Using Retrospective-Post Evaluations to Measure the Impact of Pest Management Training for School IPM Coordinators in Texas

Janet A. Hurley, Extension Program Specialist-School IPM
Department of Entomology
Texas AgriLife Extension Service
Dallas, TX
ja-hurley@tamu.edu

Michael E. Merchant, Professor, and Urban Entomologist;
Department of Entomology
Texas AgriLife Extension Service
Dallas, TX
m-merchant@tamu.edu

Paul E. Pope, Extension Program Specialist;
Department of Agricultural Leadership, Education & Communications
Texas AgriLife Extension Service
College Station, Texas
p-pope@tamu.edu

Christopher Boleman, Assistant Professor, and Extension Specialist
Department of Agricultural Leadership, Education & Communications
Texas AgriLife Extension Service
College Station, Texas
ct-boleman@tamu.edu

Don L. Renchie, Assistant Professor, and Extension Specialist
Department of Agricultural and Environmental Safety
Texas AgriLife Extension Service
College Station, Texas
d-renchie@tamu.edu

Introduction

Integrated pest management (IPM) is a knowledge-intensive strategy for managing pests using sampling, pest damage thresholds, knowledge of pest biology, and multiple control tactics selected to pose minimal health and environmental risks (Bennett, Owens, & Corrigan, 2003). The IPM process requires greater understanding and skill on the part of its practitioners compared to conventional, pesticide-intensive approaches.

In 1991, Texas passed one of the first state laws requiring that pests in and around public school buildings be managed using IPM. The Texas school IPM law further requires certification of all persons applying pesticides on school district property, and mandatory training for school administrators in charge of pest control (i.e., IPM coordinators). By state regulation, all district

IPM Coordinators are required to attend a six-hour training course covering state pesticide regulations and the basic principles of IPM (Owens, 1999; Texas Pesticide Information Network, 1999).

Since 1995, when these regulations went into effect, Texas AgriLife Extension (formerly Texas Cooperative Extension) has conducted training classes for school IPM coordinators. Class subject matter included the principles of IPM, proper inspection methods, pest identification, use of non-chemical control tactics, basic pesticide science, and regulations affecting pesticide use in schools. In 2001, a school IPM program coordinator was hired to organize training programs and develop other outreach and awareness programs for school IPM stakeholders. A team of Texas AgriLife Extension faculty and interested IPM professionals was also assembled at this time to form the Southwest Technical Resource Center for School IPM (SWTRC).

Since 2003, four region-based, two-day training courses were offered annually by the SWTRC in Texas. The first day of training was designed to cover subject matter required by the state to be taught to all new IPM coordinators. Incorporated into this day-one mandatory training was a hands-on exercise in which coordinators were provided an empty insecticide container and asked to identify (in front of the group) the product trade name, active ingredient, and signal word. Participants were then asked to classify each pesticide product as “green”, “yellow”, or “red”, according to categories established by state regulations. This classification skill has consistently been one of the most difficult skills for new IPM coordinators to acquire, because of the understanding of pesticides and their modes of action necessary to perform this task.

The second day of these region-based training classes was designed to cover advanced topics in IPM, beyond the basic subject matter required by the state. Recently, the school IPM team has enhanced day-two training by utilizing additional Extension specialists with expertise in a wide variety of topics relevant to coordinators such as turf management, insect identification, rodent exclusion and removal, and pesticide safety.

One of the challenges in conducting Extension training courses is measuring the impact and satisfaction levels among class participants. Two traditional assessment tools include pre- and post-testing and retrospective-post evaluations (Klatch and Taylor-Powell, 2005). The pre-post design requires administration of a knowledge exam both before and after the course. Disadvantages of this method include time to develop a valid exam that effectively measures knowledge, and the extra time needed in class to administer the exam. In this project, pre-post-tests and retrospective-post evaluations were used.

Purpose and Objectives

The purpose of this study was to determine the educational impact of school IPM training and to compare two different methods of assessing student learning. Specific research questions are noted below:

1. Did participants increase their knowledge of IPM?
2. Did participants increase their knowledge of the Texas School IPM law and regulations?

3. Were participants satisfied with the training?
4. To what extent were training topics chosen for the classes useful to them?

Evaluation Methodology

In 2003 and 2004, all region-based training course participants were evaluated using a traditional pre-post test for measuring change in knowledge. In 2005, the IPM team transitioned to a retrospective-post evaluation (Pratt, McGuigan, & Katsev, 2000), which has been used to date.

2003 – 2004 Instrument. In 2003 and 2004, we evaluated twenty-four groups of school district IPM coordinators who attended training courses taught by faculty of the SWTRC. Participants were asked to answer ten multiple-choice questions about school IPM concepts and regulations related to pesticide use in schools. The same test was administered both before and after the course. The difference in the number answered correctly used as an indicator of knowledge gained as a result of the training.

Revised Instrument. In 2005, we used a retrospective-post design questionnaire (Pratt, McGuigan, & Katsev, 2000) to assess learning among eight classes of school IPM coordinators. Using this method, data was collected at the conclusion of training only, saving time and assessing participants' own perception of learning during the course. Participants were asked to reflect on their level of understanding on topics before the program, and then provide their level of understanding after the program. Specifically, the revised instrument measured: (1) perceived change in understanding via a retrospective-post evaluation, (2) overall satisfaction with the training and (3) usefulness of specific information presented.

Quantitative data were analyzed using SPSS 15.0 for Windows software. Descriptive statistics were used to summarize data. Frequencies, percentages, central tendency measures, and variability measures were used to describe these data. Confidence intervals and tests for statistical significance were set *a priori* at the 0.05 level. In addition to significance testing, effect size was examined using Cohen's d – a measure of standardized difference between means – in order to determine if meaningful differences existed (Cohen, 1988). Cohen's broad guideline for interpreting the statistic was also used where 0.2 is indicative of a small effect, 0.5 a medium effect, and 0.8 a large effect (Cohen, 1988; Cohen, 1992).

Results

2002-2003 Results. Accuracy of pre- and post-test assessments is highly dependent on the quality and number of questions chosen for the evaluation. Unfortunately, due to time considerations, test length was limited to only ten questions. We felt that the shortness of the exam limited the use and meaningfulness of this instrument; nevertheless, participants improved their scores 27% and 22% in 2002 and 2003, respectively.

2005 Results. In 2005, 134 participants completed a retrospective-post evaluation instrument (Day-one training only). Results indicated that coordinators had high satisfaction levels with the training overall. On a five-point scale of satisfaction ranging from 1="*not at all*" satisfied to 5="*completely*" satisfied, the mean score was 4.8. Virtually all coordinators (99%) were

"completely" or "mostly" satisfied with the training. Similarly, results indicated that coordinators found the training useful. On a five-point scale of usefulness ranging from 1="not useful" to 5="highly useful", the mean score on five facets of the training ranged from 4.6 to 4.7.

Participants indicated significant gains in their understanding of IPM concepts and their confidence in being able to fill the role of IPM coordinator (t-test, $P<0.05$). Average percent changes in understanding ranged from 37.8% to 65.2% for the different questions asked (Table 1). Cohen's d statistic indicated a large effect for all questions asked.

Table 1. Self-evaluations of understanding of IPM and pesticide regulations as determined by a retrospective-post questionnaire[1] given to participants at school pest management training in 2005 (n = 134).

Level of understanding of Participants	**Before Mean**	**After Mean (% change)**	**Difference ± SEM**	**t**	**d.f.**	**Cohen's *d* statistic[2]**
I understand the principles of IPM practices	2.81	4.46 (58.7)	1.67±0.10	17.04**	131	1.66
I understand the paperwork requirements for pesticide applications for yellow and red list products	2.67	4.41 (65.2)	1.74±0.10	16.75**	131	1.56
I understand when you must notify building occupants about pesticide applications	3.39	4.67 (37.8)	1.28±0.11	11.84**	132	1.20
I feel comfortable that I have the skills needed to implement an IPM program	2.73	4.28 (56.8)	1.55±0.10	16.01**	132	1.37
I understand my role as IPM Coordinator	2.80	4.42 (57.9)	1.61±0.11	14.21**	127	1.36

1Based on modified Likert scale where: 1 = *Not at all* , 2 = *Slightly,* 3 = *Somewhat,* 4 = *Mostly*, 5 = *Completely.*
[2]Cohen's d measures affect size as a standardized difference between two groups, where $d > 0.8$ is considered a "large" effect. (Cohen, 1988)
** significance using the t-statistic ($P<0.01$).

In 2006, 115 participants completed the instrument on day-one training and 67 participants completed the instrument for day-two training.

Results indicated that coordinators were highly satisfied with the day-one training with an average satisfaction rating of 4.8 (out of 5). All coordinators were "completely" (84%) or "mostly" (16%) satisfied with the training on both days. The coordinators also found the training useful. Course content was useful to participants with an average score of 4.7 (out of 5).

Results of day-one training in 2006 were similar to those from 2005. Participants indicated significant gains in their understanding of IPM concepts and their confidence in being able to fill the role of IPM coordinator (t-test, $P<0.05$). Average percent changes in understanding ranged from 40.1% to 61.8% for the different questions asked (Table 2). Cohen's d statistic indicated a large effect for all questions asked.

Day-two evaluations indicated that coordinators were highly satisfied with the training, with an average satisfaction rating 4.82 (out of 5.0). All coordinators were "completely" (82%) or "mostly" (18%) satisfied with the training. Course content was useful to participants with an average score of 4.65 (out of 5).

Participants indicated significant gains in their understanding of the major learning objectives for day-two (t-test, $P<0.05$). Average percent change in understanding ranged from 44.7% to 57.2% (Table 3). The associated effect size was large for all knowledge areas (Cohen's d test).

Table 2. Self evaluations of understanding of IPM and pesticide regulations as determined by a retrospective-post questionnaire[1] given to participants on day-one of school pest management training in 2006 (n = 115).

Level of understanding of Participants	Before Mean	After Mean (% change)	Difference ±SEM	t	d.f.	Cohen's d statistic[2]
I understand the principles of IPM practices	2.83	4.40 (55.5)	1.57±0.09	17.90**	114	1.55
I understand the paperwork requirements for pesticide applications for yellow and red list products	2.67	4.32 (61.8)	1.57±0.10	15.84**	114	1.42
I understand when you must notify building occupants about pesticide applications	3.32	4.65 (40.1)	1.32±0.11	12.48**	114	1.28

I feel comfortable that I have the skills needed to implement an IPM program	2.92	4.40 (50.7)	1.49±0.11	13.93**	112	1.36
I understand my role as IPM Coordinator	3.00	4.60 (53.3)	1.61±0.12	13.53**	113	1.40

1Based on modified Likert scale where: 1 = *Not at all* , 2 = *Slightly,* 3 = *Somewhat,* 4 = *Mostly,* 5 = *Completely.*
[2]Cohen's d measures affect size as a standardized difference between two groups, where d > 0.8 is considered a "large" effect. (Cohen, 1988)
** significance using the t-statistic (P<0.01).

Table 3. Self evaluations of understanding of IPM and pesticide regulations as determined by a retrospective-post questionnaire[1] given to participants on day-two of school pest management training in 2006 (n = 67).

Level of understanding of Participants	**Before Mean**	**After Mean (% change)**	**Difference ±SEM**	**t**	**d.f.**	**Cohen's d statistic[2]**
I understand the three most common types of rodents	3.13	4.70 (50.2)	1.57±0.13	11.92**	66	1.65
I understand the importance of pre-baiting for a rat control program	3.04	4.78 (57.2)	1.73±0.13	13.46**	66	1.88
I understand how to select a least toxic pesticide for at least one pest in my school district	3.16	4.63 (46.5)	1.46±0.14	10.33**	66	1.48
I feel comfortable I have the skills needed to organize my school district's IPM program	3.06	4.54 (48.3)	1.48±0.13	11.52**	66	1.42
I understand the difference between an IPM policy statement and an IPM plan	3.18	4.60 (44.7)	1.42±0.13	10.79**	66	1.41

1Based on modified Likert scale where: 1 = *Not at all* , 2 = *Slightly,* 3 = *Somewhat,* 4 = *Mostly,* 5 = *Completely.*
[2]Cohen's d measures affect size as a standardized difference between two groups, where d > 0.8 is considered a "large" effect. (Cohen, 1988)
** significance using the t-statistic (P<0.01).

Conclusions, Recommendations and Implications

One of the factors contributing to the success of any IPM program is training. School IPM training provides IPM coordinators a chance to learn the laws and rules governing pesticide use

in schools and basic principles of IPM, as well as more advanced topics (day-two training). This statute requires that Coordinators be taught both mandated procedures, but also learn behavioral concepts that only happen over time.

This requires that the six-hour mandated training class include lectures on school IPM regulations, pesticide safety, and basic IPM tenets. These classroom lectures provides the foundation of concrete learning having both the spoken and written word given at the same time. The majority of adult learners also need a tactile or kinesthetic part to any new training; the school IPM team enhances this with the hands-on portion of the day using empty pesticide containers and IPM inspection walk-through on every school site.

IPM is a process. In states like Texas that have a school IPM law, disseminating information can be difficult. The Diffusion Model is a broad model that can explain the technology adoption process in a social community, like schools, and can help the person promoting the new technology to see it from a potential adopters point of view (Green et. al., 2008). That is why the measurement of these training evaluations is so remarkable. Integrated pest management is a concept that requires time to master, but the basic principals of IPM can be taught in a short time period.

This mandated standardized training for all school IPM coordinators benefits Texas schools by improving implementation of IPM principals and assisting Texas school IPM coordinators in passing inspections conducted by the Texas Structural Pest Control Board (TXSPCB). Since 2002, the TXSPCB has inspected public schools in Texas to ensure adoption and implementation of school IPM regulations.

Developing and implementing standardized training programs for school IPM coordinators is essential. While IPM is a still a strategy that is learned over time, this study indicates that training can be effective in quickly raising participants' knowledge and competence level in applying IPM principles in a school setting. Extension agencies should consider implementing an organized training program offered to school IPM coordinators on a routine basis.

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Abstract

Integrated pest management (IPM) is knowledge intensive strategy for managing pests that requires practitioners to understand several key principles; one of the challenges in conducting Extension training courses in IPM is measuring the impact of this knowledge. This article reports research on what IPM Coordinators in Texas are learning and the impact this has on their IPM program. Using a retrospective-post evaluation instrument participant's increased their knowledge by 37.8% to 65.2% and 99% of attendees were completely satisfied with the training. Measuring impact can be done using standardize training for IPM Coordinators.

Keyword List

Integrated pest management, school IPM, measuring impact, retrospective-post evaluation instrument