1996-97 Annual Compendium of Articles, Conference Reports, and Research

Associated With

The National Institute of Environmental Health Sciences'

Worker Safety and Health Training Program

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Introduction

Included in this compendium are articles and reports documenting the progress of the Worker Safety and Health Training Program administered by the National Institute of Environmental Health Sciences (NIEHS). Also included are documents by those associated with the program that discuss issues important to HAZMAT training.

Since the NIEHS Worker Safety and Health Training Program began in 1986, more than 100 organizations from across the country have trained workers to better protect themselves, their colleagues, and the communities in which they work from the dangers of hazardous materials. As a result of these programs, trained employees work more effectively at their job sites to promote safer processes and procedures. Twenty awardee groups and consortia, representing labor-management, labor, and academia, have developed model curricula and delivered training to half a million workers.

The 1986 Superfund Amendments and Reauthorization Act of 1986 (SARA) authorized a program of grants for safety and health training for workers involved with hazardous materials and waste removal, containment, and emergency response. NIEHS was assigned responsibility for administering the grants program with recipients to be non-profit organizations with demonstrated experience and ability in reaching target populations and operating worker safety and health programs. The Department of Energy also has a cooperative agreement with NIEHS to make training grants. In addition, Congress appropriated money for a Minority Worker Training Program to establish a series of national pilot programs. These programs test a range of strategies for the recruitment and training of young persons living near hazardous waste sites or in communities at risk of exposure to contaminated properties for work in the environmental field.

Evaluating Health and Safety Training Programs

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There are four key questions that need to be answered in order to effectively evaluate any training program; they are:

1. To what extent was the training program appropriate for the participants of the program?

2. To what extent was the training implemented?

3. To what extent did the training cause the anticipated outcomes, both short-term and long-term?

4. To what extent can the training be applied in other contexts with different people or at different places and times?

Anyone who invests time and energy in developing (or buying) training programs wants answers to these questions. Both qualitative and quantitative research methods have a role to play in answering them. Research conducted to answer each of these questions gives insight into different types of evaluation.

Appropriateness of Training

Formative evaluation is research conducted to learn about the needs, wants, and desires of training participants. Research might reveal that they need knowledge in a certain area or specific skills in another area. It also assesses how participants might learn best, the settings that might be most conducive to learning, and what might be perceived barriers or benefits to them thinking or acting a certain way. By doing a little formative research trainers can gauge what knowledge or skills they should emphasize for a specific audience, as well as to accommodate different learning styles to optimize learning. Often, formative research is done directly by interviewing audience members either one-to-one (in-depth interviews) or in small groups (focus group) or indirectly by

reviewing the literature. Again, formative research is used to design or modify training programs so that they "fit" the needs of training participants. Focus groups are a commonly used research method for program planners.

Focus Groups

Focus groups allow program planners to learn about their target audience's knowledge, attitudes, and practices regarding a particular issue. Information collected from focus group discussions can be used to decide:

- who the primary <u>audience</u> for the training should be? who are secondary audiences? (e.g. who needs the information or skills the most?);

- what the <u>content</u> of the training program should be (e.g. should it be fact-oriented, motivational, or skills-building in nature?);

- what the <u>format</u> of the training should be (e.g. lecture, hands-on practice sessions, small group discussions, role playing, and/or simulations);

- what the <u>costs</u> should be for participants and their sponsors (e.g. money, transportation, energy and time);

- <u>where</u> the training should be held;

- <u>when</u> the training should be held (e.g. best time of year or week or day); and

- what's the best way to <u>promote</u> the training program among the intended audience(s).

Focus groups are usually composed of six to twelve people who are similar to each other (either in age, gender, or trade). The group meets in a relaxed, informal setting to participate in a semi-structured interview. A moderator guides the discussion in a way that stimulates interaction and encourages sharing of feelings, attitudes, and ideas from all group members on a specific topic. Usually, the discussion is either tape-recorded or videotaped so that program planners can review the information discussed and incorporate ideas into their curriculum or modify their curriculum based on suggestions of group members.

Focus groups have many <u>advantages</u>, including:

- they are relatively inexpensive;

- they can be arranged and completed in a short time frame;

- they can easily be carried out among a variety of groups;

- they elicit a wide range of ideas because of the interaction between group members;

- they allow for clarification of ideas (the moderator can ask questions to make sure ideas are clear); and

- they encourage spontaneous and open, honest expression among members.

Focus groups have a number of disadvantages as well, including:

- they provide qualitative data, not quantitative data that can be analyzed statistically;

- they are not random samples so results from focus groups cannot be generalized to entire populations;

- they may not be representative of the population you intend to reach because the recruitment process may be both difficult and biased (workers who participate in a focus group could be very different from workers who choose not to participate in a focus group); and

- the results often are dependent on the skill of the moderator (Did the moderator create an environment in which all members could participate? Did the moderator ask participants for clarification of key ideas or issues when necessary?)

Focus groups have much to offer in the way of helping planners to develop effective, "tailored" training programs for specific groups, but they should not be the only means for making key decisions; it is important to use focus groups in conjunction with other research methods.

Implementation of Training

Process evaluation, often referred to as tracking evaluation, is research that investigates whether the training program was fully implemented. Questions asked include:

- Did people attend the training program (how many)?

- Did the instructor follow the curriculum (how closely)?

- Did the environment support or hinder the training experience?

- Did participants like the program?

- Did participants find the training useful for or relevant to their job?

Process evaluation is the most common type of evaluation. Trainers usually have to report what they taught (curriculum/topic), to whom, at what place, and at what time. They usually also give students an opportunity to assess their performance and make suggestions for improving the training experience for others.

Impact and Outcomes of Training

Impact and outcome evaluation is conducted less often than process evaluation. Impact evaluation looks at the short-term or immediate effects of the training program. Often, trainers will give tests before and after the training to measure changes in knowledge or skills that can be directly attributed to the training. Outcome evaluation, which looks at the long-term effects of training, is rarely done because it is very complex and expensive. If it were done well, it would require an experimental design which would randomly assign workers to groups that would receive training and groups that would not receive training and then follow them for a number of years to see if there are differences in injury rates or property damage due to lack of training. Because training is required for certain types of workers, withholding training which might protect them from harm is unethical. Also, because there are so many factors that influence injuries (e.g. management emphasis on safety; equipment maintenance; production demands) it is still difficult to show a clear causal link between training and injury/accident prevention. Another way to look at long-term outcomes is to investigate accidents after they occur to explore all the factors that might have contributed to its occurrence; certainly, training should be assessed as one of many factors. In-depth interviews with workers and managers, written surveys of employees, site inspections, and curriculum review are all techniques used for doing this kind of retrospective outcome evaluation.

Generalizability of Training

Experimentally designed research among many different audiences and contexts can provide important information about what might work best in different places among different people groups. In this scenario, different groups of people receive different training programs and then comparisons are made across groups to assess factors that seemed most influential for each group. This information is usually published so that others designing training programs can use these findings to shape their programs.

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MEASURING IMMEDIATE OUTCOMES OF TRAINING:

AN INTERACTIVE, TRAINEE-CENTERED APPROACH

by

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One of the most important challenges we face as trainers is to accurately measure the immediate outcomes of training. This allows us to determine whether or not major training objectives have been met by the end of a course. This, in turn, allows us to identify weak areas and make needed improvements in our courses.

Within the past year, the UAB/CLEAR instructional staff has done a major revamp of our hazardous waste site worker course. This effort centered around adoption of an interactive, participant-centered approach to training. Our procedures for measuring the immediate outcomes of training were also modified based on the same principles. Our goals in making these modifications included the following:

- Make measured outcomes less dependent on trainee reading and writing capability.

- Make measurement and evaluation an embedded part of the   teaching/learning process.

- Make the process less stressful than a conventional written testing approach.

    In this chapter, I will describe three interactive measurement methods we are currently using to achieve these goals.

Method 1. Skills Performance Checklists

An example of a skills performance checklist is included in Appendix 1. You can use checklists to be sure that all steps in a process are completed in the correct order.

You can use the type of form shown in Appendix 1 to document that a trainee has learned to use a self-contained breathing apparatus. This

includes procedures for inspection, donning, doffing, and air cylinder change. The same form can also help trainees to learn those procedures.

You can use checklists in various ways. These ways include:

- Using the checklist yourself to check trainees out.

- Allowing trainees to use the checklist to check themselves out.

- Dividing a class into pairs so students can check each other through the list using the buddy system.

    We could probably argue about whether checklists are a training tool or a device for measuring the outcomes of training. Ideally, they combine both functions.

<u>Method 2. Pictorial/Written Examination</u>

In conjunction with other changes in our site worker course, we got rid of our written final exam. Our reasons for this included the following:

- Written exams discriminate against trainees who don't read and write well.

- Written exams don't incorporate well into the teaching/learning process. At best, they serve strictly as a tool for measuring the outcomes of the process.

- Written exams give students the feeling of being tested. This can result in test anxiety and invalid exam results.

- Written exams tend to be boring and unpleasant to take.

  We replaced our written exam with a pictorial/written exam. Our new exam is included in Appendix 2. This type of exam offers the following advantages:

- You can use it effectively with trainees of all literacy levels. If need be, you can make transparencies from the illustrations and give the exam using an overhead projector.

- You can present the exam as a class exercise or activity, rather than a test. This reduces text anxiety.

- You can review the entire exam with overhead transparencies after trainees complete it. This allows you to clear up points of confusion, and be sure that learning objectives have been achieved.

- The exam review is a part of the teaching/learning process. It serves as a springboard for valuable discussion. We have actually included the new exam in our update courses. It is presented as an activity titled "General Topics Review".

- The examination process is almost fun in comparison to a written test.

<u>Method 3. Final Field Exercise</u>

In this exercise the entire class responds to a simulated hazardous waste site emergency on the training field. However, student involvement begins long before the class hits the field. All trainees are actively involved in assessing hazards and planning for the response. This requires decision-making and utilization of skills from the entire course. It also, allows a chance for us to monitor trainee performance and provide assistance as needed.

When the class hits the field, trainees execute the plan they have developed.   The field exercise is exciting and fun. It also serves as an excellent way to measure the mastery of basic skills. These include skills such as use of protective equipment, hazardous materials control procedures, and decontamination.

We have all heard the old saying that a picture is worth a thousand words. If that is true, then a video cassette is worth a million words. This is the reasoning behind our use of video for review of the final exercise. After the exercise, the entire class reviews the video footage. This serves as a basis for discussion of good and bad techniques seen in the field. It is also fun for everyone involved.

CONCLUSION

We have found the methods described here to be appropriate for measuring the immediate outcomes of training. These methods incorporate both classroom and field performance into the process. They are not stressful to workers. We can adapt them to all literacy levels. In short, these methods place the trainee, rather than a written test, at the center of the measurement process.

Interactive, trainee-centered methods also allow identification of unachieved training objectives while a course is still under way. The same methods can also provide a means for achieving those objectives. These methods can therefore be considered a part of the teaching/learning process as well as the measurement process.

PITFALLS OF CONVENTIONAL COURSE EVALUATION FORMATS

By

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I believe all labor educators will agree that feedback from trainees is important for training process evaluation. We at UAB/CLEAR have conducted NIEHS-funded Hazardous Waste Operations and Emergency Response (HAZWOPER) courses for most of the last nine years. During most of that time, we used conventional course evaluation forms to get feedback from trainees. In this chapter, I will use our program as a case-history in describing some of the pitfalls we encountered. I will also describe recent changes we made in an attempt at improvement.

What I am calling the "conventional approach" uses standardized course evaluation forms such as the one shown in Appendix 1. In this approach, each trainee completes and turns in a course evaluation at the end of each course. These evaluations are intended to provide an assessment of training from the trainee's point of view. These insights are intended to be used to improve training. This method of process evaluation is probably familiar to us all. It has been in common use, with minor variations, for years.

PITFALLS OF THE PROCESS

Nine years ago an initial group of instructors parachuted into UAB/CLEAR and began HAZWOPER training. At that time, we were given the course evaluation format shown in Appendix 1 as a standard. I don't know where the format came from. However, we dutifully used it without question for years, sort of like trainer zombies in a George ("Night of the Living Dead") Romero movie. However, over several years of training, we gradually became aware of major problems in our course evaluation process. These problems were related to the basic concept and format of our course evaluation form.

In the following paragraphs, I will work through the evaluation format shown in Appendix 1 section by section. As I do so, I will describe some of the problems we encountered in using it.

Section 1: Rating Overall Effectiveness of Training

This section simply asks, "After taking this course will you be able to perform your job better?" This is obviously an important question. However, wouldn't a better question be, "After taking this course will you be able to perform your job more safely?"

I realize this may seem like a minor point. However, "better" and "safer" may not be synonyms for everyone. This calls into question the amount of thought put into developing the form.

Section 2: Rating Instructor Presentations

In our program, this section functioned mainly as an instructor popularity contest. I became aware of this after realizing that our worst instructor consistently received superior presentation ratings.

The instructor in question often used incorrect terms, provided incorrect information, and made disorganized presentations. Also, he constantly told war stories. These often strayed from the topic and sometimes consisted of obvious lies. Needless to say, he is no longer employed in our program.

How, you might ask, did such an instructor get superior ratings? Simply stated, he was very well liked by our trainees. He joked with them during class, smoked with them during breaks, and organized recreational events after hours. As a result, he was popular with our students and consistently received superior student evaluations.

Section 3: Rating Coverage of Topics

Results from this section often were not consistent with results from section 2. For instance, a given trainee might rate my presentations in a course with low scores in section 2. However, the same student might rate coverage of the topics I presented with high scores in section 3. While I am admittedly multi-talented, I always found it baffling that I could make presentations that were simultaneously seen as bad and good.

In some cases, topics would appear in section 3 which had not actually been covered. In such cases, we would remind trainees not to evaluate those topics. In such cases, almost all trainees would evaluate the topics which had not been covered. This caused us to doubt the validity of the student feedback we were receiving.

Section 4: Rating Course Interest Level, Materials, and Quality

Our major complaint about this section was that results were too general. For example, do poor ratings on audiovisual materials apply to the course as a whole? If not, then which topics do negative ratings refer to? Evaluations which fail to answers questions such as these provide little guidance for improvement.

Section 5: Rating Time Spent on Topics

Like section 4, the feedback provided from this section was generalized across the entire course. Students sometimes indicated that time spent on topics was too short or too long. However, they rarely specified which topics they were referring to. Thus, this feedback was not very helpful to us in making time adjustments.

Occasionally, students would indicate that the time devoted to course topics was both too short and too long. While such replies are useful for philosophical contemplation, they are not very helpful for course improvement.

Sections 6 and 7: Course Likes and Dislikes

Sections 6 and 7 allowed trainees to let us know what they liked and disliked about a course. These sections of the evaluation consistently provided helpful feedback for course improvement.

However, even these sections occasionally produced results that were not very helpful. For example, we have received complaints about bad weather, students not being able to leave early on payday, and other things beyond our control.

Also, trainee's personal comments were sometimes not very helpful. This factor reminds me of a friend who teaches Introductory Anthropology at a small college. He enjoys sharing in his students observations through course evaluations. One student wrote, "This teacher is like Hannibal Lechter from the movie *The Silence of the Lambs* ". Another wrote "The instructor reminds me of the Mr. Hyde phase of the Dr. Jekyll/Mr. Hyde character from the Bugs Bunny cartoons". I believe that students should have a chance to make any comments they like on course evaluations. However, some observations, although very interesting to read, don't provide a lot of guidance for improvement.

CONSIDERATIONS FOR IMPROVEMENT

At UAB/CLEAR we recently began an effort to improve our course evaluation process. We had one major advantage in this effort: We knew what bad evaluation was. We were intimately acquainted with bad evaluation because we had been doing it for years. In our case bad evaluation produced results which were overly subjective, confusing, occasionally bizarre, and sometimes bad for instructor morale. Moreover, bad evaluation provided very little guidance for improvement of training.

As a starting point for improvement, we threw out our old evaluation form. We did retain the few questions which sometimes provided useful information. We then identified additional questions that we wanted our evaluations to answer. We rewrote the questions several times to make them easier to read and understand. These questions served as the basis for our new evaluation format.

A NEW AND IMPROVED EVALUATION FORMAT

Our initial efforts at improvement resulted in a new evaluation form, as shown in Appendix 2. It is designed to provide answers to the questions we had about how students experience our courses. The new evaluation format consists of three parts, as described below.

Part 1: Trainee Education and Work Experience

This section provides information on educational level, and work experience for each respondent. We plan to correlate this information with trainee responses on the evaluation.

Part 2: Evaluation of Course Modules

This section allows trainees to provide basic feedback on all modules of the course. We ask that they do this as the course progresses rather than waiting until the end. Otherwise, they tend to forget topics over a long course.

This section is completed by answering "Yes" or "No" to the following set of questions for each module.

• Was this part of the course interesting?

• Did you have the chance to really take part?

• Were you able to follow what was taught?

• Did you learn things that can help you stay safe and healthy on the job?

    If No, why not? Check One.

    - Couldn't understand the material

    - Already knew all I needed to know about the topic

    - Information did not pertain to my job

• Should we take more time to cover this material?

• Could we have covered this material in a shorter time?

Part 3: Overall Impressions of Course and Comments

This section is intended to provide feedback on the course as a whole. Was it worthwhile? Did the modules fit together well? Was the learning environment comfortable? What parts were especially liked or disliked, and why?

Also, what evaluation form would be complete without a "comments" space? This serves as a place for lingering comments which didn't quite fit in elsewhere.

CONCLUSION

We've only recently begun using our new evaluation format. We don't know yet if it will solve all the problems that I've described. However, early indications have been good. We remain optimistic.

I believe that course evaluation is problematic by nature. Thus, as glaring problems are corrected, more subtle or insidious difficulties may become apparent. I strongly suspect that improvement of evaluation will be an ongoing evolutionary process. However, I do feel that we have taken a valuable first step in that process. I just wish we had done it years ago.