Using Advanced Instructional Technology To Enhance Pesticide Applicator Training Programs

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As public concern over the use of pesticides grows, the need for properly trained applicators becomes more important. University Extension training programs are the major source of pesticide applicator education. Such programs have used traditional delivery techniques to train applicators until recently, when new technologies have been integrated into training efforts in several states in an effort to enhance program impact. Interactive video, satellite broadcast training, and multimedia demonstration kits are methods being adopted in Virginia. Incorporation of new methodology is occurring gradually, and audience and agent acceptance is increasing.

Introduction

In 1972, an amendment to the Federal Insecticide, Fungicide and Rodenticide Act classified certain pesticides as restricted use, and mandated training for pesticide applicators using these compounds. As the number of these restricted use chemicals increases, more and more applicators look to the Cooperative Extension/Land-Grant University System for the training necessary to prepare them to meet state and federal competency requirements. Extension at the state level conducts programs for both private (*farmers*) and commercial (*those who apply pesticides for hire*) applicators.

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These programs encompass a curriculum based on federal guidelines which include a host of topics such as: laws and regulations, labels and labeling comprehension, personal safety, environmental considerations, pest identification and control, pesticide characteristics, application equipment, equipment calibration, application techniques, transportation, storage, decontamination, waste minimization and disposal, record keeping, public relations, integrated pest management, alternative pest controls, and other special concerns. This curriculum is the basis for training subject matter and is the focus for all programming efforts. As a result, most training aids developed in one state can be used in others.

Since its initiation in 1976, the national Extension pesticide applicator training effort has included classroom instruction, publications, audio-visual media, on-site demonstrations, and hands-on experience. The program has been very successful in training thousands of pesticide applicators and, in general, these applicators have been very receptive to both their initial training and periodic recertification (re-training) sessions. However, after 15 years, many state programs have been affected by a lack of federal and state funding, limited personnel resources, and increased numbers of applicators seeking training.

Since the program started in 1976, there have been over 19,000 private and over 4,000 commercial applicators certified under the Virginia Pesticide Applicator Training and Certification Program. Private applicators received training for initial certification and testing through the local Extension offices. Pest control professionals and other commercial applicators received their training through local, state and regional sources including Extension programs and through training conducted by the private sector. Annually, in Virginia, over 2,000 applicators enter the program for the first time by becoming certified and on average over 5,000 others must update their certifications by attending additional training programs for recertification.

In Virginia, pesticide applicator training has suffered from the inability to provide new training media to replenish local county Extension training programs and from a general lack of continuity in the program statewide. In recent years, traditional programming methods have not been able to meet all demands for individualized or small group instruction, mainly due to financial constraints. Finally, providing current information in a time of rapid scientific and technological advancement and a fresh approach to basic, required subject matter is a constant challenge to Extension pesticide applicator training and recertification programs.

Starting in 1981, in an attempt to address these concerns, new communication technology was incorporated into the Virginia pesticide education program. Interactive video courseware, video teleconferences, and multimedia teaching kits are all part of a new approach aimed at making the subject matter more interesting to the student and reducing preparation time and duplication of effort for the instructor. Most of the resources to support this effort have come from special grants and contracts with state and federal agencies.

Interactive Video Training

Every year many applicators attend organized classroom instruction sessions for training credit, but

a large number also approach their Extension agent for individualized training. In order to meet this need, clients are usually given a videotape or slide/tape module to view, a training manual or other study guide to read, or the benefit of a private lesson from their Extension agent. Unfortunately, these methods either demand great amounts of instructor time or provide very little stimulation to the student.

Many of the current training methods do not require much involvement on the part of the student. As a result, most applicators do not learn as much as they could had they interacted with the instructor or instructional medium. The benefits of one-on-one, self-paced instruction initiated the idea to use interactive video technology as a delivery method for pesticide applicator training. The use of interactive video seems to be a natural fit for pesticide applicator training, because it has the potential to capture and hold the student's interest, prompt the student to become involved in practical tasks related to the lesson's subject matter, provide instant feedback and coaching, and track student progress throughout the lesson. Interactive video also has the capabilities to provide high quality programmed instruction without high demands on the individual instructor.

In 1981, a project was initiated in Virginia to develop a computer-based instruction program to train applicators to properly handle pesticides. Computer-assisted instruction programs were evaluated and tested with applicators and graduate students. Initially, most of the resulting programs were seen more as a curiosity than a viable instruction tool.

In 1985, a pilot program was developed which used the IMSATT authoring system and operated on an IBM-XT with a touch screen monitor. The pilot program consisted of a collection of 2,000 still images organized into chapters relative to topics appropriate to pesticide safety. The slides were presented in the form of still images to support a page of text. The user moved through the text or enlarged the images to full screen by touching the computer screen. This program was comparable to an electronic training manual.

Following this effort, grant funds were used to refine the existing concept of an electronic training device into a product which would allow for actual in-field training of pesticide applicators. The product was also part of an experiment to determine the feasibility of using level three interactive video to train pesticide applicators.

In 1986, a project was contracted with the Virginia Tech Learning Resources Center (LRC), Educational Technologies Division, to work cooperatively with subject matter personnel to develop an interactive video-based system to train pesticide applicators. The spring of 1987 was used to develop a concept model of the subject matter and to determine the learning patterns of the typical pesticide applicator.

The concept model assumes that applicators learn how to handle pesticides through several processes including classroom training, on-the-job training, basic information manuals, and testing. This was the premise used to build the courseware module, where the applicator first receives basic information via on-line help, screens and visuals, and a tutorial similar to the information they would receive in classroom training. Then, a simulator provides an opportunity for application of

these concepts such as one would receive in hands-on training. Finally, an on-line exercise simulates the tests given applicators who must comply with state certification requirements. After development of a model delivery system, the subject matter was divided into 15 lessons based on the curriculum topics outlined in the introduction. The model system would then be used to deliver training for each topic as funds became available to produce new courseware modules. It was decided that this particular effort would center around the development of one topic which was best suited for use with interactive video. To accomplish this, another model was built which was based on the tasks associated with pesticide application and handling. The task model was used to study the steps associated with the decision process carried out by each applicator conducting their job. By studying each task associated with the process, and the pesticide applicator training curriculum needs, it was decided that the fundamentals of sprayer system calibration was the ideal module to fit this model delivery system for development under the project.

Of all of the topics of pesticide education, sprayer system calibration is one of the most difficult to teach. Due to its complexity, applicators shy away from dealing with calibration in training, as well as in actual field application. This avoidance can result in serious problems. Over application can have undesirable environmental effects and/or produce unacceptable chemical residues in the food supply. Under application can contribute to pest resistance and crop damage, and waste precious resources for the applicator. To complicate the situation, the instructor may also avoid teaching the subject because of difficult mathematics and the number of possible workable solution methods. Interactive video is ideally suited for the difficult task of teaching calibration for several reasons. The method allows the instructor to track a student's progress and assess how well they were able to follow the lesson. In addition, students may work at their own pace, which is very important with pesticide applicators since individual educational levels differ greatly. Interactive video also allows for delivery of a uniform program which presents the same information to all students. In traditional programming, training may differ from one county Extension program to the next due to differences in agent knowledge, confidence, ingenuity, and attitudes toward the subject matter. Thus, use of interactive video can provide statewide continuity and quality in programming, which is particularly important in the case of a critical but conceptually difficult topic such as calibration of a spraying system.

The project to develop a working module was started in July, 1987. Script writing and project layout were followed by video production and program writing. In March 1988, in-field video was completed, followed by audio production and final editing for pressing a check-disc. At the same time, generation of computer graphics and program testing took place. A check-disc was obtained in May and used to finish the interactive design process.

This final stage of development also included peer review, student testing, software documentation, and refinement of the final product. As part of this review process, the program was tested by over 100 students from various backgrounds. The project was completed in August,

1988. The final product is packaged in a folding case and is currently available for distribution. The program takes about one hour to complete. It can be used to train farmers, agriculture students, and commercial pesticide applicators in sprayer system calibration.

The program was developed using IBM InfoWindow Pilot Presentation Authoring Software. The hardware configuration used for development was the IBM InfoWindow Display, IBM PC/XT, and a Pioneer 6000 Video Laserdisc Player. The software was programmed to use the InfoWindow touchscreen. A 12-inch laserdisc was mastered with 23 minutes of video motion, audio, and over 3,500 still images from 35mm slides. The computer program was designed to run with IBM InfoWindow PILOT-Presentation Runtime software.

Since completion, the product has been used by hundreds of people at national meetings, Extension demonstrations, and research field days. In addition, undergraduate and graduate students have used the tool as part of formal coursework and on an as-needed tutorial basis. The use of interactive video during classroom use in Virginia Tech's College of Agriculture and Life Sciences Agricultural Technology curriculum has provided some measurement of the program's potential value. Over the past two years, this program has been used in a pest control course to teach sprayer calibration principles. Of the 18 students completing the module, 17 scored 100% on the exercise section of 24 questions after completing the initial parts of the program (a tutorial and simulation section). The other student scored 96%, missing one of the questions. The students in these classes are vocational students who will return to agricultural operations after their two-year educational experience. They are often right off the farm and serve as a good barometer of the younger farm generation's aptitudes and attitudes.

However, the typical American farmer is over 54 years of age and has a high school education. The success in classroom use will hopefully be reflected by in-field use of the program for recertification training of private applicators. This step of the process has begun with installation of a workstation in the Montgomery County Extension Office in September 1990. This trial will involve the instruction of local farmers using the software for accreditation under the Virginia Pesticide Applicator Certification Program. We will report on the results of this phase at a later date.

Even if the trial use by a local Extension office is successful, the future use of the program is questionable over the short term. The use of interactive video in pesticide applicator training is a logical means to provide much needed, individualized, intensified training. Unfortunately, the costs of media development and hardware is currently prohibitive for use in Extension field offices in most states. In Virginia, the process of placing this program in the hands of the users for which it was designed is proceeding very slowly, although several training stations will be in place by 1992.

Satellite-broadcast Programming

One major problem associated with conducting a statewide training program is the need to provide a uniform message to all students enrolled in the program. Another concern is the demand on the time and resources of instructors at every training site. In Virginia, an average

of 300 meetings are held annually by Virginia Cooperative Extension to train applicators for certification and recertification credit at over 100 county and city unit sites.

For Extension, a lack of resources to support pesticide applicator training over the past 10 years has caused many programs to stagnate. This was especially true of programs held for private applicators at the county level. Most of this problem was caused by the lack of funds to purchase support media and a wide variation in the interest and expertise of Extension field personnel conducting the training. The result has been excellent programs in some counties and marginal or poor ones in others. The quality of the message to the applicator has varied, resulting in uneven support for the program at the state level.

A different problem existed for commercial applicators. Here the largest difficulty was the lack of local training programs, resultant loss of time on the job, and costs of travel to regional workshops. In addition, many commercial applicators had few opportunities to earn training credit in an accreditation cycle due to the scarcity of state-approved workshops. This problem was most severe for applicators certified in specialized categories such as seed treatment, aquatic pest control, or demonstration and research. Even for applicators in the mainstream, which included those working in ornamentals and turf or general pest control, it wasn't always convenient to attend a meeting in another part of the state. It involved travel, lodging, loss of work time and, in the winter, the dangers of hazardous roads.

In 1987, the Virginia Cooperative Extension Service initiated program delivery via satellite. The use of the university up-link facility was a unique opportunity to provide Extension clientele programs in local areas all over the state at one time with minimal travel and costs to both the student and instructors.

In February, 1988, Virginia Tech delivered the first organized pesticide applicator training programs using this technology. Program format included one and one half hours of instruction and one half hour for an interactive question and answer segment where applicators could call the instructor using a toll-free number to the studio. Their voices were heard over the air to allow the audience to monitor the feedback. Two programs were viewed by 576 persons, mostly private applicators, at 31 downlinks statewide. Program subject matter included farm health hazards, personal protection, and regulatory changes. Contacts from other states indicated that the programs were also received by 12 states. A third teleconference was conducted in May on the Hazard Communication Standard for the 31 downlinks in an evening session to an estimated 300 farmers. This session was one hour in duration including a 20 minute question and answer segment.

In December, 1988, two new teleconferences, following a similar format to the February 1988 programs, were aired, but this time they were offered for recertification credit to both private and commercial applicators in Virginia. Each participant was asked to complete an application for recertification credit which was sent to the state regulatory agency for credit. Participants were provided with information on pesticide storage technology and protective clothing and equipment. Programs were viewed live by 971 applicators at 42 sites in Virginia. In other states, programs were either viewed live or,

as was the case in most instances, taped for later use. One exception was South Carolina, where the live sessions were viewed by 280 applicators. Program evaluation results for these two teleconferences indicated that these programs were high quality in nature. Most applicators rated the programs very good to excellent. Participants did not feel that the use of satellite technology affected the program quality in any way. The results indicated that most participants felt that the information was valuable to their professions and would be used to improve their pesticide management practices; most indicated a willingness to attend another teleconference session.

In December, 1989, two additional programs were delivered via satellite; their topics were protection of water resources from pesticide contamination and advanced pesticide handling technology. Over 4,000 applicators viewed the sessions live or on videotape. The entire workshop curriculum included on-site speakers and the taped or live broadcast, so sessions using the live broadcast and the pre-recorded videotape were essentially the same. Evaluation surveys and the information required by the regulatory agency to apply for re-certification credit were given to viewers in different sections of one form. The programs were delivered live at 56 downlinks, and seen in these and other locations using tapes at a later date. Commercial applicators were asked to pre-register, which allowed agents to assess the nature and size of the audience in advance. High levels of interest prompted many to offer the sessions several times, both live and using recordings of the teleconferences at a later date. Again, session format was essentially the same as the 1988 programs.

Multimedia Demonstration Kits

In various forms, field demonstration kits have been used for a number of years to train pesticide applicators. In Virginia, multimedia kits are being developed using the topics and video footage from the teleconferences. For example, one such kit is being developed using existing edited video on protective clothing and equipment and advanced pesticide handling technology. In addition to the finished videotape, this kit will include samples of protective clothing, posters, publications, and an exhibit board for using the materials at fairs and other static demonstrations. The other use of the package will be for in-field teaching using only the support materials in the kit. Similar kits are being developed on water quality and storage.

The multimedia kits are an Extension of the video teleconferencing and interactive video training programs. They are the first effort to establish in-field demonstration programs based on the efforts of Extension agents, specialists and local applicators who are willing to cooperate to establish "training-by-example" programs at the county or multi-county levels. The goal will be to use the practices of some progressive and innovative clientele to set an example for the more reluctant clientele. This practice is an old one in Extension, but has not been extensively used in pesticide safety training. This effort will continue in order to establish two to four "training-by-example" cooperators by 1992.

Summary

Pesticide applicator training is one of a number of nationally coordinated programs made available by

the hard work of many Extension specialists and agents. While the pesticide applicator training program's success is hard to measure, it has no doubt protected the health of many applicators, as well as that of the public at large. This program is not a flashy one which immediately catches the attention of the public or our peers in the institutions that we serve. In fact, according to a recent American Farm Bureau Federation survey, most Americans are not aware of the existence of Extension's education efforts. However, pesticide applicator training is EPA and state-mandated and thus is more in demand each year. Responsible applicators, who live and work in the environment in which pesticides are used, are greatly concerned about personal and environmental safety for themselves, their families, their customers, and the consumers of their products. Therefore, pesticide applicator training programs are eagerly sought. Unfortunately, as a result of the aforementioned lack of attention, the program as a whole is not heavily funded by either state or federal agencies. Poor support has placed a strain on Extension's pesticide education program, especially in light of the demands and expectations placed on it.

Virginia Extension is making an effort to produce pesticide applicator training that is something other than ordinary. By providing trainers with new methods to educate their clientele and continuing to work on training program content, instructional design, and delivery techniques, we hope to continue to provide quality education to the public. By using interactive video for individuals, multimedia programs for small groups, and video teleconferencing for larger groups, along with traditional methods, we hope to offer a comprehensive program to the clientele in Virginia.

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