge and information presented during the training. Second was a self-disclosure type of questionnaire which is self-reporting regarding the educational orientation of the participants. Third, was a reactionnaire or a satisfaction index. The participants were asked to report by themselves their reactions to the instructional program. These three types of data were considered as dependent variables. In addition, background information of the participants was collected and considered as independent variables.

Pre-, Post- and Follow-up Questionnaires

In this study the data were collected at three different times. The first time was prior to the implementation of the training program as a pre-questionnaire. The second time was immediately after the completion of the training program as a post-questionnaire; and the third time was two to three months after the training program as a follow-up questionnaire. Pre- and Post-questionnaires allowed for the monitoring of the actual operations of the training process. Collecting data while the program was in operation help the problem of trying to piece together what went on to be avoided, and minimized the distortions of hindsight.

A follow-up procedure was used a while after the participants had been involved in and completed the training and had a chance to implement the procedures that were taught to them. Data collection during this phase stemmed from an interest in learning about

the long term benefits of the training and the cumulative effects of the application of the ideas presented during the training.

Training Program

Michigan state legislation requires that every pesticide applicator have a license. In order to get a license an applicator must pass a licensing test. This training program, initiated by the Pesticide Education Coordinator of the Michigan Cooperative Extension Service in cooperation with the Michigan Department of Agriculture will facilitate state regulations by providing a vehicle for education to help applicators pass this licensing test. The training program also considers the importance of training the trainers, and does not use tax dollars or government money. It is paid for from operating revenue.

The content of the training program was primarily on pesticides. It also included a session on how technical specialists could become better adult educators. This research focuses on the session related to the enhancement of adult education and not on the entire day of training.

This study used an existing training program. The Pesticide Applicator Trainer Course (PATC) took place at five different locations in the state of Michigan: (1) MSU Kellogg Center, East Lansing. (2) Roma's, Bloomfield Hills. (3) Sheraton, Lansing. (4) Holiday Inn, Kalamazoo, and (5) Holiday Inn, Grayling.

Sampling Procedure

Sampling means selecting a given number of subjects from a defined population as representative of that population (Babbie, 1983; and Borg and Gall, 1983). The advantage of drawing a small sample from a large target population is that it saves the researcher the time and expense of studying the entire population (Babbie, 1983).

Sampling is widely used in research. The two key terms in sampling are population and sample. A population is referred to as the total group and is defined as a collection of elements (people or objects) having one or more characteristics in common. A sample is a part of the population or the process by which a portion of a large group, or population, is selected to be included in the study. In selecting a sample we usually wish to select a part of the population that is representative of the total population.

The potential population for this study was all technical specialists involved with or working in the field of pesticide application. The target population, therefore, was all the participants who registered to attend the Pesticide Applicator Trainer Course (PATC). The study sample was identified using a purposive sampling method. The technical specialists who completed the pre-, post-, and follow-up questionnaires attended one of the first five sessions and were treated as the study sample.

In selecting a sample, there are two major concerns. First, the sample should be representative of the population. If any part of the population has a very low or no chance of being selected for inclusion in the sample, the sample is likely to be biased. Sometimes special provisions are made to insure that groups that make up a very small

fraction of the population are included in the sample. Usually this is accomplished through stratification. The second concern in sampling is precision; that is, the estimates of the characteristics of the population are based on sample results.

There were 433 possible participants who registered and attended the Pesticide Applicator Trainer Course (PATC), and who could have been involved in this study. Of the total participants, 357 completed the pre- and post- questionnaires, and only 102 completed the pre, post and follow-up questionnaires (Table 1).

Table 1. Number of Participants in Attendence and the Study Sample of the Pesticide Applicator Trainer Course (PATC).

Session	# of participants		
	Registered	Pre & Post-q.[a)]	Pre-,Post & F. up-q.[b)]
I	53	46	14
II	116	93	22
III	119	105	39
IV	89	68	21
V	56	45	6
Total	433	357	102

a)Participants who completed the Pre- and Post-questionnaires.
b)Participants who completed the Pre-, Post- and Follow-up questionnaires.

Instrumentation

To collect data for this study, survey questionnaires were designed to accommodate the three types of instruments. The instruments were then organized as Pre-Questionnaire (Appendix B), Post-Questionnaires (Appendix C), and Follow-up Questionnaires (Appendix D). The sources of information used in developing the instruments were: (1) the literature review discussed in Chapter II, (2) the instrument used in the study to measure educational orientation of adult educators as it relates to andragogy by Hadley (1975), (3) input from the researcher's dissertation committee, and (4) the researcher's own personal insight.

The survey instrument covered the following areas:

1. Perceptions of the respondents regarding principles of teaching and learning in adult education.
2. Appraisal by the respondents regarding their andragogical educational orientation.
3. Appraisal by the respondents regarding teaching techniques and instructional tools currently used and perceived to be effective and useful in training programs.
4. Appraisal by the respondents regarding their confidence about training others in the area of pesticide application.
5. Appraisal by the respondents regarding their experiences in the pesticide field.
6. Demographic characteristics of the respondents.

Likert-type scales were used for areas 2 and 5. The scales ranged from 1 to 5 where 1 = Strongly Disagree, and 5 = Strongly Agree.

The Likert-type scales used for area 3 ranged from 1 to 5 where 1 = Not Useful, and 5 = Very Useful.

And the Likert-type scales used for area 4 ranged from 1 to 5 where 1 = Not Confident, and 5 = Very Confident.

Michigan State University's Committee on Research Involving Human Subjects reviewed and approved the questionnaire. This review insured that personal rights would not be violated by using this data collection instrument (Appendix E).

Data Collection

In this study, quantitative and qualitative data were collected. Quantitative data is information which is typically collected by providing a pre-set range of options from which persons choose the most appropriate answer to a particular question. The range of possible responses is predetermined, which allows us to report the number of respondents for each option.

Qualitative data is the information which typically is collected by allowing questions to be answered in a person's own words. The range of possible responses is open-ended and usually requires that the range of verbal responses be listed or summarized.

The open-ended questions require feedback from the training participants and include information about the perceptions of the technical specialists' participation in the instructional program. Using open-ended questions is a method of generating theory from qualitative data in which the researcher progressively codes 'incidents' noted in the data into categories. As each incident is coded, it is compared with previously coded incidents in the same

and different categories. This constant comparison allows the researcher to develop explanations for relationships progressively. The data were analyzed and grouped according to categories. The analysis does not rely on scientific measurement nor emphasize numbers such as test scores. Most do not require a sophisticated mathematical analysis.

The questionnaire was photocopied on to different colored-paper to enhance the professional image and to differentiate between the study locations. Pre- and Post- Questionnaires were handed out prior to and immediately following the conclusion of the training program, during the period of January through March 1991. The Follow-up Questionnaire with a cover letter was mailed in May 1991 and returned in June and July 1991. Questionnaires were identified by the respondents' birth dates and paper color.

The returned questionnaires were carefully reviewed and matched. Three-hundred-fifty-seven questionnaires were matched on the pre and post-questionnaires. The information was coded and entered into a microcomputer data file. On the follow-up questionnaire, out of 433 questionnaires mailed, 117 were returned and only 102 or 29 percent were matched between Pre-, Post- and Follow-up questionnaires.

Data Analysis

The Statistical Package for Social Sciences (SPSS/PC^{+TM}) microcomputer software was used in data analysis. The data from the questionnaires were coded and checked for any errors or

inconsistencies. Variable names and labels were created before data entry. Frequency distributions and descriptive statistics were used to detect coding and data entry errors. Necessary corrections were made in the data file.

The analysis consisted of determining demographic characteristics of the sample survey, response frequencies, percentages, ranges and measures of central tendency, and dispersion.

The cognitive teaching-learning part of the instrument consisted of seven statements/questions that related to teaching and learning knowledge. Each question had three alternative answers which were rated as either true or false. For the purpose of statistical analysis, the correct answer/response was considered as true, and given a score of 1, and the wrong answer was marked as false with a score of 0. Therefore, the maximum possible score was seven and the minimum was zero. The score for each respondent was determined by averaging the numerical values. Based on these scores, descriptive statistics were used to analyze the data.

The educational orientation, teaching techniques, and level of confidence parts of the questionnaire that provided for responses on Likert-type attitudinal scales were analyzed and interpreted at an interval level. The statistical procedure was used with Cronbach's alpha to determine reliability at 0.72, and 0.69 for instruments pertaining to andragogical educational orientation and teaching techniques, respectively.

The andragogical educational orientation part of the questionnaire consisted of twelve statements developed on a five

point Likert-type scale from which the responses as determined in the instrumentation section where chosen.

The teaching techniques part of the instrument consisted of nine items. A procedure was used similar to that of the andragogical educational orientation in terms of a scale of different levels of usefulness. A similar procedure was also used for the level of confidence part of the instrument.

Descriptive statistics were used to analyze the respondents' cognitive teaching-learning knowledge, andragogical educational orientation, teaching techniques, level of confidence and information needed.

Pearson's product moment correlation coefficient was computed to examine the nature and extent of the linear relationships between the continuous demographic characteristics of age, gender, education, experience in the commercial pesticide field, experience as a pesticide applicator, and experience as a pesticide applicator trainee, with respect to the respondent's educational orientation. Similar procedures were utilized to test the relationships between demographic characteristics such as age, gender, education, and experience in teaching people about pesticide application with respect to cognitive teaching-learning knowledge.

T-tests were performed to examine whether respondents differed in their cognitive teaching-learning knowledge scores before and after participating in the training program, and their educational orientation as it relates to gender, degree held, and teaching experience.

One-way analysis of variance and the Scheffe post-hoc procedure

were used to find out the differences in cognitive teaching-learning before participation in the training program, immediately following training, and two to three months after completion of the program.

The alpha 0.05 level of significance was set apriori as the critical value for the analysis. The data were analyzed according to the research questions in order to address the objectives of the study.

Limitations of the Study

This study is limited to the Michigan technical specialists who were involved or worked with pesticide application as educators with or without prior experience. This study assumed some differences between Michigan technical specialists and those operating in other states or other countries. Therefore, precautions must be taken when applying the findings of this study in other settings.

It is not the intent of this study to determine the factors affecting skills and performance of the technical specialists. Knowledge and performance were studied only in relation to andragogical educational orientation. No attempt was made to find out their performance and certification with respect to their personal information.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Evaluation of a program is seen as an investigative enterprise that uses qualitative and quantitative methods, as well as formal and informal procedures, to gather a variety of information about educational enterprises in order to understand then, judge then, and help improve then (Wolf, 1984).

In this chapter, attention is given to the analysis and interpretation of information produced in this study based on the procedures described in Chapter III. This involves both statistical and judgmental considerations. Quantitative and qualitative data/ information were analyzed. The quantitative data includes the ratings of the conceptual understanding of the participants, the rankings of knowledge, and their personal background data. The qualitative information includes the participants' comments about the program, problems anticipated that may be faced, and actual problems faced by the participants when they conducted their own training programs. These data were derived from the three types of instruments, pre-questionnaire, post-questionnaire and follow-up questionnaire. The information in this chapter is organized according to a specific plan.

First, the data were described using frequency distributions for each variable. The means were used for ordinal level analysis. Measurement of the relationships between variables (Livingston and

Abbey, 1982; Alreck and Settle, 1985) were employed. In order to obtain a composite score for each knowledge level, agreement indices were constructed. To calculate the index, each respondent's responses for each statement were added. The distribution of the respondents' scores for each statement were subdivided into 'strong', 'moderate', and 'low' agreement, and the percentages for each of these categories were calculated. Finally, the background information was coded and crosstabulated with other data to find any relevant sub-group differences.

Characteristics of Respondents

The subjects of this study were Michigan technical specialists who were involved or worked with pesticide application and the training of pesticide applicators. Selected demographic information was collected from the subjects to better understand the nature of the population. This section presents information regarding the respondents' ages, sex, education, number of employees in their companies, and the experiences they have had (i) in the commercial pesticide field, (ii) as pesticide applicators, (iii) as pesticide applicator trainers, and (iv) as trainers in other topics.

The following analysis will use two different groups. First, the 'Study Sample' was the group of respondents (102 respondents) who completed all three questionnaire - the pre-questionnaire; post-questionnaire, and the follow-up questionnaire.

Second, the 'Comparison Group' was the group of respondents (357 respondents) who completed the pre-questionnaire and the post-questionnaire, but not the follow-up questionnaire. This group was

used as a basis of comparison to show if the study group was similar or different from others who participated in the training program.

Age: The age of the technical specialists ranged from 26 to 64 years with a mean of 39.2 years and a standard deviation of 8.2 years based on the 'study sample' group of 102 respondents. Comparing this information with the 'comparison group' of 357 respondents showed that the age range of 21 to 77 years with a mean of 38.22 years and standard deviation of 9.05 years, was very similar. This is shown in Table 2.

Table 2. Age of Respondents

Age range	Comparison group		Study Sample	
	N	(%)	N	(%)
Less than 30 years	73	(20.4)	12	(11.8)
31 - 40 years	155	(43.4)	49	(48.0)
41 - 50 years	88	(24.7)	29	(28.4)
51 years and over	41	(11.5)	12	(11.8)
Total	357	(100)	102	(100)
Range	21 - 77		26 - 64	
Mean	38.22		39.20	
Std. Deviation	9.05		8.20	

Table 2 indicates that the proportion of the distribution of ages between the two tests was similar. The majority of the respondents' ages fall between 31 and 50 years. Only 11.8 percent indicated an age of 51 years and older.

Gender: The majority of the technical specialists, 95.1 percent, were men and only 5 percent were women based on the study sample group of 102 respondents. These results were very similar to the comparison group of 357 respondents, as shown in Table 3.

Table 3. Gender of Respondents

Gender	Comparison group		Study sample	
	N	(%)	N	(%)
Men	338	(94.7)	97	(95.1)
Women	19	(5.3)	5	(4.9)
Total	357	(100)	102	(100)

Education: Respondents were asked to indicate their educational level or amount of schooling completed. The comparison between the study sample group and the comparison group is shown in Table 4.

Table 4. Education of Respondents

School completed	Comparison group N	(%)	Study sample N	(%)
High School	155	(43.4)	25	(24.5)
Associate's Degree	73	(20.4)	24	(23.5)
Bachelor's Degree	84	(23.5)	35	(34.3)
Graduate Degree	40	(11.2)	17	(16.7)
Other(undefined)	5	(1.4)	1	(1.0)
Total	357	(100)	102	(100)

As shown in Table 4, regarding the study sample, 24.5 percent completed high school, 23.5 percent completed an Associate's Degree, 34.3 percent, a Bachelor's Degree, and 16.7 percent, a graduate degree. The remaining one percent did not indicate their educational level. These findings were different when the two groups were compared. A larger percent (43.4 percent) of the respondents in the comparison group completed high school only, while the sample survey group had a higher percentage of respondents who completed higher levels of education.

Experience: All of the respondents worked for companies which had from 0 to 7000 employees, with a mean of 177 and a standard deviation of 876. Respondents' experiences in the

commercial pesticide field ranged from 0 to 50 years, with a mean of 12.2 years and a standard deviation of 7.9 years. They had been commercial pesticide applicators for 0 to 32 years, with a mean of 9.1 years and a standard deviation of 6.3 years. Experience as pesticide applicator trainers ranged from 0 to 40 years, with a mean of 6.3 years and a standard deviation of 6.9 years.

The number of pesticide applicator training sessions they had conducted in the past ranged from 0 to 75 with a mean of 7.8 and a standard deviation of 12.5. Experience in conducting training programs covering other topics ranged from 0 to 99 with a mean of 10.3 and a standard deviation of 18.1. When the study sample is compared to the comparison group there are similarities, however the study sample has a little more experience than the comparison group as shown in Table 5.

Table 5. Respondents' Experiences

Experience		Comparison group (n = 357)	Study sample (n = 102)
Work in the commercial pesticide field (yrs)	Range	0 - 50	0 - 50
	Mean	11.4	12.2
	Std.Dev.	7.2	7.9
-As a commercial pesticide applicator(yrs)	Range	0 - 36	0 - 32
	Mean	9.0	9.1
	Std.Dev.	6.3	6.3

Table 5. (cont'd)

-As a pesticide applicator trainer (yrs)	Range	0 - 40	0 - 40
	Mean	5.7	6.3
	Std.Dev.	6.3	6.9
# of pesticide applicator training programs/sessions conducted	Range	0 - 75	0 - 75
	Mean	6.8	7.8
	Std.Dev.	11.4	12.5
# of training programs covering other topics	Range	0 - 99	0 - 99
	Mean	8.5	10.3
	Std.Dev.	15.7	18.1

Andragogical Educational Orientation

The first research question of this study asked about the educational orientations held by the technical specialists. The technical specialists in their current job as pesticide applicators were studied regarding their andragogical educational orientation by using an instrument. The instrument consisted of twelve statements related to education, teaching and learning. Each statement was rated on a five point Likert-type scale ranging from 1 to 5 where 1 = Strongly Disagree and 5 = Strongly Agree. The scores for each respondent were determined by averaging the numerical values. Based on these scores, descriptive statistics were used to analyze the data.

The andragogical educational orientation score of the study sample ranged from 1.42 to 4.67 with a mean of 3.19 and a standard deviation of 0.54. This can be seen in Table 6.

Table 6. Andragogical Orientation Scores of the Respondents.

Level of andragogical orientation score	Range of score	Comparison group		Study-sample	
		N	(%)	N	(%)
Low	< 2.5	27	(7.6)	8	(7.8)
Moderate	2.5 - 3.5	239	(66.9)	69	(67.7)
Strong	> 3.5	91	(25.5)	25	(24.5)
Total		357	(100)	102	(100)
Range	:	1.48 - 4.71		1.42 - 4.67	
Mean	:	3.22		3.19	
Std. Deviation	:	1.22		0.54	

The frequency distribution in Table 6 shows that 7.8 percent of the respondents had an andragogy score of less than 2.5, 67.7 percent had an andragogy score between 2.5 and 3.5, and 24.5 percent had an andragogy score of higher than 3.5 based on the 1 - 5 scale. When the study sample is compared to the comparison group it can be seen in Table 6 that there is little difference. This further supports the idea that the 29 percent response rate is not a severe limitation in this study.

Descriptive statistics of the individual statements referring to andragogical orientation of the study sample are presented in Table 7.

Table 7. Andragogical Item Means of the Study Sample.

Andragogical statements	Mean	St. Dev.
Organization of the content and sequence of learning activities should grow out of learner needs, with their participation. (Item # 2 on the instrument)	3.81	0.88
The best sources of ideas for improving educational programs are the learners. (Item # 3 on the instrument)	3.80	0.93
A teacher's mission is to help each learner learn what he/she decides will aid in achieving his/her personal goals. (Item # 11 on the instrument)	3.75	1.03
Educational objectives should define changes in behavior which the learners desire and the teacher helps them undertake. (Item # 6 on the instrument)	3.55	0.92
Effective learning occurs most often when the learner actively participates in deciding what is to be learned and how. (Item # 1 on the instrument).	3.55	1.06
Planning units of work should be done by learners and teachers together. (Item # 12 on the instrument).	3.51	1.00
A teacher's primary responsibility is helping learners choose and develop their own direction for learning. (Item # 4 on the instrument).	3.22	1.03
The goals that the learners set for themselves, rather than the goals that the teacher sets for the learners, are the basis for effective learning. (Item # 10 on the instrument).	3.08	1.24

Table 7 (cont'd)

Evaluations prepared by the learners are just as effective as those prepared by the teacher. (Item # 9 on the instrument)	2.87	1.09
Learners are quite competent to choose and carry out their own projects for learning. Item # 7 on the instrument).	2.55	0.98
Evaluating his/her achievement should be primarily a responsibility of the learner since he/she has the necessary information. (Item # 5 on the instrument).	2.50	1.04
It is better for learners to create their own learning activities and materials than for the teacher to provide them. (Item # 8 on the instrument)	2.14	0.89

The data in Table 7 indicate that the technical specialists posses a moderate to strong andragogical orientation. The technical specialists indicated a stronger agreement with the statements related to their participation in educational programs. The strongest agreement was on the statement, "Organization of the content and sequence of learning activities should grow out of learner needs, with their participation" with a mean of 3.81 and a standard deviation of 0.88. The second strongest agreement was on "The best source of ideas for improving educational programs are the learners" with a mean of 3.80. Low agreement was on the statement "It is better for learners to create their own learning activities and materials than for the teacher to provide them" with a mean of 2.14 and a standard deviation of 0.89.

Among the twelve statements on andragogical orientation, the technical specialists indicated a strong agreement on six, with a mean

higher than 3.5 on a 1 - 5 scale. Moderate agreement was indicated on five statements with a mean between 2.5 and 3.5. Only one statement, with a mean score below 2.5, was categorized as having low agreement.

Cognitive Knowledge

The second research question of this study attempted to find out the immediate effect of the training on the participants' cognitive knowledge regarding teaching-learning. In this section, attention was directed toward ascertaining the extent to which participants increased and retained their cognitive knowledge derived from participating in the training program.

The technical specialists, in their current jobs as pesticide applicators, were studied regarding their cognitive knowledge by using an instrument that tested for cognitive information. The instrument was included in the pre-, post-, and follow-up questionnaires and consisted of seven statements/questions that related to teaching and learning. Each question had three alternative answers which were rated as either true or false. For the purpose of statistical analysis, the correct answer/response was considered as true and given a score of 1, and the wrong answer was marked as false with a score of 0. Therefore, the maximum possible score was seven and the minimum was zero. The score for each respondent was determined by averaging the numerical values. Based on these scores, descriptive statistics were used to analyze the data.

The pre-, post-, and follow-up scores of the cognitive teaching-

learning test for the study sample are presented in Table 8.

Table 8. Number of Correct Answers on the Cognitive Teaching- Learning Test.

No. of correct answers	Pre N	Pre (%)	Post N	Post (%)	Follow-up N	Follow-up (%)
0	0	(0)	0	(0)	1	(0.9)
1	1	(0.9)	0	(0)	2	(2.0)
2	2	(2.0)	3	(2.9)	1	(0.9)
3	10	(9.8)	6	(5.9)	8	(7.8)
4	31	(30.4)	15	(14.7)	21	(20.6)
5	31	(30.4)	30	(29.4)	30	(29.4)
6	21	(20.6)	34	(33.4)	32	(31.4)
7	6	(5.9)	14	(13.7)	7	(6.9)
Total	102	(100)	102	(100)	102	(100)
Mean	4.73		5.25		4.93	
St. Dev.	1.19		1.22		1.33	

Table 8 shows the results from the three administrations of the cognitive teaching-learning test. The pre-test showed that the score ranged from 1.00 to 7.00, with a mean of 4.73 and a standard deviation of 1.19. The post-test showed a higher score which ranged from 2.00 to 7.00 with a mean of 5.25 and a standard deviation of 1.22. The range of the follow-up test was from 0.00 to 7.00 with a

mean of 4.93 and a standard deviation of 1.33. The results of the t-test showed no significant difference between the means of the pre-, post-, and the follow-up tests.

In terms of the long term effects of the training on the participants, research question # 3, the results of the follow-up questionnaire showed that the mean of 4.93 was lower than the post-questionnaire mean of 5.25 but still higher than the pre-evaluation mean of 4.73. The standard deviation of the follow-up questionnaire was 1.33, which was higher than the pre- and post-questionnaires scores. These data show that cognitive learning occurred between the pre- and post-tests. Though cognitive learning dropped for the follow-up test, the data show that learning was still higher then than after the pre-test.

Cumulative frequencies with the percentage of correct answers are presented in Table 9.

Table 9. Cumulative Number and Percentage of Correct Items on the Cognitive Teaching-Learning Test.

No. of correct answers	Pre Cumulative		Post Cumulative		Follow-up Cumulative	
	N	(%)	N	(%)	N	(%)
7	6	(5.9)	14	(13.7)	7	(6.9)
6	27	(26.5)	48	(47.1)	39	(38.3)
5	58	(56.9)	78	(76.5)	69	(67.7)
4	89	(87.3)	93	(91.2)	90	(88.3)
3	99	(97.1)	99	(97.1)	98	(96.1)
2	101	(99.1)	102	(100)	99	(97.0)

Table 9 (cont'd)

1	102	(100)	0	(0)	101	(99.0)
0	0	(0)	0	(0)	102	(100)
Total	102	(100)	102	(100)	102	(100)

Table 9 shows that the results of the post-test, the cumulative and the percentage of correct items, were higher than the pre-test. For example, 91.2 percent of the respondents obtained four or more correct answers on the post-test while only 87.3 percent obtained four or more correct answers on the pre-test. The same results were obtained for five, six and seven correct answers. Although the results of the follow-up test were lower than the results of the post-test they were still higher than the results of the pre-test, except for the first three correct items. This mean that more correct answers were given by the respondents after participation in the training program.

Descriptive statistics for the individual statements on the Cognitive Teaching-Learning Test for the study sample are presented in Table 10.

Table 10. Percentage Correct for Each Item on the Cognitive Teaching-Learning Test.

Teaching-learning statement stem and correct ending	% of subjects getting item correct		
	Pre	Post	Follow-up
	%		
1. Most often the adult learner/ trainee wants to learn: c: information to solve his/her problems	42	70	63
2. It is important to know what the learner/trainee: a: already knows	79	79	79
3. At the beginning of a training session try and: b: provide an overview of what will be covered	63	86	77
4. It is best to teach the employee: c: a full understanding of the topic	85	64	63
5. We can learn: a: from the learner/trainee	35	59	45
6. Teaching strategies: c: can best be used in combinations	95	96	94
7. A well trained employee: a: represents your company in a variety of ways	73	72	72

The data in Table 10 indicate the percentage of the study sample that got each test item correct. The greatest number of technical specialists selected the correct answer on "Teaching strategies can best be used in combination" on the pre-, post-, and

follow-up tests as represented by 95, 96 and 94 percent, respectively. The second greatest number of respondents selected correct answers on "It's important to know what the learner/trainee already knows", with 79 percent getting that item correct on all three tests. Although the statement, "It's best to teach the employee a full understanding of the topics", received the second greatest percentage of correct answers on the pre-test, it showed a large decrease on the post- and follow-up tests. The item with the lowest number of respondents indicating the correct answer was "We can learn from the learner/trainee", with only 35, 59 and 45 percent correct for the pre-, post-, and follow-up tests, respectively.

The effect of the training on the participants' teaching-learning knowledge can be seen by taking the items with 50 percent and higher correct answers. Among the seven items, five items were higher than 50 percent on the pre-test, all seven items were higher than 50 percent on the post-test, and six items scored higher than 50 percent on the follow-up test. In other words, two items from the pre-test, none from post-test and one from the follow-up test fell below the 50 percent correct answer mark. Therefore, the participants performed better in teaching-learning knowledge on the post- and follow-up tests, than on the pre-test.

Some items which showed an increase in the percentage of correct answers on the three tests were considered as having a positive effect. It was found that three items showed a positive effect (items 1, 3, and 5). Another three items remained the same (items 2, 6, and 7), and only one item (# 4) showed a negative effect.

Since the three statements on the cognitive teaching-learning

test showed a positive effect in relation to the respondents' teaching-learning scores, items 1, 3, and 5, a correlation analysis was done to examine the relationships between demographic characteristics and the cognitive teaching-learning scores. The results show that there were no significant linear relationships between any demographic characteristics and the three
selected cognitive teaching-learning statements, as shown in Appendix F.

Teaching Techniques

Research question # 4 was concerned with the usefulness of the different teaching techniques that are used for training. An instrument was developed and was included in the pre-, post-, and follow-up questionnaires, to asses the study samples' reactions to nine different teaching techniques. Each technique was rated on a five point Likert-type scale ranging from 1 to 5 where 1 = Not Useful and 5 = Very Useful. The score for each respondent was determined by averaging the numerical values. Based on these scores, descriptive statistics were used to analyze the data.

The scores on teaching techniques from the three-questionnaires given to the study sample are shown in Table 11.

Table 11. The Usefulness of Different Teaching Techniques for Training Pesticide Applicators.

Level of usefulness (score)	Range of (score)	Pre N	Pre %	Post N	Post %	Follow-up N	Follow-up %
Low	< 2.5	0	(0.0)	2	(2.0)	2	(2.0)
Moderate	2.5 - 3.5	26	(25.5)	30	(29.4)	38	(37.3)
Strong	> 3.5	76	(74.5)	70	(68.6)	62	(60.7)
Total		102	(100)	102	(100)	102	(100)
Range		2.56 - 5.00		2.33 - 4.78		2.33 - 5.00	
Mean		3.78		3.67		3.59	
Std. Deviation		0.48		0.44		0.49	

Table 11 shows that the scores on the pre-questionnaire ranged from 2.56 to 5.00 with a mean of 3.78 and a standard deviation of 0.48. The frequency distribution shows that none of the teaching techniques had a score of less than 2.5, 25.5 percent had a score between 2.5 and 3.5, and 75.5 percent had a score higher than 3.5 based on a 1 - 5 scale.

On the post-questionnaire, the scores ranged from 2.33 to 4.78 with a mean of 3.67 and a standard deviation of 0.44. The frequency distribution shows that 2.0 percent of the teaching techniques had a score below 2.5, 29.4 percent had a score between 2.5 and 3,5, and 68.6 percent had a score higher than 3.5 based on a 1 - 5 scale.

On the follow-up questionnaire, the scores ranged from 2.33 to 5.00 with a mean of 3.59 and a standard deviation of 0.49. This

frequency distribution shows that 2.0 percent of the teaching techniques had a score of less than 2.5, 37.3 percent had a score between 2.5 and 3.5, and 60.7 percent had a score higher than 3.5 based on a 1 - 5 scale. This means that the participants valued the items regarding teaching techniques as useful. The usefulness of the teaching techniques was further analyzed on an individual basis.

The mean and standard deviations of the individual teaching techniques for the pre-, post-, and follow-up instrument are presented in Table 12.

Table 12. The Usefulness of the Individual Teaching Techniques for Training Pesticide Applicators.

Teaching techniques	Pre		Post		Follow-up	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Extremely Useful						
Demonstration	4.54	0.71	4.67	0.57	4.45	0.68
Very Useful						
Group Discussion	4.03	0.90	3.99	0,81	3.85	0.86
Field Trip	3.99	1.01	3.97	0.94	3.98	0.96
Useful						
Exhibit	3.75	0.85	3.70	0.88	3.65	0.90
Role Playing	3.62	1.24	3.63	1.00	3.53	1.12
Case Study	3.60	0.93	3.70	0.76	3.50	0.92
Note Taking Guide	3.55	0.92	3.25	0.91	3.26	0.88
Lecture	3.51	0.92	3.34	0.85	3.15	0.83

Table 12. (cont'd)

Somewhat Useful						
Newsletters	3.46	0.84	2.81	1.03	2.96	0.99

Table 12 shows that the individual teaching techniques scores can be grouped into four categories: Extremely Useful, Very Useful, Useful, and Somewhat Useful. First, the "demonstration" technique possessed the highest mean scores of 4.54, 4.67 and 4.45 for the pre-, post- and follow-up tests, respectively. Therefore, it was considered as an extremely useful technique. The second highest ranked techniques consisted of "group discussion" and "field trip". Group discussion had a mean score of 4.03 for the pre-test and 3.99 for the post-test. On the follow-up test, however, "field trip" had a higher mean. The third category of teaching technique included "exhibit, role playing, case study, note taking guide and lecture" with means ranging from 3.51 to 3.75 for the pre-test, 3.34 to 3.70 for the post-test, and 3.15 to 3.65 for the follow-up test, respectively. The somewhat useful teaching technique, or the fourth category, was "newsletter" with means of 3.46, 2.81, and 2.96 for the pre-, post-, and follow-up questionnaires, respectively. Its standard deviations were 0.84, 1.03, and 0.99 for the pre-, post-, and follow-up questionnaires, respectively.

There was only one teaching technique which scored below 3.50 on the pre-questionnaire, three on the post- and three on the follow-up questionnaire, respectively. The mean scores of most of the items

decreased from pre-questionnaire to post-questionnaire, and from post-questionnaire to follow-up questionnaire.

Personal Characteristics as Related to Educational Orientation and The Cognitive Teaching-Learning Test.

The fifth research question of this study attempted to find out the relationship between the technical specialists' personal characteristics with respect to their andragogical educational orientation and their cognitive teaching-learning scores.

The Pearson correlation coefficient was computed to measure the linear relationships between the demographic variables of age, gender, level of schooling completed, number of employees in their companies, years of experience in the commercial pesticide field, years as a commercial pesticide applicator, years as a pesticide applicator trainer, number of training programs conducted about pesticide application, number of training programs conducted about other topics, and confidence in training others. Some characteristics of the Pearson correlation coefficient (Norusis, 1988) are: (i) If there is no linear relationship between two variables, the value of the coefficient is 0.

(ii) If there is a perfect positive linear relationship, the value is + 1.

(iii) If there is a perfect negative linear relationship, the value is - 1.

The values of the coefficient can range from - 1 to + 1.

The strength of an association between two variables was determined on the basis of the descriptors proposed by Rowntree

(1981). The kinds of descriptors of the correlation coefficient (whether positive or negative) are as follows:

(i). 0.0 to 0.2 is described as Very weak, negligible.

(ii). 0.2 to 0.4 is described as Weak, having a low association.

(iii). 0.4 to 0.7 is described as having Moderate association.

(iv). 0.7 to 0.9 is described as Strong, having high or marked association.

(v). 0.9 to 1.0 is described as Very Strong, having a very high association.

The results of the analysis are shown in Table 13.

Table 13. Pearson Correlation Coefficients for Demographic Characteristics with respect to Educational Orientation and Cognitive Teaching-Learning Scores.

Characteristics	Correlation Coefficient (r) Educational Orientation	Cognitive Teaching Learning scores Pre	Post	F.Up
Age	.03	.05	- .15	- .04
Gender	.11	.05	- .01	- .02
Level of schooling completed	.16	.10	.17	.13
No. of employees in their companies	.14	.03	- .02	.06
Experience in pesticide field	- .07	- .04	- .12	- .06
- as pesticide applicator	- .04	- .20	- .18	- .19
- as pesticide trainer	- .04	- .21	- .16	- .10
No. of training prog re: pest. appl.	.03	- .03	- .01	- .02
No. of training about other topics	.01	.15	.05	.08
Confident about training others	- .05	.02	- .09	- .03

Table 13 shows no viable linear relationships between demographic characteristics and educational orientation, or between demographic characteristics and cognitive teaching-learning scores. The correlation coefficients fall between the low and negligible association ranges.

T-tests were used in order to see if the technical specialists had different educational orientations in relation to their personal characteristics of gender and education, and to the "extreme values" of age, number of employees in their companies, years of work in the commercial pesticide field, years of work as pesticide applicators, and number of training programs conducted to teach people about pesticide application. The "extreme value" was measured by calculating the mean and standard deviation scores of each variable based on the normal distribution. On the positive value side, the mean was added to one standard deviation and considered as extremely high. A similar procedure was calculated on negative value side where the mean was subtracted from one standard deviation and considered as an extremely low value.

The findings are presented in Table 14.

Table 14. T-tests Comparing Demographic Characteristics with Educational Orientation Scores

Characteristics/group		Ed. Orientation score	t-value	Prob.
Age	31-y or less(15)	3.13	- 0.40	0.69
	47-y or higher(16)	3.20		
Gender	Male (97)	3.18	- 1.19	0.29
	Female (5)	3.45		

Table 14. (cont'd)

Graduate Degree	Yes(17)	3.44	- 1.98	0.06
	No(85)	3.15		
No. of employees in their companies	177 or less(89)	3.15	- 1.48	0.29
	1050 or higher(3)	3.71		
Yrs. work in commercial pesticide field	4 or less(14)	3.08	- 0.23	0.82
	20 or higher(19)	3.12		
Yrs. as commercial pesticide applicator	3 or lees (14)	3.11	0.64	0.53
	15 or higher(15)	2.90		
No. of training conducted to teach pest.appl.	1 or less (18)	3.08	- 0.04	0.97
	10 or higher(34)	3.09		

Figures in parentheses indicate the number of cases of each group

Table 14 shows that no significant differences were found between personal characteristics and educational orientation. The technical specialists, whether young or old, male or female, holding graduate degrees or not, having large numbers of employees in their companies or not, having more or less experience in the commercial pesticide field, more or less experience as commercial pesticide applicators, or having conducted large numbers of training programs about pesticide application or not, did not hold different perceptions in terms of andragogical educational orientation.

Similar t-tests were also conducted to see if the technical specialists had different cognitive teaching-learning scores in relation to their personal characteristics of gender, and level of schooling

completed, and to their extreme values of age, number of employees in their companies, years of work in the commercial pesticide field, years of work as commercial pesticide applicators, and number of training programs conducted to teach people about pesticide application. Unlike the educational orientation scores which were collected only once, the cognitive scores were assessed on three occasions: pre-, post-, and follow-up. T-tests for all administrations are shown in Table 15.

Table 15. T-tests Comparing Demographic Characteristics with Cognitive Teaching-Learning Scores.

Characteristics/group		Cognitive Teaching-Learning score	t-value	Prob.
Age	31-y or less(15)	0.65		
	(pre-ev.)		- 0.95	0.35
	47-y or older(16)	0.71		
	31-y or less(15)	0.76		
	(post-ev.)		0.78	0.44
	47-y or older(16)	0.71		
	31-y or less(15)	0.68		
	(f.-up-ev.)		- 0.59	0.55
	47-y or older(16)	0.71		
Gender	Male(97)	0.67		
	(pre-ev.)		- 0.45	0.68
	Female(5)	0.71		
	Male(97)	0.75		
	(post-ev.)		0.15	0.89
	Female(5)	0.74		
	Male(97)	0.71		
	(f.-up ev.)		0.35	0.74
	Female(5)	0.69		

Table 15. (cont'd)

Graduate Degree	Yes(17)	0.69		
	(pre-ev.)		- 0.30	0.77
	No(85)	0.67		
	Yes(17)	0.84		
	(post-ev.)		- 2.88	0.01*
	No(85)	0.73		
	Yes(17)	0.73		
	(f.-up ev.)		- 0.73	0.47
	No(85)	0.70		
No. of employees in their companies	177 or less(89)	0.67		
	(pre-ev.)		one or more samples had no variance	
	1050 or higher(2)	0.71		
	177 or less(79)	0.74		
	(post-ev.)		had no variance	
	1050 or higher(2)	0.71		
	177 or less(89)	0.70		
	(f.-up-ev.)		- 0.61	0.54
	1050 or higher(2)	0.79		
Yrs. work in commercial pesticide field	4 or less(14)	0.73		
	(pre-ev.)		- 1.01	0.30
	20 or higher(19)	0.68		
	4 or less(14)	0.77		
	(post-ev.)		0.68	0.50
	20 or higher(19)	0.73		
	4 or less(14)	0.76		
	(f.-up-ev.)		1.15	0.25
	20 or higher(19)	0.69		
Yrs. as commercial pesticide applicator	4 or less(14)	0.73		
	(pre-ev.)		1.91	0.06
	20 or higher(19)	0.62		
	4 or less(14)	0.77		
	(pos-ev.)		0.98	0.33
	20 or higher(19)	0.71		

Table 15. (cont'd)

	4 or less(14)	0.73		
	(f.-up ev.)		1.97	0.06
	20 or higher(19)	0.59		
No. of training conducted to teach people about pest appl.	1 or less (18) (pre-ev.)	0.74	- 1.17	0.26
	13 or higher(11)	0.66		
	1 or less (18)	0.75		
	(post-ev.)		0.36	0.70
	13 or higher(11)	0.72		
	1 or less (18)	0.76		
	(pre-ev.)		1.50	0.14
	13 or higher(11)	0.65		

Figures in parentheses indicate the number of cases in each group
* Significantly different at 5% level.

Table 15 shows that technical specialists with graduate degrees received different cognitive teaching-learning scores than non-graduate degree holders on the post-questionnaire. The results showed that the significant difference level measuring greater than the 0.05 level was observed among the technical specialists with different educational levels with respect to their cognitive teaching-learning scores.

On the other hand, no significant differences were found between other personal characteristics and cognitive teaching-learning skills. In other words, technical specialists, whether young or old, male or female, having large a lot numbers of employees in their companies or not, having more or less experience in the

commercial pesticide field and as commercial pesticide applicators, or having much teaching experience or not, did not perform differently in terms of their cognitive teaching-learning skills.

Based on the findings in Table 15, the Cognitive Teaching-Learning scores received by the technical specialists were further studied with respect to their education levels. Further analysis was conducted due to the significant findings regarding graduate degrees. The mean scores of the cognitive teaching-learning test on the post-questionnaire are presented in Table 16.

Table 16 . Analysis of Variance of the Cognitive Teaching-Learning Scores on the Post-test when Considering the Respondent's Education.

Source	DF	Sum of square	Mean square	F Ratio	F Prob.
Between Groups	4	.2964	.0741	2.6118	.0400
Within Group	97	2.7520	.0284		
Total	101	3.0484			

Multiple Range Tests: Scheffe Procedure

Group	School completed	Mean	Group 1	2	3	4	5
1	High School	.7600					
2	Associate's Degree	.6726					
3	Bachelor's Degree	.7510					
4	Graduate Degree	.8403		*			
5	Others (undefined)+	.8571					

* Denotes pairs of groups significantly different at the .05 level.

+ One percent of the respondents did not indicate their education level.

Table 16 shows that graduate degree holders had the highest teaching and learning scores followed by high school graduate, bachelor degree holders, and associate degree holders, respectively.

One-way analysis of variance was conducted using the Scheffe Multiple-Range test to examine the differences in the cognitive teaching-learning scores in terms of the technical specialists' education levels. The results show that a significant difference at the greater than 0.05 level was observed between those holding a graduate degree and those with associate degrees. Although "others (undefined)" had the highest mean educational levels, this group only included one percent of the respondents, and therefore was not significantly different from the teaching-learning scores of the other degree holding respondents.

A similar procedure was followed to test for differences between the teaching-learning scores on the pre- and follow-up tests with respect to the technical specialists' educational levels. The results of the Scheffe procedure, however, showed no significant difference when comparing the teaching-learning scores of the technical specialists to the different levels of education on the pre- and follow-up tests.

The Effect of Participation on the Respondents' Confidence

The sixth research question was concerned with the effect of participation in the instructional program on the participants' confidence.

The technical specialists were surveyed regarding their levels of confidence toward training others by using an instrument. A five-

point Likert-type scale on confidence levels related to training others was used. The technical specialists were asked to indicate the extent to which they were confident by circling a response which varied from "very confident" to "not confident". A numerical score of 5 to 1 was assigned to each response with "5" being Very Confident and "1" being Not Confident.

Descriptive statistics for each confidence level were computed. The mean and standard deviation values are presented in Table 17.

Table 17. Respondents' Levels of Confidence about the Training of Others

Confidence	Pre		Post		Follow-up	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Confident about training others	4.34	0.75	4.34	0.65	4.29	0.70

Findings in Table 17 show that technical specialists were very confident about the teaching of others. The mean and standard deviations were 4.34 and 0.75 on the pre-questionnaire, 4.34 and 0.65 on the post-questionnaire, and 4.29 and 0.70 on the follow-up questionnaire, respectively.

T-tests were also used to find out if the mean scores of the technical specialists' confidence levels were significantly different between the pre- to follow-up tests and between the post- to follow-up tests. Results of the tests show that no significant differences were found. Though the follow-up questionnaire mean scores appear lower,

there was no significant difference between them and the post-questionnaire scores. The technical specialists' confidence levels were the same on all three administrations of the instruments.

The distribution of the technical specialists' confidence scores, when grouped in three categories, is presented in Table 18.

Table 18. Distribution of the Technical Specialists' Confidence Scores.

Levels of Confidence	Range of Score	Pre N	Pre (%)	Post N	Post (%)	Follow-up N	Follow-up (%)
Low	< 2.5	0	(0.0)	1	(0.1)	1	(0.1)
Moderate	2.5-3.5	21	(20.6)	32	(31.4)	46	(45.1)
Strong	> 3.5	81	(79.4)	69	(67.6)	55	(53.9)
Total		102	(100)	102	(100)	102	(100)

Table 18 shows that the level of confidence of the technical specialists ranged primarily from moderate to strong. Although the number of respondents in the 'strong group' decreased from pre- to post- and to follow-up time, the percentage of the technical specialists who had strong confidence level was high. The percentage of the technical specialists who fell into the 'moderate group' increased from 20.6 percent on the pre-questionnaire to 31.4 percent on the post-questionnaire and 45.1 on the follow-up questionnaire.

In terms of information needed to improve confidence as a

trainer of others, descriptive analysis of the mean and standard deviation was used and presented in Table 19.

Table 19. Information Needed to Improve Confidence as a Trainer of Others

Information needed	Pre		Post		Follow-up	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Information needed about pesticide application	3.84	0.94	3.56	1.07	3.45	0.96
Information needed about people be taught	3.57	1.00	3.75	0.85	3.34	0.94
Information needed about adult teaching techniques	4.19	0.85	3.92	0.92	3.68	0.97

Findings in Table 19 show that the technical specialists, before participation in the instructional program, needed more information than immediately following the program, or at a period of time after the conclusion of the program. The most desired information was regarding adult teaching techniques with a mean score of 4.19 and a standard deviation of 0.85, followed by pesticide application information with a mean of 3.84 and a standard deviation of 0.94, and then by the people to be taught with a mean score of 3.57 and a standard deviation of 1.0. Less information was needed after participation in the instructional program as indicated by the decreased mean scores on the post- and the follow-up questionnaires. The mean scores regarding information needed about adult teaching

techniques decreased to 3.92 and 3.68 on the post- and follow-up questionnaires, respectively. Similar results occurred regarding the information needed about pesticide application. The mean scores regarding information needed about people to be taught increased from 3.57 on the pre-questionnaire to 3.75 on the post-questionnaire, and then decreased to 3.34 on the follow-up questionnaire.

T-tests were used in order to see if the mean scores of the information needed on pre-, post- and follow-up tests about pesticide application, about people, and about adult teaching techniques influenced the confidence levels of teaching others. Findings of the tests are presented in Table 20.

Table 20. T-test Analyzing the Information Needed to Improve Confidence as a Trainer of Others

Item	Tests	Information needed score	t-value	Prob.
Information needed about pesticide application	Pre	3.84		
			2.65	0.009*
	Post	3.56		
			0.93	0.353
	F.-up	3.45		
			4.19	0.000*
	Pre	3.84		
Information needed about people to be taught	Pre	3.57		
			- 1.67	0.098
	Post	3.75		
			3.63	0.000*
	F.-up	3.34		
			1.96	0.052
	Pre	3.57		

Table 20. (cont'd)

Information needed about adult teaching techniques	Pre	4.19	3.26	0.002*
	Post	3.92	2.58	0.011*
	F.-up	3.68	5.30	0.000*
	Pre	4.19		

* Significantly different at 0.05 level

Table 20 shows that information needed about adult teaching techniques between all three administrations of the questionnaire, pre- to post-, post- to follow-up, and pre- to follow-up, were significantly different. In other words, the technical specialists felt they needed less information about adult teaching techniques after participation in the instructional program, as indicated by the decreasing mean scores. This result was the very good of the training program.

The mean scores regarding the information needed about pesticide application between the pre- to post- and pre- to follow-up tests were also significantly different. Similar results occurred with the information needed about people to be taught between the post- to follow-up test.

Feedback from the Participants on the Instructional Program

In addition to the main data collected through various procedures such as testing for cognitive teaching-learning knowledge, andragogical educational orientation, teaching techniques, confidence, and self-reporting by completing a self-disclosure type of test, subjective feedback on the training was also collected. Participants were asked about their impressions, observations and personal judgments as to whether the training program they had attended was interesting and useful for them. This section discusses primarily the open-ended feedback provided by the pre-, post-, and follow-up questionnaires.

The open-ended questions include information about the perceptions of the technical specialists' participation in the instructional program.

The open ended information collected in this study consisted of:

1. Types of training the participants have previously had about pesticide application. This question was in section III-10 of the pre-questionnaire.
2. Respondents' comments about the instructional program attended including: (i) The weak points of the program.
   (ii) The strong points of the program.
   (iii) Improvements that could be made in the future.
   (iv) Respondents' reactions toward the program.

   These questions were on the post- and follow-up-questionnaires under sections I-1, I-2, I-3 and I-4a, 4b, 4c and 4d of the

instruments, respectively.

3. Problems that the respondents expected to have, and that were found when conducting their own programs. These questions were in section III-3 on the post-questionnaire and section III-2 on the follow-up questionnaire.
4. In terms of training materials used for conducting their own training programs, the technical specialists were asked to report the area(s) that were most difficult for their trainees to learn. These questions were in section III-6 of the follow-up questionnaire.
5. General comments from the respondents.

The information from the questionnaire was enumerated and tabulated.

Previous Training Attended.

As an educator, it is important to know the participants' backgrounds regarding previous related technical training programs they had attended. Types of training previously attended by the participants is presented in Table 21.

Table 21. Previous Related Training Attended[a)]

Types of training	Respondents indicating each type of training[b)] (%)
1. Seminar/workshop	75.5
2. Self-study/field experience	50.0

Table 21. (cont'd)

3. On the job training	43.1
4. MPCA (Michigan Pest Control Assoc.)	30.4
5. Turf conference	12.7
6. MSU (IPM, Entomology)	9.8
7. None	2.9

a)Derived from Appendix G.
b)Respondents gave more than one answer.

Table 21 shows that seminars/workshops were the most frequently attended programs by the participants. Out of a total of 102 respondents, 77 responses or 75.5 percent indicated that they had attended seminars or workshops related to pesticides. Self-study or field experience rated second at 50.0 percent, and on the job 76 training was ranked third at 43.1 percent. Only 2.9 percent of the respondents indicated no previous training experience.

Respondents' Comments about the Instructional Program

At the end of the program, the participants were asked to give their comments or reactions about their participation in the instructional program. Participants' reactions toward the program were divided into three categories and four sub-categories. The three categories were: (1) Reactions related to Learners and/or Teaching. (2) Reactions related to the Content of the program, and (3) Reactions related to the Administration of the Program. The four sub-

categories were: (a) the weak points of the instructional program, (b) the strong points of the instructional program, (c) how the instructional program could be improved, and (d) the problems faced when conducting an instructional program. The results of the tabulated information of the "weak" and "strong" points are presented in Table 22.

Table 22. The Weak and Strong Points of the Program

Reactions	Respondents indicating each statement (%)	
	Weak	Strong
1. Reactions related to learners/teaching		
Adult teaching techniques	5.9	28.4
Focus on training the trainers	-	7.8
Getting learners interested	-	2.9
Group interaction	-	4.9
Good speakers, informative, knowledgeable	-	13.7
2. Reactions related to Content		
Training manuals/materials	1.9	6.8
Time for questions & answers	2.9	1.9
Explanation of regulations	4.9	12.7
Same materials for different fields	3.9	-
3. Reactions related to program administration		
Set-up training	2.9	3.9
Program implementation	2.9	12.7
Initial organization	1.9	-

Table 22. (cont'd)

Paper work to MDA	1.9	-
Program too long	13.7	-
Groups too large	10.8	-
Too much information	1.9	-

Table 22 shows that the participants' reactions on the three categories varied between items. By looking at the responses of 10 percent and above under the category related to learners and teaching, adult teaching techniques, and good and informative speakers were the two strong points/items represented by 28 and 13.7 percent, respectively. There was no weak point observed in this category. Regarding respondents' reactions related to program content, 12 percent reported that the strong point was the explanation of regulations. In terms of the reactions related to program administration, two items were weak. Thirteen-point-four percent reported that the program was too long, and 10.9 percent said the groups were too large. Only one strong item was reported on program implementation receiving 12.0 percent.

Participants' reactions toward how the program could be improved in the future is presented in Table 23.

Table 23. Participants' Reactions Toward Program Improvement in the Future.

Reactions	Respondents indicating each statement (%)	
	Post	Follow-up
1. Reactions related to learners/teaching		
Concentrate on how to teach adult	6.8	1.9
Focus on training the trainers	3.9	1.9
Concentrate on teaching aid	2.9	-
Specific group interaction	11.8	8.8
Update learners with new information	1.9	3.9
2. Reactions related to Content		
Training manuals/materials	1.9	3.9
Time for questions & answers	8.8	-
Explanation on regulation	3.9	2.9
Different materials for different fields	2.9	3.9
3. Reactions related to program administration		
Set-up training	4.9	3.9
Initial organization	1.9	1.9
Shorten the program	7.8	5.8
Make the group smaller	9.8	5.8
More locations	2.9	-
Set-up programs for each business	3.9	-
Have annual seminars related to the field	3.9	-

The data in Table 24 indicate that by taking the responses of 10 percent and above under the learner and teaching category, one item was observed as needing improvement in the future. Specific group interaction was suggested by 11.8 percent of the respondents on the post-questionnaire, and by 8.8 percent on the follow-up questionnaire. Although there were no responses of 10 percent given the categories related to program content and program administration, some items were reported consistently on the post- and follow-up questionnaires that need to be improved in the future. Some improvements were training materials, explanation of regulations and different materials for different fields under the category related to program content. Set-up training/initial organization, shortening the program, and making the groups smaller were the respondents' reactions related to program administration improvements.

Problems that the respondents expected to have and that were found when conducting their own programs are presented in Table 24.

Table 24. Problems Expected and Faced by the Respondents when Conducting their Own Programs.

Problems	Respondents indicating each statement (%)	
	Expected	Actual
1. Problems related to learners/teaching		
Maintain motivation	17.6	1.9
Focus on training the trainers	7.8	-
Coming in contact with slow learners	2.9	1.9

Table 24. (cont'd)

Getting learners interest	1.9	0.01
Seasonal employee	-	1.9
How to fit into employee workday	2.9	-
Different knowledge levels	1.9	1.9
2. Problems related to Content		
Training manuals/materials	-	4.9
Time for questions & answers	2.9	0.01
Explanation on regulation	-	3.9
Setting up agendas	6.8	-
Learning large amounts of material	4.9	2.9
3. Problems related to program administration		
Set-up training	2.9	1.9
Initial organization	8.8	-
Paper work to MDA	1.9	-
More locations	8.8	-
# of participants available	2.9	-
Employee turnover	1.9	1.9
Set-up program for each business	-	1.9

The data in Table 24 indicate that, generally, the technical specialists expected more problems before conducting their own training programs. In other words, they expected more of problems than they actually faced. Among six items or problems expected

related to learners and teaching, two of them no longer existed. On the other hand, "seasonal employee" was an unexpected problem that was faced when they conducted their own training programs.

There were three expected problems related to program content, and four problems found when conducting their own programs. Among those encountered problems, two of them were unexpected and one expected problem no longer existed as an actual problem. There were a number of problems related to program administration. Among six expected problems, two of them were actual problems. One actual problem was not expected.

These results indicate that more problems were encountered dealing with learners and teaching, than with content and program administration. As a result, the mean score of the actual training program conducted (1.93) was lower than the mean of the anticipated training program, at 3.36.

Respondents were asked on the post-questionnaire and the follow-up questionnaire their reactions toward their participation in the program. Four statements were rated on a five point Likert-type scale ranging from 1 to 5 where 1 = strongly disagree and 5 = strongly agree. The score of each response was determined by averaging the numerical values. The four statements that were reacted to were: (a) the usefulness of the presentation, (b) the clarity of the presentation, (c) the location, and (d) the worthiness of the time invested. A summary of the means and standard deviations is presented in Table 25.

Table 25. Participants' Reactions Toward the Training Program.

Reactions	Post		Follow-up	
	Mean	S. D	Mean	S. D
Usefulness of presentation	4.06	0.97	3.59	0.86
Clarity of presentation	3.81	0.83	3.68	0.90
Convenience of location	4.00	1.11	3.92	1.02
Worth the time invested	3.86	1.08	3.43	1.16

The results in Table 25 show the respondents' positive attitudes toward the program as indicated by the high scores given to each item. On the post-questionnaire, the mean and standard deviation of presentations during the training program were 4.06 and 0.97, respectively. The results of the follow-up questionnaire showed a decrease in the mean to 3.59 and the standard deviation to 0.86 on presentations during the training program. Similar results were observed on the clarity of presentation, given a mean of 3.81 on the post-questionnaire decreasing to 3.68 on the follow-up questionnaire; convenience of location, a mean of 4.00 on the post-questionnaire decreased to 3.92 on the follow-up, and worthiness of time invested dropped from a mean of 3.86 on the post-questionnaire to 3.43 on the follow-up.

The follow-up questionnaire asked the respondents to select the areas which they felt were the most difficult for their trainees to learn. These data are shown in Table 26.

Table 26. The Most Difficult Area(s) for the Respondents' Trainees to Learn[a)]

Areas	Respondents indicating each type of area[b)] (%)
Pesticide Laws & Regulations	68.6
Pest Identification	43.1
Pesticides & Human health	25.5
Pesticides & the Environment.	24.5
Pest & Pesticide Management	17.6
Pesticides	15.6
Pesticide Labels	14.7
Pesticide Handling, Storage & Disposal	7.8
Pesticide Application Equipment	7.8

a)Derived from Appendix H.

b)Respondents gave more than one answer.

Table 26 shows that pesticide laws and regulations was seen as the most difficult area for the respondents' trainees to learn, as reported by 68.6 percent, followed by pesticide identification at 43.1 percent, pesticides and human health at 25.5 percent, and pesticides and the environment at 24.5 percent. Pest and Pesticide management, pesticides, and pesticide labels were reported as being moderately difficult at 17.6, 15.6 and 14.7 percent, respectively. And pesticide handling, storage & disposal, and pesticide application

equipment were considered the least difficult at 7.8 percent.

Another open-ended type of question was the general comments made by the respondents. A total of 44 comments were made. The information was tabulated and summarized into three categories: First, information related to teaching adults and/or learners (18.2 percent). Second, information related to program content (36.4 percent). And third, information related to program administration (31.9 percent), based on the total responses. There were 13.6 percent related to a combination of all three categories. This summary was derived from Appendix I. Of the 44 comments, 75.0 percent were categorized as positive comments, 15.9 percent as neutral, and 9.1 percent were categorized as negative comments.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents three sections: First, an overview of the research questions, procedures and results of the study. Second, a discussion of the major conclusions that were reached, and third, a number of recommendations that were formulated based on the findings and conclusions. Recommendations for future research are included in this section.

Summary

The primary purpose of this study was to validate a set of instructional materials designed to enhance the adult educator competencies of a group of technical specialists. This study deals with the evaluation of the instructional materials. Its intention is to find out the impact of the participation of the learners in the instructional program and how the learners changed or benefitted. More specifically, this study is organized in a set of six interrelated research questions.

The research questions that this study attempts to answer are:

1. What educational orientations do the training participants (technical specialists) hold?
2. Does participation in the instructional program have an immediate effect on the participants in terms of an increase in their cognitive

knowledge? (Achievement)

3. Does participation in the instructional program have a long term effect on the participants in terms of retaining the cognitive knowledge they derived from the instructional program? (Retention)

4. Which teaching techniques are perceived by the participants as useful? How is their perception affected by participation in the instructional program?

5. Is there a relationship between personal characteristics with respect to the andragogical educational orientation and cognitive teaching-learning knowledge of the participants before and after training?

6. Does participation in the instructional program have an effect on the participants' confidence and the information needed.

The target population for this study was the technical specialists who registered to attend the PATC during one of the first five sessions. A total of 357 technical specialists were identified from the pre- and post-questionnaire and 102 technical specialists were identified from the pre-, post- and follow-up questionnaires. This study uses the latter group of 102 technical specialists as the study sample.

The results of this study have some implications to those involved in managing the work of adult education, in general. In particular, this study has implications for those technical specialists who are engaged in developing instructional programs for teaching adults.

The instruments used for data collection in this study were self-administered questionnaires. They were all developed by the

researcher, except for the andragogical educational orientation scale which was adopted from a previously validated instrument. This instrument was the measure of educational orientation of adult educators as it relates to andragogy by Hadley (1975). The reliability test and Cronbach's alpha were determined at 0.72 for the scale pertaining to andragogy. The instruments consisted of three types of questionnaires: (i) Pre-Questionnaire, (ii) Post-Questionnaire, and (iii) Follow-up Questionnaire.

The pre-questionnaire was handed out prior to the training program in each of the sections. The Post-questionnaires were distributed immediately after training was completed in the Pesticide Applicator Trainer Course during the period of January through March, 1991. The follow-up questionnaires with cover letters were mailed to the identified population in May, 1991, and the responses were returned throughout June, 1991.

There were 357 respondents who completed the pre- and post-questionnaires and who were considered as the Comparison Group. One hundred-two respondents were identified as having completed the pre-, post- and follow-up questionnaires. This group was treated as the Study Sample. The response rate, therefore, was 29 percent. No additional follow-up was made. A comparison made between the Comparison Group and the Study Sample indicated no significant differences between the two groups.

Statistical techniques used for data analysis were frequency distribution, descriptive analysis, ranges, means, standard deviations, percentages, correlations, t-test, and analysis of variance. The SPSS/PC+ computer program was used for this

purpose.

The results of the study reveal that the age of the technical specialists ranged from 26 to 64 years with a mean of 39.2 years and a standard deviation of 8.2 years. Of this age, 11.8 percent were under 30 years and over 51 years, respectively.

Of the survey respondents, 95 percent were male and only 5 percent were female. Respondents' experience in the commercial pesticide field ranged from 0 to 50 years, with a mean of 12.2 years and a standard deviation of 7.9 years. Their experience as commercial pesticide applicators ranged from 0 to 32 years, with a mean of 9.1 years and a standard deviation of 6.3 years. Experience as a pesticide applicator trainer ranged from 0 to 40 years, with a mean of 6.3 years and a standard deviation of 6.9 years. The number of pesticide application training sessions they had conducted in the past ranged from 0 to 75 with a mean of 7.8 and a standard deviation of 12.5. The number of training sessions they had conducted about other topics ranged from 0 to 99 with a mean of 10.3 and a standard deviation of 18.1.

A total of 34.3 percent of the respondents had completed Bachelor's Degrees, 24.5 percent completed high school, 23.5 percent completed Associate Degrees, and 16.7 percent held graduate degrees. The remaining one percent did not indicate their educational levels.

The first research question of this study asked about the andragogical educational orientation held by the technical specialists. The andragogical educational orientation score of the technical specialists ranged from 1.42 to 4.67 with a mean of 3.19 and a

standard deviation of 0.54. Of the technical specialists, 24.5 percent possessed a high level of andragogical orientation with a score higher than 3.5; 67.7 percent were moderate with a score between 2.5 - 3.5; and only 7.8 percent scored less than 2.5 on a 1 - 5 scale.

Of the twelve andragogical educational orientation statements, technical specialists indicated a strong agreement on six, with a mean higher that 3.5 on a 1 - 5 scale. They indicated a moderate agreement on five statements with a mean between 2.5 and 3.5, and only one statement with a mean score below 2.5 meaning low agreement.

The second research question of this study attempted to find out the immediate effect of the training on the participants' cognitive teaching-learning knowledge. Findings showed that the scores ranged on the pre-questionnaire from 1.90 to 7.00 with a mean of 4.73 and a standard deviation of 1.19. Higher scores on the post-questionnaire ranged from 2.00 to 7.00 with a mean of 5.25 and a standard deviation of 1.22. The follow-up questionnaire range was from 0.00 to 7.00 with a mean of 4.93 and a standard deviation of 1.33.

The third research question attempted to find out the long term effect of the instructional program on the participants. The results of the follow-up questionnaire show that the follow-up mean of 4.93 was lower than the post-questionnaire mean of 5.25, but still higher than the pre-questionnaire mean of 4.73. The standard deviation of this follow-up questionnaire was 1.33, and is the highest as compared to the pre- and post-questionnaires. These results suggest that cognitive learning occurred between the pre- and the

post-tests. Though cognitive learning dropped for the follow-up test, the data show that the learning was still higher than the pre-test.

Overall, the number of correct answers increased. At least 91.2 percent of the respondents obtained four or more correct answers on the post-test while only 87.3 percent obtained four or more correct answers on the pre-test. The same results were obtained for five, six, and seven correct answers. Although the results of the follow-up test were lower than the results of the post-test, they were still higher than the results of the pre-test, except for the first three correct items. These results suggest that participation in the instructional program had a long term effect on the participants in terms of an increase in their cognitive teaching-learning knowledge. The question is, how long will this knowledge be retained?

It was found that the content of the cognitive teaching-learning test items had some discriminative questions. Among the seven items, three items/statements showed a positive effect, another three items remained the same and one item showed a negative effect in relation to the respondents' teaching-learning scores.

The fourth research question was concerned with the usefulness of the different teaching techniques that were used for training. The results showed that, based on a 1 - 5 scale, the mean scores of the overall teaching techniques were 3.78 on the pre-questionnaire, 3.67 on the post-questionnaire, and 3.59 on the follow-up questionnaire, respectively. This means that the technical specialists considered the teaching technique items as very useful.

The mean scores of the individual teaching techniques on the pre-, post-, and follow-up questionnaires showed that 'demonstration'

ranked highest with scores of 4.54, 4.67, and 4.45, respectively. This indicates that 'demonstration' was seen as the most useful technique. The second most useful technique was 'group discussion' with a mean of 4.03, 3.99, and 3.85 on the pre-, post- and follow-up questionnaires, respectively. Over all, the technical specialists indicated that the least useful technique was the 'newsletter' with a mean of 3.46, 2.81, and 2.96 on the pre-, post-, and follow-up questionnaires, respectively. There was one teaching technique score below 3.50 on the pre-test, three on the post-test, and three on the follow-up test, respectively. The mean scores of most of the teaching technique items decreased from pre-questionnaire to post-questionnaire, and from post-questionnaire to follow-up questionnaire.

The fifth research question of this study deals with the relationship between the technical specialists' demographic characteristics with respect to their andragogical educational orientation and their cognitive teaching-learning knowledge. Results of the Pearson correlation analysis showed no linear relationships between demographic characteristics and educational orientation, and between demographic characteristics and the cognitive teaching-learning scores. The correlation coefficients fall between low-association to negligible association. Similar results were observed when using the same method with the Pearson correlation analysis to see the relationships of the extreme values of personal characteristics with respect to educational orientation and cognitive teaching-learning knowledge.

Exceptions found were that technical specialists with graduate degrees received different cognitive teaching-learning knowledge

scores than non-graduate degree holders on the post-questionnaire. The results show a significant difference at the greater than 0.05 level among the technical specialists under different educational levels with respect to cognitive teaching-learning knowledge.

One-way analysis of variance was used for further clarification of the educational differences toward cognitive teaching-learning knowledge. The results of the Scheffe procedure showed that the cognitive teaching-learning knowledge scores of the graduate degree holding respondents were significantly different from the cognitive teaching-learning knowledge scores of the associate degree holding respondents.

The sixth research question was concerned with the effect of participation in the instructional program on the participants' confidence. Findings showed that technical specialists were very confident about the teaching of others. The level of confidence ranged primarily from moderate to strong. The mean and standard deviation scores were 4.34 and 0.75 on the pre-questionnaire, 4.34 and 0.65 on the post-questionnaire, and 4.29 and 0.70 on the follow-up questionnaire, respectively.

In terms of information needed to improve confidence, findings showed that technical specialists before participation in the instructional program generally needed more information than immediately following the program or at the period of time after the conclusion of the program. Information about adult teaching techniques was the most desired type of information as indicated on the pre-questionnaire with a mean score of 4.19 and a standard deviation of 0.85. This was followed by pesticide application

information with a mean of 3.84 and a standard deviation of 0.94, and by the people to be taught with a mean of 3.57 and a standard deviation of 1.00. Less information was needed after participation in the instructional program as indicated by the decreased means on the post- and follow-up questionnaires. The mean scores regarding information needed about adult teaching techniques decreased from 4.19 to 3.92 and 3.68 on the post- and follow-up questionnaires, respectively. There were similar results for the information needed about pesticide application with a decrease in the mean from 3.84 on the pre-questionnaire to 3.56 and 3.45 on the post- and follow-up questionnaires, respectively. The mean scores regarding information needed about people to be taught increased from 3.57 on the pre-questionnaire to 3.75 on the post-questionnaire. On the follow-up questionnaire the mean decreased to 3.34.

Results of the t-test showed that the information needed about adult teaching techniques between pre- and post-, between post- and follow-up, and between pre- and follow-up questionnaires was significantly different. In other words, the technical specialists needed less information about adult teaching techniques after participation in the instructional program as indicated by a decrease in the mean scores of the information needed. This result was the very goal of the training program.

Results regarding information needed about pesticide application between pre- and post,- and between pre- and follow-up questionnaires was also significantly different. Similar results were found with respect to information needed about people to be taught between post- and follow-up questionnaires.

Previous related training that the technical specialists had attended showed that 75.5 percent of them had attended seminars/workshops related to pesticides. Half of them indicated field experience and self study as the type of program attended; 43.1 percent had on the job training, followed by MPCA at 30.4 percent; turf conferences, 12.7 percent, and 8.8 percent had attended entomology courses at Michigan State University. Only 2.9 percent of the technical specialists had no previous training experience.

Participant reactions toward the training program were divided into three categories: reactions related to learners and teaching, reactions related to program content, and reactions related to program administration. By looking at the responses in the 10 percent and above category related to learners and teaching, they revealed that adult teaching techniques and good and informative speakers were the two strong points represented by 28 and 13.7 percent, respectively. In this sense, the adult teaching techniques strengthen the program. In terms of respondents' reactions related to the program content, 12 percent reported that the strong point was the explanation of regulations. In terms of reactions related to program administration, the two items of weakness reported by 13.4 percent were that the program was too long, and by 10.9 percent, that the group was too large. The main reaction to a strength was the area of program implementation as reported by 12 percent of the respondents.

In general, the technical specialists expected more problems before conducting their own training programs. The actual problems they faced were smaller in number than those expected. Among the

six items or problems that were expected related to learners and teaching, two of them no longer existed per the follow-up. On the other hand, 'seasonal employee' was an unexpected problem that was faced when the respondents conducted their own training programs.

In terms of problems related to the program content, three were expected and four problems were uncovered after conducting their own programs. Among those encountered problems, two of them were unexpected and one expected problem no longer existed as an actual problem. There were a number of problems related to program administration. Among six expected problems, two of them appeared as actual. One actual problem was not expected.

These results indicate that there were more problems encountered in dealing with the learners and teaching, than compared with content and program administration. Maintaining trainees' motivation was the biggest problem respondents had when conducting their own training programs. The reason for this was that they were coming from different fields. The problems mentioned may affect the number of actual training programs conducted as indicated by a mean of 1.93 compared to a mean of anticipated training programs at 3.36.

In terms of how the instructional program can be improved in the future, the technical specialists suggested more specific field group interaction as a priority, consideration of the size of the group, and the duration of the program. In terms of the materials used by the respondents for their trainees to learn, they found out that pesticide laws and regulations was the most difficult area as compared with other areas such as pesticide equipment, handling, and storage.

A summary from the general comments indicates that the technical specialists had a lot more comments related to program content than to program administration. Very few comments related to learners and teaching. Most of the comments were positive, some were neutral, and very few were negative comments.

Over all, the technical specialists placed high value on the program in which they had participated. The presentations were clear and useful, the locations were convenient, and they were well worth the time invested.

Conclusions

The technical specialists who were studied in this research held moderate to strong andragogical educational orientations. The mean score of andragogical educational orientation was 3.19 on a 1 - 5 scale, which suggests that these technical specialists, as adult educators, can be categorized as andragogical. This is a similar conclusion/finding to that found by Suvedi (1991) and Hadley (1975) who reported that Extension agents and County Extension Directors (CEDs) hold an andragogical orientation. This conclusion is consistent with Knowles' (1984) view that adult educators are andragogical. In relation to age and education, the technical specialists were adults, well educated, and had a lot of experience. As adults, they were problem oriented.

However, it should be pointed out that the sampling procedure used in this research may have had a strong effect on these findings. These subjects may not be representative of the larger population. This may be caused by the fact that the study data were only collected

during the first five offerings of a state-wide program that was offered 10 - 12 times. Those attending the first sessions of such a program may be more highly motivated as adult educators, more desirous of learning this material and consequently, more andragogical in nature.

The cognitive teaching-learning knowledge of the technical specialists increased between the pre- and the post-tests. This suggests that their participation in the training program had an immediate and positive effect on learning. Though cognitive learning dropped for the follow-up test, the data show that the follow-up learning was still higher than the pre-test learning. In other words, participation in the training program had a long term effect on the participants in terms of an increase in their cognitive teaching-learning knowledge. They learned and retained some amount of the knowledge gained from the program.

As was noted above, the sampling procedure may have had an effect on the findings. This effect may have also been involved with the cognitive teaching learning area. If the study sample participants were more knowledgeable regarding cognitive teaching-learning than can be expected in the population, then a lesser effect may be shown through this finding. In other words, a more "typical" respondent may demonstrate a greater change in learning, pre' to post' and pre' to follow-up, than those in this study sample. There is no way of knowing, at this time, whether the pre-test scores are truly representative of the population. If the sampling was biased, the pre-test scores may be higher than what would be expected.

The cognitive teaching-learning test had some discriminative questions. Among the seven items, three items/statements showed a

positive effect, another three items remained the same and one item showed a negative effect in relation to the respondents' teaching-learning scores.

Among nine items regarding teaching techniques, the technical specialists indicated that demonstration was the most useful technique with very consistent scores over all the questionnaires. The second most useful technique was group discussion, and newsletter was categorized as somewhat useful. However, on the post- and follow-up tests, the scores were lower and the ranges were wider. The training affected the participants by making them more critical of the usefulness of all teaching techniques except the demonstration technique. This may have occurred because of their experiences in teaching.

No linear relationships were observed between personal characteristics such as age, gender, education, and experiences in the pesticide field with respect to andragogical educational orientation and between personal characteristics and cognitive teaching-learning knowledge. Similar results were observed using the same method of the Pearson correlation analysis to see the relationships of the extreme values of personal characteristics with respect to educational orientation and cognitive teaching-learning knowledge. An exception was that technical specialists with graduate degrees were found to have a different level of cognitive teaching-learning knowledge than non-graduate degree holders on the post-questionnaire. Analysis of variance using the Scheffe procedure showed that the cognitive teaching-learning knowledge of graduate degree holding respondents was significantly different from the

cognitive teaching-learning knowledge of associate degree holding respondents.

The non-significant relationship between personal characteristics with respect to educational orientation and cognitive knowledge may be due to the effect of sampling. As was noted, the scores on andragogy and cognitive knowledge were very high, therefore, the personal characteristics did not differentiate.

The technical specialists were very confident about their ability to teach others. Their confidence scores were consistent over all the tests. These consistencies together with andragogy and cognitive knowledge scores were maintained. This may be due to the fact that those technical specialists attending the training sessions that this study dealt with were more highly motivated, and as a result, were more confident.

The technical specialists generally needed more information about adult teaching techniques, people to be taught, and about pesticide application before participation in the training program. After participation in the training program, these types of information were perceived as less needed, particularly regarding adult teaching techniques. The training program affected the participants by making them more knowledgeable.

Recommendations

This study was designed to investigate the effectiveness of sharing technical information with adult learners through the validation of a set of instructional materials. The materials were to be used by technical specialists to train other pesticide applicators. The

primary concern of conducting training for staff employees is either to maintain or to increase the quality of their performance. This is also the case with training technical specialists.

Based on this study's findings, conclusions, and review of literature on which it is based, the following recommendations can be made:

1. Assessing needs is one focus of any such program. Therefore, the way educators teach should focus on the participants needs.
2. The educator should identify the information needed by the training participants and put emphasis on it when conducting the program. This will help in focusing on the needs of the participants.
3. The study should be replicated in the same or other areas or fields dealing with adult learners to reach more technical specialists. By using a random sampling procedure, the results of such studies will provide a wide range of information on the educational orientation and the adult teaching-learning knowledge of the technical specialists. In addition, the educational orientation instrument should be used to select trainees who score low on andragogy to see if the training materials have a more powerful effect or a larger impact on the trainee's achievement.
4. There should be a follow-up study assessing technical specialists' educational orientation, cognitive teaching-learning knowledge and performance in the field. The purpose of such a study would be to find out how long the knowledge gained from the pesticide applicator training can be retained.
5. The statements and alternative answers in the cognitive teaching-learning tests need to be reviewed and validated to avoid non-

discriminating questions. One way to conduct a validation would be to use a pre-test as a formative evaluation for program improvements. The summative evaluation that this study used was to verify the utility of the program.

6. The teaching techniques used in this study were limited to nine items. It is recommended that a more comprehensive instrument on adult teaching methods in addition to those already described in this study be developed.

7. Apart from the participants' reactions toward the program, it is important to consider two points. First, to set up a program for each type of business. This will help promote specific group interaction, smaller groups, and the same or less amount of material, thus making the program shorter; and second, to provide more locations to accommodate the demand for technical specialists and to avoid larger groups.

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APPENDICES

Appendix A: Instructional Materials

EFFECTIVE TEACHING

A set of papers focusing on the teaching of technical information to adults

S. Joseph Levine, Ph.D.

Department of Agricultural and Extension Education
412 Agriculture Hall
Michigan State University
East Lansing, MI 48824 USA

CHARACTERISTICS OF ADULT LEARNERS AND IMPLICATIONS FOR TEACHING TECHNICAL INFORMATION

S. Joseph Levine, Ph.D.

Probably the single most important concern for the teacher of technical information to adult learners is a **thorough understanding of the learner.** Through such an understanding it is possible to direct your teaching to the specific needs and interests of the adult.

Characteristic #1

The adult learner is primarily independent/self-directed in what he/she learns.

Implications for Teaching:

Try not to treat the adult like a child. Introduce yourself to the group and have them introduce themselves. Use name tags and try to call the adults by name. Make sure you allow ample time for discussion. Don't assume that you're the only one with the answer - try having the adults in the group also provide answers to each other. Handouts and materials that you provide during your teaching can help the adults learn on their own after your session is over. When the adult is learning on his own he can use the speed or rate of learning that best fits his own learning style. Different learners learn at different rates.

Characteristic #2

The adult learner has considerable experience to draw upon.

Implications for Teaching:

Provide opportunities for the adults to work together and share their ideas/experiences in small groups. Present some information and ask the adults what experience they have had in the past with the topic. Ask the adults to suggest solutions to problems/questions from the experiences they have had. Each learner's experience is unique and different. Sometimes experience may be a barrier - bad experiences may make it more difficult to teach an adult. Try and understand the experiences of your learners.

Characteristic #3

The adult learner is most apt to be interested in topics that relate to the developmental stage of their life.

Implications for Teaching:

Don't assume that young adults and older adults are interested in the same things. When you organize small groups for discussion try organizing them according to their stage of life - adults who are beginning their career in one group, those in mid-career in another group, and those who are well established in their career in another group. Provide opportunities for the learners to talk about why an idea/concept is or is not important to them. Try to hear from all of the adults in the group - don't just hear from a few of the more vocal ones.

Characteristic #4

The adult learner is most interested in information and ideas that solves problems that they are presently faced with.

Implications for Teaching:

Try to make your presentations problem-focused rather than just information-focused. Start your presentation by identifying the problems that you will be helping the learners solve. Provide opportunities for questions from the adults and urge them to describe their own specific situation and the problems they face. Try to focus your instruction on responding to the problems that they identify.

Characteristic #5

The adult learner is most interested in information that can be immediately applied.

Implications for Teaching:

Try to focus on ideas that the adults can put to use immediately after your teaching is finished. Ask the adults how they will be using, making application of, the ideas and information presented. If the adults are not able to provide examples of how they will

be using the information, try to find out why. Are they not understanding your information? Is your information not applicable to them? Are they unsure of what application opportunities they have?

Characteristic #6

The adult learner is motivated from within him/herself.

Implications for Teaching:

Offering rewards for learning usually doesn't work very well with the adult learner. You must appeal to the learner at an adult level. Try and find out what the adult places value on. Recognize and respect those things that the adult values. Let the adult know that you are concerned with those things that he/she values. And then, really be concerned!

PRINCIPLES FOR

TEACHING TECHNICAL INFORMATION TO ADULTS

S. Joseph Levine

The following is a set of basic principles that can guide the technical expert in organizing instructional presentations for adult learners. The ideas are straight forward and not meant to be very elaborate - just presented to help you realize that the task of teaching technical information can be made very effective if clearly conceived and presented.

PRINCIPLE #1

TELL THE ADULTS WHAT YOU'RE ABOUT TO TELL THEM

Probably the best place to start in planning a technical information teaching session is to realize that you and the adults are on the same side in this thing. Your goal is **not** to fool them or otherwise confuse them. Your goal is **not** to impress them with how smart you are. Your goal is to help them learn what you're about to teach. Anything that you can do to enlist their help in getting this done is to your advantage. So, let's start with the most obvious. **Start by telling the adults what you're about to teach them.**

This can be done in a number of different ways. If you've prepared a printed program/agenda for them, make sure that it's clear (try and stay away from "cute" titles) and show them that you're concerned that they know what's in it by talking them through the schedule. Cover the main ideas of each of the events of the program.

Whatever you do to tell the adults what they're about to learn, **make sure you really teach these things.** There's nothing quite so frustrating as a teacher who doesn't deliver what they said they would.

An interesting way of letting the adults know what's about to happen is to prepare a simple "test" for them to take at the very beginning of the program. The test can present questions on each of the main topics of the day. You can have the adults "correct" their own test by providing the answers on the back of the sheet. The test lets the adults know what's going to be covered and can also be used afterward to let them know that they've learned the information.

Let's try it:

TEST
Principles for
Teaching Technical Information to Adults

1. Probably the best way to help adults learn what you'd like them to learn is:

___ to speak slowly.

___ to use colorful slides.

___ to tell them what you're about to teach them.

___ to use a short test at the end.

2. It's important to always organize the sequence of your presentation around your content.

___ absolutely, the content is your guide!

___ sometimes, but there can also be other things to guide us!

___ never, you should work from the advertised schedule!

3. It's really hard to affect how much people will remember from your lecture.

___ True

___ False

4. Adults attend technical classes to:

___ pick up some new information.

___ improve their understanding of something that concerns them.

___ learn some things that can be put to use.

___ reflect on what they already know so they can share it with others.

5. A really good teacher:

___ knows when to switch between being a learner and a teacher.

___ defines a clear distinction between him/herself and the adult.

___ sees him/herself only as a learner.

6. The best way to conclude a presentation is to:

___ tell the adults how to use the ideas presented.

___ review the major concepts that were presented.

___ have the adults discuss what they'll do with the information.

(see last page for answers)

PRINCIPLE #2

ORGANIZE YOUR MATERIAL FOR PRESENTATION IN A LOGICAL ORDER

The more organized you are the easier it will be for others to learn. Sometimes the best way to organize technical information is to start with the beginning "stuff", proceed through the middle stuff, and conclude with the end stuff. However, this may not be the easiest way for the learners to learn your material. There are different ways to **logically** organize your material for presentation.

Content Ordered Look at your content and see how the concepts are built. Which ideas are foundational and which ideas are built on the foundation. Sometimes it helps in your planning to start by thinking through the concluding ideas that you want to get across. Then, work backwards until you uncover each previous idea. When you get all the way back to the beginning you're ready to start.

Experience Ordered If you know who the adults are you will also know the sorts of experiences they've had that relate to your technical information. Start your planning by **identifying their relevant experiences** and then building on them. Present content that links with their experience.

Interest Ordered Identify the most interesting things you have to share and then organize your presentation to allow these interesting aspects to periodically emerge. For instance, you'd like to get their interest at the beginning of the presentation so start out with something that will capture their interest. Any time there's a break in the program can probably also use a high interest item to get them back and tuned in again.

PRINCIPLE #3

DON'T TELL THEM EVERYTHING

Many teachers are intent on trying to tell the adult everything there is to know on the topic. This may be okay if the adult doesn't know anything, but usually they know something. So, how is it possible to tell them everything if they already know something? The answer is to **tell them a bit and then create ways to let them tell you what else they need to know.**

Here's how it works:

First, start by making a **short presentation.** Cover the main points, but don't get too detailed.

Next, give the adults a **chance to discuss what you've just said.** Have them get into small groups and share their ideas.

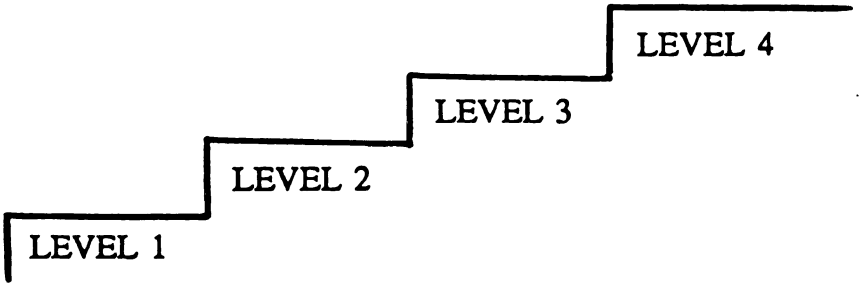
Now, bring everyone back together and **open it up for questions and answers.** The session will now easily turn toward ideas that need further clarification, new ideas that had not been previously presented, and implications drawn from the ideas.

This procedure is a much more efficient use of everyone's time since the adults are the ones pulling the information from you and specifically that information that **they** need/want to know.

PRINCIPLE #4

DECIDE WHAT YOU WANT THE ADULTS TO DO WITH YOUR TECHNICAL INFORMATION

Before you begin your technical teaching make sure you understand what you want the adults to do with the information. Maybe this sounds a bit absurd but think for a minute. Do you want them to learn it for a rainy day? Do you want them to learn it so they can use it tomorrow? Do you want them to learn it to help others use it? Once you know what you want the adults to do with the information you can decide on how to best teach it. Here are four levels to consider. Each level, like stairs on a staircase, builds one on another and leads you progressively higher.



Level 1 - **They should know the information in case they need it in the future.** This sounds like a college course! However, a lot of technical teaching is of this sort. Lecturing often works well and can be greatly improved through visuals. A handout is essential since the adult will have it available in the future when they need to know the information. You want to make sure there is time at the end for questions so that everyone can leave with the "correct" information. However, don't be disappointed if few questions arise. If the adults are only learning for future use then the questions will probably appear in the future. You may want to leave your name and address with them so that they can follow up with you at a time when they need to put the information to use.

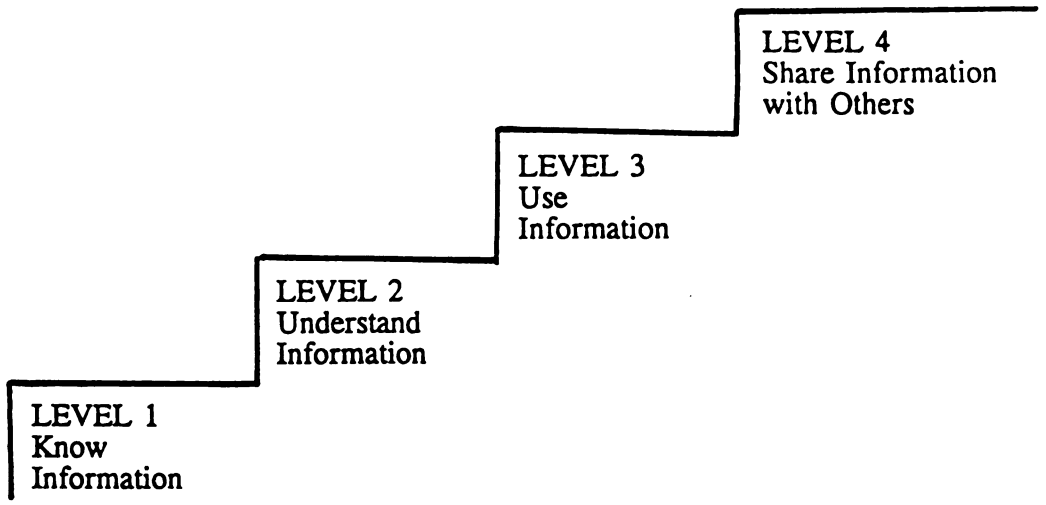
Level 2 - **They should understand the information so that they might apply the ideas in other areas.** This level is more than just remembering - it's also **understanding** the technical information. Though the adults may not have a particular application for the information, there may be other areas in which these same ideas can be most useful for them. Make sure you provide ample opportunity during your presentation time to allow them to discuss the ideas and concepts in small groups. This will allow them to see how each other may be trying to use the information. It also helps them get clarity on their own understanding. Often the adults will shy

away from asking a question in front of the entire group but will ask the question in the "privacy" of a small discussion group. Again, a handout is essential, but also some form of Note Taking Guide will really help. The main points from your presentation can be included in the Note Taking Guide with space provided for the adult to write in their own comments.

Level 3 - **They want to be able to use the information so they can put it to work for them.** This is probably the level that is the most fun for the teacher. When you've got a group of adults who want to put your information to immediate use the attention moves away from "how can I get them to learn it" and focuses more directly on "how can I get out of the way between them and the information." So much of teaching seems to be focused on tricking the adult into learning something that this level sometimes comes as a surprise to us. The adult, though, may become a bit impatient! They may not want to be lectured at but instead want to try to immediately put the information to use. So, be prepared! This is a great time for a "hands on" demonstration. Try to do a lot of showing at the beginning rather than telling. Let the adults see the information being put to use and then have them do it. You may have to create some simulated opportunities for doing. Once you've given them an opportunity to see and to do, then it's time to talk. First in small groups so that everyone can have a chance to share their thinking. Then, in the large group so that you can give specific technical answers to their technical questions. Handouts are essential, especially those that document the specific steps of doing that were demonstrated and tried during the program. Diagrams and pictures in the handouts can often spell later success as they make application after they return home.

Level #4 - **They want to be able to share these ideas with others so that others can know about it.** If your adults are wanting to learn at this level they have now become your peers! Your task should be more focused on helping them be able to communicate in the same ways that you are able to. It stands to reason, of course, that as a peer they already have a good grasp of the technical information and have already been able to put it to use. If this is not the case, maybe they really aren't at Level #4! Let's assume, however, that they know the stuff and have put it to use prior to this program. They really are at Level #4 and now they want to be able to help others know about it. You should focus your presentation around case studies and problem scenarios. Give them a problem scenario to solve that you have run into in the past. It often helps if the problem scenarios have been prepared and printed ahead of time. Divide up the adults into small groups and have them tackle one of the problem scenarios. After ample time for small group discussion, have them share their solutions and approaches in the large group. Have all groups work on the same scenario so that when the large group sharing occurs everyone knows what is happening. Try and have a selection of problem scenarios available for them. Some scenarios should focus on specific technical information aspects ("What types of

information should you provide if the problem is ...") and other problem scenarios should focus on how to help people learn the information ("What should you do if the person doesn't understand the concept of ..."). Provide a time when you ask the adults to share their experiences in helping others learn this type of information. What works for them? What things should be avoided? Be ready to describe your own successes and failures for others to learn from. Don't make yourself the center of attention but try and turn questions directed to you around so that the adults have the opportunity to respond to each other's questions.



PRINCIPLE #5

KNOW WHEN TO TEACH AND WHEN TO LEARN

Most technical teachers assume that the reason they're up in front of the group is because they've got something to teach the others. This makes a lot of sense, but can be interpreted along a continuum. At one end of the continuum is the idea that:

"I know something that I want you to know."

And, at the other end of the continuum is the idea that:

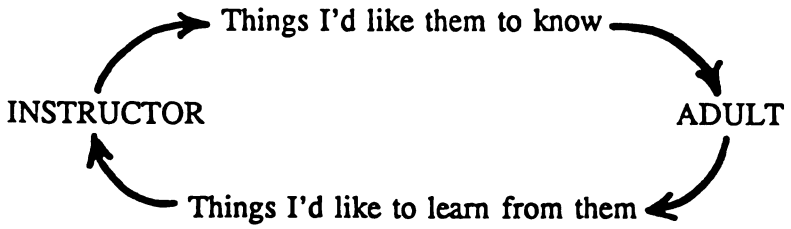
"You know something that I'd like to know."

This later position is one that is often rejected without really thinking about it. It's important for learning, almost essential, that the learner feel that he/she is an important part in the process. One way to have this happen is for the teacher to learn from the learner. And probably the very best position to find yourself in as the technical teacher is:

"Between the two of us there's got to be some new insights - let's share what we know."

Sounds rather confusing!! "How can I be the expert if I'm going to learn from them?" Or, "I'm the expert, what can they expect to teach me?" No one said that the content that each of you will teach and learn must be the same. The key is that you, as the teacher, can make the adult feel a lot more willing to learn if the adult feels that they are being listened to.

Make sure you provide ample opportunities for the adults to do some talking. And, listen when they speak. Assume that their questions are all good and work to give each questioner your full attention through your response. Try jotting down your thoughts as the adults are talking. Once written down you can go back to listening rather than having to interrupt them before you forget what you want to say. Try to provide opportunities for different people to speak. Don't let just one or two control the discussion.



PRINCIPLE #6

HELP THE ADULTS TRANSFER THE CONCEPTS TO THEIR OWN SITUATIONS

A real challenge for the teacher of technical information is to get the adult to make the shift in their mind from the classroom to their own situation. This concept, often referred to by educators as "transfer of learning", is the essence of what we're all about. If we can't stimulate our learners to make this transfer of information, to generalize to their own situation, then there really isn't much point in wasting their time listening to us.

Now it would seem that transfer can be best accommodated when we stick closely to our plan for presentation. We can then plan carefully ahead of time about how to make the transfer. But what if we allow the adults to ask questions during the program? Or, what if topics and ideas are brought out that we hadn't planned for? Is this bad or can we still help the adults to make the transfer?

Probably the easiest way to have transfer occur is through a series of very obvious questions that can be part of the concluding discussion. There are really only three questions that need be asked. The key is that you must ask them at the right time and in the right way. They are:

Question #1 - **What are the key ideas that were brought out during this session?** (Identify)

Question #2 - **From your own perspective, why are these ideas important?** (Analyze)

Question #3 - **How will you be using these ideas in your own situation?** (Generalize)

In actual use Questions #1 and #2 seem to be used the most with individuals moving back and forth between them. We start by asking someone to identify something from the session and then have them or someone else analyze why it was important. We try and stay tuned in, interjecting every once in awhile to keep things going smoothly, and then when things quiet down a bit we again ask Question #1. This process is repeated until the main ideas of the session, **from the adult's perspective**, are brought forward. Then, when it's time to finally wrap everything up we move to Question #3 - "How will you be using these ideas in your own situation?"

This last question sets the stage for the transfer of learning. Hopefully all of the adults will have a chance to share their ideas on how they will be making use of the information. Sometimes this can be helped along by moving through the group and giving everyone an opportunity to speak. The usual effect of this final sharing of insights is very powerful with the group strongly reinforcing all of the many things that were learned. In fact, it is often the case that the instructor learns about many things that were learned that weren't realized nor planned for. What a great way to end a program!

Answers to the test:

1. C 2. B 3. F 4. All 5. A 6. C

TEACHING STRATEGIES TO HELP PEOPLE LEARN TECHNICAL INFORMATION

S. Joseph Levine, Ph.D.

There are many different teaching strategies that can be used to help learners gain the understandings that you'd like. The following list/description presents some of the strategies that can be particularly helpful when trying to teach technical information to adults. These strategies can be used individually or in conjunction with each other.

Demonstration

Demonstrations can be classified in two ways:

Result Demonstration shows the results of some activity, practice or procedure through evidence that can be seen, heard, or felt.

Method Demonstration illustrates how to do something in a step-by-step fashion.

Demonstrations are most effective when the learners are concerned with an issue or problem and are looking for an answer. In such cases the demonstration can deal directly with their concern. It is important that the person doing the demonstration knows the content very well and is able to answer questions as they arise during the demonstration.

Lecture

The lecture is the most commonly used instructional strategy for working with groups of learners. Ideas for improving the effectiveness of lectures include:

Be organized - plan your lecture ahead of time and be logical in your order of presentation.

Allow for periodic breaks - don't have the learners sit and listen too long. Provide frequent breaks when they can relax and informally discuss the ideas that have been presented.

Use visuals - charts, slides and overhead transparencies all help by allowing the learners to see what they have been hearing.

Allow for questions - periodically provide a time for questions and answers. Try to respond to each question in a way that lets the learner know that you appreciate that he/she has asked the question.

Arrange the seating - try to arrange the seating so that it is less formal and allows the learners to see each other along with

seeing the instructor. This can allow for more interaction between the learners.

Provide opportunities for small group discussion - once or twice during the lecture provide a question or two that can be used as a discussion topic for small groups. Allow the groups 5-10 minutes to discuss the topic and then have them share their ideas with the total group. When appropriate continue your lecture.

Note Taking Guide

If you are presenting detailed information it is usually most helpful to provide the learner, at the beginning of the presentation, with an outline or guide by which they can follow the material being presented and also take notes when appropriate. The note taking guide doesn't have to be exceptionally detailed but should provide the structure to help the learner progress through the content that you are presenting.

Group Discussion

Group discussion is an organized opportunity for the learners to discuss selected topics/issues/ideas in a group setting. Group discussion allows more of the learners to actively participate and therefore can help to increase learning. Before organizing a group discussion it is important to make sure that the learners have a certain level of understanding that will allow them to share their ideas in the group. A group discussion that is held too close to the beginning of an instructional program may not work effectively since the members of the group may not have the basic information to be discussed.

Group discussion often works better with a group leader. This can be assigned by the instructor or selected by the group members.

Exhibit

An exhibit is a collection of materials that are displayed to help people learn. Exhibits can be very helpful as a strategy to help learners gain new understandings without the necessity of a formal course or training program. Exhibits should be set up in areas that are frequented by the learners. It is often helpful if the exhibit includes a selection of objects or pictures and also appropriate signs and written information. In addition, handouts and printed material available for the learner to take along with them is most beneficial. Don't forget to periodically change the exhibit - don't let it stay there too long.

Field Trip

A field trip is usually a well planned visit by a group of learners to some

place or organization that can provide new ideas and insights to the learners. Field trips can be planned around the visiting of experts/specialists on a certain topic, manufacturing facilities, demonstration programs, and other locations that can't come to the learners. Field trips are often used to show the results of a certain practice.

Case Study

Used to allow the learners to examine or analyze a specific situation that they may be facing in the future. Usually the situation is prepared ahead of time and distributed in written form. The learners, often working in teams, discuss how they might solve the situation that has been presented. This strategy can be very helpful following the presentation of technical information whereby the learners can then apply the information to specific problems/situations. It is also helpful for allowing the learners to assess how much they have learned and how comfortable they will be in using the information to solve problems in the future.

Brainstorming

Used when you'd like to encourage the learners to freely share their ideas. All ideas are accepted at the beginning of the process and no response, regardless of how useless or impractical it may seem, is omitted from the first stages of brainstorming. As ideas are contributed by members of the group, they are listed for all in the group to see and discuss. Discussion can include the development of spin-off ideas, the refining of ideas, the combining of ideas and reinforcing of existing ideas. Brainstorming can be excellent to help a group of learners think creatively of new ideas to solve difficult problems.

Movies/Slides/Transparencies

Visual aides to instruction can help learners better understand the ideas that are being presented. Try to make sure that the visual aides clarify the ideas that are being presented and don't confuse them. Use the same words in your presentation as are used on the visuals.

Role Playing

When learners will be expected to interact with other people as a key part of effectively using the technical information, role playing can be most helpful. In role playing two or more learners are provided with a role to play and a situation in which they are involved. The learners then act out their roles and try to solve the situation. Role playing can be done as a demonstration in front of the total group or, of it is a large group, role playing can be done simultaneously by small groups. At the conclusion of role playing the learners should be given an opportunity to talk about how they feel, what they observed, what they learned, and what they'll do differently the next time.

Independent Study

Most adult learners do most of their learning through independent study. Independent study allows the learner to select the content that he/she is most interested in learning and also to select the best time for learning. In addition the independent study learner can move through the content at his/her on pace. An instructor can help learners do independent study by providing study materials, resource guides, self-testing materials, and by being available to answer questions as they arise.

Newsletters

A periodic newsletter that reinforces the key ideas and concepts that you want to teach can be very helpful. The newsletter can also introduce ideas that will be the focus of upcoming training sessions.

Tutorial

A tutorial learning situation is most helpful when a single learner is needing specific help. The focus for a tutorial is usually the specific problems or concerns of the learner. The teacher then becomes a form of consultant to the learner and attempts to assist in helping the learner deal with his/her concerns.

SELECTING THE APPROPRIATE
TEACHING STRATEGY

	Doesn't Require Reading	Concrete Ideas	Abstract Principles	Draws on Learner Experiences	Stimulates Dialogue/ Discussion	Problem-Focused
Demonstration	++	++	+	++	++	++
Lecture	++	+	--	--	--	-
Note Taking Guide	--	++	+	--	+	-
Group Discussion	++	-	++	++	++	++
Exhibit	++	++	-	-	-	-
Field Trip	++	++	-	+	++	++
Case Study	-	++	++	++	++	++
Brainstorming	+	+	++	++	++	++
Movies/Slides	?	++	-	-	-	-
Role Playing	++	-	++	++	++	++
Independent Study	--	++	+	++	-	++
Newsletters	--	++	-	+	-	+
Tutorial	+	++	+	++	+	+

IDEAS FOR IMPROVING YOUR TECHNICAL TEACHING

S. Joseph Levine, Ph.D.

Before your class:

Prepare a class schedule ahead of time and distribute it to the learners before the session.

Arrive ahead of time and arrange the room for learning.

During your class:

Try and be honest with the learners.

Stay on schedule.

Call learners by name.

Provide appropriate handouts.

Don't spend time telling information that can be given out ahead of time.

Try to summarize your ideas at periodic intervals - don't wait only until the end to summarize.

Schedule breaks for the learners.

Ask open-ended questions.

Start and finish on time.

After your class:

Follow-up with additional information.

Be available for questions.

Check to see if learners are applying the ideas.

APPLYING TEACHING STRATEGIES

SMALL GROUP ACTIVITY

Working as a team with one or two other participants:

1. **Identify a specific sub-topic that could be taught to a pesticide applicator.**

_____

2. **What teaching strategies could be used to teach this sub-topic?**

_____

_____

_____

_____

3. **What are the strengths of teaching this way?**

_____

_____

_____

_____

_____

_____

Appendix B

PRE - QUESTIONNAIRE

Please take a few minutes before the beginning of today's program to complete this questionnaire. Your responses will help us in the further development of the Pesticide Applicator Trainer Course. Your response will be kept confidential and no attempt will be made to identify individual respondents.

Your birth date _____
(for data collection purpose only)

I. For each question check the best response.

1. Most often the adult learner/trainee want to learn:
   - ___ the information that is presented.
   - ___ only enough information for the job.
   - ___ information to solve his/her problems.
2. It's important to know what the learner/trainee:
   - ___ already knows.
   - ___ feels about the trainees.
   - ___ worries most about.
3. At the beginning of a training session try and:
   - ___ get everyone's attention.
   - ___ provide an overview of what will be covered.
   - ___ document who is attending.
4. It's best to teach the employee:
   - ___ only the essential material to perform his/her job.
   - ___ information about a variety of topics.
   - ___ a full understanding of the topic.
5. We can learn:
   - ___ from the learner/trainee.
   - ___ much faster than we usually do.
   - ___ information best as we are teaching it to others.

6. Teaching strategies:
   ___ should be used only if necessary.
   ___ are limited in the area of pesticide application.
   ___ can best be used in combinations.

7. A well trained employee:
   ___ represent your company in a variety of ways.
   ___ can only be accomplished through a training program.
   ___ is very difficult to achieve.

II. How much do you agree with each of the following statements?

	Strongly Agree				Strongly Disagree
1. Effective learning occurs most often when the learner actively participates in deciding what is to be learned and how.	5	4	3	2	1
2. Organization of the content and sequence of learning activities should grow out of learner needs, with their participation.	5	4	3	2	1
3. The best sources of ideas for improving educational programs are the learners.	5	4	3	2	1
4. A teacher's primary responsibility is helping learners choose and develop their own direction for learning.	5	4	3	2	1
5. Evaluating his/her achievement should be primarily a responsibility of the learner since he/she has the necessary information.	5	4	3	2	1
6. Educational objectives should define changes in behavior which the learners desire and the teacher helps them undertake.	5	4	3	2	1
7. Learners are quite competent to choose and carry out their own projects for learning.	5	4	3	2	1
8. It is better for learners to create their own learning activities and materials than for the teacher to provide them	5	4	3	2	1
9. Evaluations prepared by the learners are just as effective as those prepared by the teacher.	5	4	3	2	1

10. The goals that the learner's set for themselves, rather than the goals that the teacher sets for the learners, are the basis for effective learning	5	4	3	2	1
11. A teacher's mission is to help each learner learn what he/she decides will aid in achieving of his/her personal goals.	5	4	3	2	1
12. Planning units of work should be done by learners and teachers agent together.	5	4	3	2	1

III. Personal Data.

1. Your age ___ years 2. Gender: ___Male ___Female
3. Schooling completed? ___High School ___Associate's Degree ___Bachelor Degree ___Graduate Degree___Other(specify)_____
4. Number of employees in your company? ___
5. Number of years you have work in the commercial pesticide field?____ years
6. Of these years, how many have been as:
   a commercial pesticide applicator? ___years
   a pesticide applicator trainer? ___years
7. In the past year, how many training sessions have you conducted to teach people about pesticide application? ___
8. In the past year, how many training sessions have you conducted to teach people about other topics? ___
9. How useful do you feel each of the following teaching techniques is for training pesticide applicators?

	Very useful				Not useful
a. Lecture	5	4	3	2	1
b. Group Discussion	5	4	3	2	1
c. Demonstration	5	4	3	2	1
d. Field Trip	5	4	3	2	1

e. Note Taking Guide	5	4	3	2	1
f. Exhibit	5	4	3	2	1
g. Case Study	5	4	3	2	1
h. Role Playing	5	4	3	2	1
i. Newsletters	5	4	3	2	1

10. What other types of training have you previously had about pesticide application: _____

11. How confident do you feel about training others in the area of pesticide application?

Very Confident 5 4 3 2 1 Not Confident

12. How much would each of the following improve your confidence as a trainer of others?

	Greatly Improve my Confidence				Not improve my Confidence
a. More information about pesticide application	5	4	3	2	1
b. More information about the people I'll be teaching	5	4	3	2	1
c. More information about different teaching techniques	5	4	3	2	1

13. General Comments

Thank you for your cooperation, please turn in this questionnaire.

Appendix C

POST - QUESTIONNAIRE

Please take a few minutes before leaving to complete this questionnaire. Your responses will help us in the further development of the Pesticide Applicator Trainer Course. Your response will be kept confidential and no attempt will be made to identify individual respondents.

Your birth date _____
(for research purpose only)

I. What comment do you have about today's program?

1. What were the WEAK points of in today's program?

2. What were the STRONG points of in today's program?

3. How can this program be improved in the future?

4. How much do you agree with each of the following statement?

	Strongly Agree				Strongly Disagree
a. The information that was presented during the program will be USEFUL.	5	4	3	2	1
b. The presentation that were made were CLEAR	5	4	3	2	1
c. The location of today's program was CONVENIENT	5	4	3	2	1
d. Today's program was WORTH THE TIME that I invested in it	5	4	3	2	1

II. For each question check the best response.

1. Most often the adult learner/trainee want to learn:
   ___ the information that is presented.
   ___ only enough information for the job.
   ___ information to solve his/her problems.

2. It's important to know what the learner/trainee:
   ___ already knows.
   ___ feels about the trainees.
   ___ worries most about.

3. At the beginning of a training session try and:
   ___ get everyone's attention.
   ___ provide an overview of what will be covered.
   ___ document who is attending.

4. It's best to teach the employee:
   ___ only the essential material to perform his/her job.
   ___ information about a variety of topics.
   ___ a full understanding of the topic.

5. We can learn:
   ___ from the learner/trainee.
   ___ much faster than we usually do.
   ___ information best as we are teaching it to others.

6. Teaching strategies:
   ___ should be used only if necessary.
   ___ are limited in the area of pesticide application.
   ___ can best be used in combinations.

7. A well trained employee:
   ___ represent your company in a variety of ways.
   ___ can only be accomplished through a training program.
   ___ is very difficult to achieve.

III. Implementation of Ideas

1. How useful do you feel each of the following teaching techniques is for training pesticide applicators?

	Very useful				Not useful
a. Lecture	5	4	3	2	1
b. Group Discussion	5	4	3	2	1
c. Demonstration	5	4	3	2	1
d. Field Trip	5	4	3	2	1
e. Note Taking Guide	5	4	3	2	1
f. Exhibit	5	4	3	2	1
g. Case Study	5	4	3	2	1
h. Role Playing	5	4	3	2	1
i. Newsletters	5	4	3	2	1

2. How many training programs do you plan on conducting/organizing during the next 3 months? _____

3. What problems do you expect to have when you conduct your programs?

4. How confident do you feel about training others in the area of pesticide application?

Very Confident 5 4 3 2 1 Not Confident

5. How much would each of the following improve your confidence as a trainer of others?

	Greatly Improve my Confidence				Not improve my Confidence
a. More information about pesticide application	5	4	3	2	1

b. More information about the people I'll be teaching	5	4	3	2	1
c. More information about different teaching techniques	5	4	3	2	1

6. General Comments:

Thank you for your cooperation, please turn in this questionnaire as you leave.

Appendix D

FOLLOW - UP QUESTIONNAIRE

A few months ago you attended a Pesticide Applicator Trainer Course. Would you please take a few minutes to answer these questions. Your responses will help us improve the training program. Your responses will be kept confidential and no attempt will be made to identify individual respondents.

Your birth date _____
(for research purpose only)

I. What comments do you have about the program you attended?

1. What were the WEAK points in the program?

2. What were the STRONG points in the program?

3.How can the program be improved in the future?

4. How much do you agree with each of the following statement?

	Strongly Agree				Strongly Disagree
a. The information that was presented was USEFUL.	5	4	3	2	1
b. The presentation that were made were CLEAR	5	4	3	2	1
c. The location of today's program was CONVENIENT	5	4	3	2	1

d. The program was WORTH THE TIME that I invested in it 5 4 3 2 1

II. For each question check the best response.

1. Most often the adult learner/trainee want to learn:
   ___ the information that is presented.
   ___ only enough information for the job.
   ___ information to solve his/her problems.

2. It's important to know what the learner/trainee:
   ___ already knows.
   ___ feels about the trainees.
   ___ worries most about.

3. At the beginning of a training session try and:
   ___ get everyone's attention.
   ___ provide an overview of what will be covered.
   ___ document who is attending.

4. It's best to teach the employee:
   ___ only the essential material to perform his/her job.
   ___ information about a variety of topics.
   ___ a full understanding of the topic.

5. We can learn:
   ___ from the learner/trainee.
   ___ much faster than we usually do.
   ___ information best as we are teaching it to others.

6. Teaching strategies:
   ___ should be used only if necessary.
   ___ are limited in the area of pesticide application.
   ___ can best be used in combinations.

7. A well trained employee:
   ___ represent your company in a variety of ways.
   ___ can only be accomplished through a training program.
   ___ is very difficult to achieve.

III. Implementation of Ideas

1. How many training programs have you conducted since you attended the Pesticide Applicator Trainer Course? _____

2. What problems did you find when you conducted your programs?

3. How useful do you feel each of the following teaching techniques is for training pesticide applicators?

	Very useful				Not useful
a. Lecture	5	4	3	2	1
b. Group Discussion	5	4	3	2	1
c. Demonstration	5	4	3	2	1
d. Field Trip	5	4	3	2	1
e. Note Taking Guide	5	4	3	2	1
f. Exhibit	5	4	3	2	1
g. Case Study	5	4	3	2	1
h. Role Playing	5	4	3	2	1
i. Newsletters	5	4	3	2	1

4. How confident do you feel about training others in the area of pesticide application?

Very Confident 5 4 3 2 1 Not Confident

5. How much would each of the following improve your confidence as a trainer of others?

	Greatly Improve my Confidence				Not improve my Confidence
a. More information about pesticide application	5	4	3	2	1

b. More information about the people I'll be teaching	5	4	3	2	1
c. More information about different teaching techniques	5	4	3	2	1

6. For each of the following areas, check the ones which are most difficult for your trainees to learn:

___Pest and Pest management

___Pest Identification and

___Pesticide

___Pesticides and the Environment

___Pesticides and Human Health

___Pesticides handling, Storage Disposal

___The Pesticide Label

___Pesticides Application Equipment

___Pesticide Laws and Regulations

7. General Comments:

Thank you for your cooperation in completing this survey. Please return it in the enclosed stamped envelope.

Appendix E: MSU's Committee on Research Involving Human Subjects

MICHIGAN STATE UNIVERSITY

OFFICE OF VICE PRESIDENT FOR RESEARCH
AND DEAN OF THE GRADUATE SCHOOL

EAST LANSING • MICHIGAN • 48824-1046

February 20, 1991

Mr. M. Yusuf Maamun
Agriculture and Extension Education
412 Agriculture Hall

RE: DEVELOPMENT AND VALIDATION OF AN INSTRUCTIONAL PACKAGE TO TEACH TECHNICAL SPECIALISTS HOW TO EFFECTIVELY SHARE TECHNICAL INFORMATION WITH ADULTS, IRB#91-056

Dear Mr. Maamun:

The above project is exempt from full UCRIHS review. I have reviewed the proposed research protocol and find that the rights and welfare of human subjects appear to be protected. You have approval to conduct the research.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval one month prior to February 11, 1992.

Any changes in procedures involving human subjects must be reviewed by the UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to our attention. If we can be of any future help, please do not hesitate to let us know.

Sincerely,

David E. Wright

David E. Wright, Ph.D.
Chair, UCRIHS

DEW/ deo

cc: Dr. S. Joseph Levine

Appendix F.

Pearson correlation coefficient for demographic characteristics with respect to selected statements from the Cognitive Teaching-Learning Test.

Demographic characteristic	Correlation Coefficient (r) score on selected statements from Cognitive Teaching-Learning Test (Item 1,3,& 5)		
	Pre	Post	Follow-up
Age	.03 (.05)	- .06 (-.15)	- .06 (-.04)
Gender	.16 (.05)	- .04 (-.01)	.09 (-.02)
School completed	.12 (.10)	.23 (.17)	.15 (.13)
Experience in pesticide field	- .04 (-.04)	- .02 (-.12)	- .05 (-.06)
-as pesticide applicator	- .15 (-.20)	- .08 (-.18)	- .12 (-.19)
-as pesticide app.trainer	- .09 (-.21)	- .05 (-.16)	- .16 (-.10)
Confident in training others	- .15 (.02)	- .05 (-.09)	.08 (-.03)

Figures in parentheses were the correlation coefficients between demographic characteristics with respect to all seven statements in the Cognitive Teaching-Leaning Tests.

Appendix G.

Previous Related Training Attended

Items	Section 1 (n=14)	2 (n=22)	3 (n=39)	4 (n=21)	5 (n=6)	Total responses[a] N (102)	(%)
1. Seminar/workshop	12	20	26	15	4	77	(75.5)
2. Self study/field exp.	-	6	27	12	6	51	(50.0)
3. On the job training	7	12	17	4	4	44	(43.1)
4. MPCA[b]	9	1	11	6	4	31	(30.4)
6. Turf conference	-	1	2	7	2	13	(12.7)
7. MSU (IPM, Ento.)	7	2	-	1	-	10	(9.8)
5. None	-	1	1	1	-	3	(2.9)

[a] Respondents gave more than one answer

[b] Michigan Pest Control Association

Appendix H.

The Most Difficult Areas of the Respondents' Trainees to Learn

Areas	Section 1 (n=14)	2 (n=22)	3 (n=39)	4 (n=21)	5 (n=6)	Total responses[a] N (102)	(%)
Pest & P. Mgt.	2	8	5	3	0	18	(17.6)
Pest Identification	7	11	13	11	2	44	(43.1)
Pesticides	0	5	6	3	2	16	(15.6)
Pesticides & Env.	0	8	9	8	0	25	(24.5)
Pest.&Human health	3	7	8	6	2	26	(25.5)
Pest. Handling, Storage & Disposal	1	2	5	0	0	8	(7.8)
Pesticide Label	0	3	6	6	0	15	(14.7)
Pest. Appli. Equip.	1	3	2	2	0	8	(7.8)
Pest. Laws & Regul.	8	19	22	17	4	70	(68.6)

[a]Respondents gave more than one answer

Appendix I.

General Comments

No.	Comments	Category (L, C, A)	(+, o, -)
1.	The company which is has training guidelines will fit what the MDA wants.	A	+
2.	This program will help raise the standard of our industry.	C	+
3.	Overall, it was an excellent and informative program (7 same comments)	LCA	+
4.	I can't wait until one of the association develop training program that company can rely on to do training.	A	+
5.	Need a full practice test for core manual with answer.	C	o
6.	This was a very well organized program, location was good too.	A	+
7.	This program is going to cause more problems than we already have	C	-
8.	Great job, I enjoy it	LCA	+
9.	Every person should be certified	A	o
10.	Offering a choice between being Registered or Certified is a waste of time. If you have to pass core exam, then just take a category specific test at the same time	A	-
11.	The whole seminar as one was a very good learning experience. I really do appreciate the hard work you (MSU,MDA) have done	A	+
12.	Be industry specific in your training session (Turf, General pest, ornamental, etc.)	C	o
13.	The program was well developed. It will helpful to set my own	A	+

14.	Great job, we need more training/ discussion certified applicators	C	+
15.	Experience in developing own program --increase confidence	L	+
16.	Spend more time getting to the point (don't beat around the bush)	C	-
17.	Registration/certification training needed development	A	o
18.	Outstanding job/excellent (2 same comments)	LCA	+
19.	This is overall a very good program (6 same comments)	LCA	+
20.	I think that training our people will benefit us all in the long run	L	+
21.	The implementation of regulation 636 is a process for all of us. It takes time & effect to teach it, to learn it, to do it. Thank you for your help and continue help	C	+
22.	Overall content were very good, speakers were excellent.	C	+
23.	There should be more locations through out state.	A	+
24.	Long session but good information (2 same comments)	A	+
25.	To learn more myself	L	+
26.	I think having registered technicians is great for industry	C	+
27.	The program is a major challenge and will shape the future	C	+
28.	Employee become certified rather than registered	L	+
29.	Thank you for your efforts in a controversial area	C	+
30.	It is certainly time that program has been initiated to protect environment	C	+

31.	Nice program but a lot of bugs to work out	C	+
32.	Very informative program, keep improving	C	+
33.	This will afford too fairly good employees in my company who are notoriously poor test takers, an opportunity to succeed	L	+
34.	As usual the MDA & MSU did a good job. More specific teaching ideas would be helpful.	A	+
35.	What will be done about enforcement. Lot of people will be ignoring the new regulation	A	o
36.	All are well. I enjoyed learned and will be useful in the future	L	+
37.	Good, interesting (4 same comments)	LCA	+
38.	It is been real	LCA	-
39.	The information/tool gained will be useful in my life	L	+
40.	This is good direction to be heading	A	+
41.	Keep informed at all times to different change	C	+
42.	Better explanation material sent to sign up for this program	A	o
43.	We should have all been able to introduce ourselves	L	o
44.	The topics were very helpful in understanding laws	C	+

Summary

L =learner related	: 8 (18.2%).	+ (positive)	: 33 (75.0%)
C=content related	: 16 (36.4%).	- (negative)	: 4 (9.1%)
A=administratively related:	14 (31.9%).	o (neutral)	: 7 (15.9%)
LCA=combination	: 6 (13.6%).		
Total	: 44 (100%).	Total	: 44 (100%)
