

An Education and Training Evaluation that Changed a Program

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ABSTRACT

This paper presents an evaluation of Wisconsin's Daylighting Collaborative as a case study of a successful education and training evaluation that helped drive subsequent program activities. Kirkpatrick's four levels of training evaluation serve as an organizing framework for discussing how the evaluation's use of common techniques relate to the theory of education and training evaluation. The paper presents the daylighting evaluation's methodology in the context of these "four levels," reports evaluation findings, and discusses the evaluation's effects on the program. This discussion suggests several keys – both methodological and organizational – to the evaluation's success as a driver of program change.

Introduction

An internal evaluation of the Energy Center of Wisconsin's Daylighting Collaborative offers an example of an education and training evaluation that helped drive subsequent program activities. This paper presents the evaluation as a case study that illustrates (1) the various elements that make up a comprehensive education and training evaluation and (2) how education and training evaluation can play an important role in program design.

The Daylighting Collaborative was organized in 1998 to save energy through increased use of daylighting in commercial buildings. The program was based on a particular daylighting approach that promises high quality natural light at little or no additional first cost. To deliver on these promises, the approach relies on controlled admittance of light and cooling load avoidance that allows downsizing of cooling systems.

Program activities began in 1999 with the rollout of a two-part series of full-day technical training events for architects, engineers, and building owners. These training events were designed to introduce attendees to the program's daylighting approach and to motivate them to implement daylighting in upcoming building projects. Training was complemented by outreach activities and the availability of "second-look" design assistance for architects who attended a training event.

The initial focus of the program was new construction of office and educational buildings in Wisconsin.

The Energy Center of Wisconsin set aside a portion of the Daylighting Collaborative's budget for evaluation. Because the program's approach relied so heavily on education and training, the evaluation focused much of its early activities on an assessment of the effectiveness of these training events.

Framework for Evaluating Education and Training Events

In 1959, Donald Kirkpatrick set the standard for evaluations of education and training programs with his publication of four evaluation levels (see Kirkpatrick 1994). The four levels are reaction, learning, behavior, and results. Growing expectations by those who fund training – especially in the corporate world – have led to more attention to a component of the fourth level; increasing numbers of managers are asking for a quantitative calculation of return on investment. This trend has caused some

authors to dedicate a fifth level of evaluation to “ROI” while adding their own mark on the Kirkpatrick model (e.g., Phillips & Stone 2002). Proving a financial return has not yet become an expectation for energy training events in Wisconsin, however, making the fifth level less applicable.

Any of the Kirkpatrick-based models would serve as a useful organizing framework for this paper. This author has opted to use Phillips & Stone’s version of the model, but without return on investment. The remaining levels are:

1. **Reaction, satisfaction, and planned action** – Captures the attendees’ initial reaction to the training. Did the content meet their needs? Was it delivered well? Do they intend to use the information presented?
2. **Learning** – Compares what the attendees learned (or what main messages they took away from the training) to the event’s learning objectives.
3. **Implementation** – Determines what actions, if any, attendees took as a result of the training.
4. **Business impact** – Identifies how the training affects the sponsoring organization’s business objectives, which could be in terms of internal product inputs (cost, product quality, etc.) or external measures (increased customer awareness, implementation, etc.).

Although coincidentally, the Energy Center of Wisconsin’s evaluation activities mirrored these four levels of training evaluation. The table below maps our evaluation activities to these levels.

Table 1: Evaluation Activities for the Daylighting Collaborative

Level of Training Evaluation	Evaluation Activities for the Daylighting Collaborative	Scope (program activities included)	Completions
Reaction, Satisfaction, and Planned Action	Questionnaires completed by attendees immediately after training (“day-of-training questionnaires”)	Training events only	385
Learning	Day-of-training questionnaires	Training events only	385*
	Telephone interviews of a sample of attendees	All program activities	11
Implementation	Telephone interviews of a sample of attendees	All program activities	11*
	Mail survey of a sample of architects and engineers who attended	All program activities	39
Business Impact	Analysis of data collected	All program activities	n/a

*	same as reported in the prior level
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Results

This section discusses each of these levels of training in more detail, followed by the Energy Center of Wisconsin's (hereafter, "our") evaluation approach for each level, the evaluation findings, and their effects on the program.

Reaction, Satisfaction, and Planned Action

Day-of-training questionnaires provide a valuable and cost-effective tool in the evaluation of education and training events. Capturing attendees' reactions while they are still gathered at the training facility with the event fresh in their minds provides an opportunity to efficiently assess attendees' overall perceptions. It also allows evaluators to obtain feedback on whether the event:

- provided useful and credible content to the attendee,
- delivered content effectively,
- motivated any planned changes in attendees' practices, and
- met the event's learning objectives (a second-level issue).

For the daylighting evaluation, we made full use of an existing assessment system in place for the Energy Center of Wisconsin's education and training events since 1997. Attendees to these events are asked to complete a questionnaire at the conclusion of the training. These questionnaires contain standard questions asked at all events, as well as customized questions dealing specifically with the event being evaluated. This system provides a wealth of comparative evaluation data that encompasses 7,000 respondents who attended 250 training events related to energy efficiency in all major sectors.¹

Attendees at all daylighting technical trainings were asked to complete a customized version of these questionnaires. Three hundred eighty-five respondents (about 73 percent of attendees) gave the daylighting program's technical trainings an average grade of B+ (4.37 on a five-point scale) during its first 18 months of operation. Further, 77 percent claimed that they would apply the information they had learned in their jobs. Comparison of these scores to those of the Energy Center of Wisconsin's other training events showed that the daylighting events were performing well. For example, the average grade for all training events in 1999-2000 was also a B+ (4.31).²

For some day-of-training questionnaires, we also added more detailed questions about likely implementation of daylighting and possible barriers. When we asked these questions at one event held in December 2000 (18 months into the program), a majority of respondents (83%) indicated they were likely to incorporate program recommendations concerning the amount of installed electric lighting in their next building project. Most respondents answered similarly concerning the characteristics of glass specified (76%), the sizing of the cooling system (73%), the use of daylighting controls (70%), the placement of windows (68%), and the use of shading devices (55%). These six actions encompass the core of the daylighting approach advocated by the program and taught in the training events.

However, one important market barrier began to emerge on these questionnaires. Sixty-one percent of respondents agreed with the statement that "most of my clients would consider Cool Daylighting³ only if done without *any* increase in first cost." Although most respondents (including

¹ These statistics include events held through June 2002. About half of these evaluation responses were available to provide context for our evaluation of education and training events held by the Daylighting Collaborative.

² The Energy Center of Wisconsin's (ECW's) education and training events are generally regarded as high-quality events, so we interpreted the daylighting events' scores at and above ECW's overall average as positive results.

³ "Cool Daylighting" was the program's name for its particular version of daylighting.

84 percent of those agreeing with the statement above) thought they could implement Cool Daylighting without increasing first cost, we would need to follow up with attendees to determine whether they had been successful.

Because the training events were the core program activity at that time, day-of-training questionnaires served as a foundation for our evaluation of the program. They provided cause for optimism that attendees would implement – or, at least, try to implement – daylighting in the facilities they were designing and building. However, these questionnaires could not provide any actual information on attendee practices once they left the training facility. Confirming the persistence of attendee enthusiasm and on-the-job application of daylighting would require additional evaluation work.

Learning

The primary purpose of education and training is to impart learning. Learning could come in various forms – as facts and knowledge, as skills, or even as a change of perception. Each education and training event should have clear learner outcomes, and these should be measured by the evaluation.

In our evaluation, we addressed learning on both the day-of-training questionnaires and in follow-up interviews. The questionnaires asked attendees to rate how well the training event met its learning objectives. As shown in the table below, attendees generally rated the events positively on meeting their objectives.

Table 2: Attendee Assessment of Training Objectives

Training Objective	Grade	Numeric Score (on a 5-point scale)
Explaining Cool Daylighting	B+	4.37
Explaining Economic Benefits	B+	4.40
Explaining Environmental Benefits	B+	4.27
Explaining Human Performance Benefits	B	3.97
Providing Technical Information to Apply	B+	4.20

In our follow-up interviews, we asked attendees whether they felt technically prepared to implement the daylighting strategy recommended by the program. Most felt that they had the information they would need to implement daylighting, although a couple of architects seemed unsure whether they had sufficient knowledge to "crunch the numbers." Hence, the interviews suggest that technical skill was not a pervasive barrier to implementation.

Implementation

Education and training events for adults are generally intended to result in changed behavior, such as changed practices or decisions. Evaluating whether a training event resulted in (or facilitated) the desired response requires follow-up after the attendees have had a reasonable amount of time to incorporate training concepts into their work. A follow-up at that time is much more likely than day-of-training questionnaires to provide an accurate measure of whether the training had the desired effect on behavior. These follow-ups can also help to identify unintended effects of a training event and barriers to implementation encountered by attendees.

We conducted both a quantitative implementation survey and qualitative follow-up interviews. Contrary to usual practice, we conducted the implementation survey first and then added qualitative follow-ups to help us interpret and determine the reliability of the survey results. (The reliability of the

survey results became suspect when our response rate was a disappointing 42 percent of sampled program participants.)

Implementation Survey. Our implementation survey consisted of a one-page questionnaire mailed to 89 building decision-makers⁴ (mostly architects) who had attended the program's technical training events. The goal of the survey was to determine the extent to which training attendees were incorporating daylighting into building design projects, to identify barriers to daylighting, and to solicit suggestions for the program.

Survey results indicate that many respondents:

- were incorporating daylighting into at least some of their building designs;
- had altered some design elements of at least one building as a result of the program's training event;
- viewed cost and a lack of demand by owners as the biggest barriers they faced to further implementation of daylighting; and
- believed that the program should continue to offer training events, continue its outreach efforts, and showcase more real-life examples of daylighting.

In one sequence of questions, we attempted to ascertain which aspects of the program's daylighting approach were being implemented. The table below shows the percentage of respondents who indicated that they approached any of six design elements differently for at least one building as a result of the training.

Table 3: Effect of Technical Training Events on Building Design

(Percentage of respondents who approached the stated design elements differently for at least one building as a result of the technical training)

Design Element	Percentage of Respondents
placement of windows	70%
characteristics of glass specified	65%
amount of installed electric lighting	65%
use of shading devices	57%
use of daylighting controls	51%
sizing of the cooling system	24%

These survey results provided an indication that the training was having an effect on building design, but at least one important program strategy was not being implemented. The reduction of a daylight building's cooling system is a critical component of the program's daylighting approach because it produces cost savings that then become available for more expensive glazing and other daylighting-related costs. Only a quarter of respondents claimed to have changed the size of any cooling systems.

Follow-up Interviews. The low response rate to the implementation survey reinforced the need for additional follow-ups in the form of 11 qualitative interviews. The primary goals of these interviews

⁴ These 89 decision-makers represented the vast majority of Wisconsin-based architects, engineers, and building owners who could be identified as fitting in one of these groups from training registrations and who had attended the program's training events at the time of the survey.

was to (1) assess the risk of non-response bias in our survey results and (2) obtain a deeper understanding of how the training events had influenced attendees after they had returned to their jobs. To accomplish these goals, we interviewed a mix of respondents and non-respondents to the implementation survey.

Most interviewees seemed genuinely enthusiastic about daylighting and interested in applying some of the concepts covered in the training. Some spoke about a desire to apply the program's daylighting approach as a complete package, while others focused on specific elements.

Despite their enthusiasm, none of the interviewees had fully implemented the recommended daylighting approach in any design project. Three interviewees had attempted full implementation, but encountered various barriers or circumstances outside their control. Five others had implemented some, but not all, aspects of the daylighting approach.

Most commonly, the partial implementers focused on design elements that bring light into the building more effectively, such as increasing the shading coefficient of the glass they specified, modifying window placement to bring light into the building more effectively, and designing the interior of the building to allow deeper penetration of natural light. Interviewee comments about the selling points of daylighting confirmed that they were focused on improving the quality of light and, therefore, most likely to implement changes that bring this result.

However, two important aspects of the program's daylighting approach – reduced electric lighting and downsizing of the cooling system – received little mention in interviewees' descriptions of their use of daylighting. When asked about installed lighting levels, only one interviewee reported having made any changes as a result of the training. Similarly, only one interviewee reported any changes to the cooling system. None of the interviewees fully implemented the program's recommendations concerning lighting levels or downsizing of cooling systems.

Several barriers emerged from the interviews, both in response to direct questions and through interviewees' descriptions of their use of daylighting. Not surprisingly, the most commonly cited barriers resembled some of those identified by the implementation survey. They were:

- lack of awareness and interest by owners;
- concerns about the effect on project cost; and
- financial disincentives for design professionals.

When we compared responses to the interviews and the survey, we found that the extent of daylighting activity described by respondents during the interviews was lower than that reported by the same individuals to the survey. The difference may lie in the fact that some of the questions on the mail survey addressed daylighting generally, while the interviews focused more on the program's recommended approach. Alternatively, respondents to the implementation survey may have been more generous in counting certain buildings as "daylit" than when they were interviewed and asked to describe their designs. In either case, this comparison suggested that the results of the implementation survey may overstate actual training effects and may not provide an accurate quantitative accounting of daylighting implementation.

Business Impact

Organizations sponsor education and training for a reason. In assessing the business impact of an education and training event, evaluators need to determine how well the event accomplished the "business reason" for sponsoring the event in the first place. In the case of for-profit businesses, this step may require additional data collection to quantify such effects as cost reductions, improvements in

product quality, or increases in sales. In the case of the Daylighting Collaborative, this step required only a “matching up” of the effects of the training on attendees with the program’s goals.

Whether or not the Daylighting Collaborative was achieving its primary goals (i.e., whether it had the desired “business impact”) depended on two key design factors in training attendees’ buildings: the reduction of installed electric lighting intensity and the downsizing of cooling systems. Reduced lighting intensity is the program’s primary path to its *raison d’être*: achieving energy savings. Downsized cooling systems (made possible by cooling load avoidance) are the program’s answer to cost concerns, which are the most commonly cited barrier to daylighting. We could tell how well the program was performing in these areas from the follow-up interviews and surveys described previously, so we needed only analyze the results to assess the program’s “business impact.”

Unfortunately, it appeared that the two key program design factors were often left out when participants implemented the program’s recommended daylighting program only partially. Our analysis suggested two major barriers to more complete implementation:

1. Some architects were only interested in improving the quality of light in the buildings they designed with little concern for energy consumption.
2. Attendees who wanted to implement the program’s recommended approach encountered resistance from other members of the building design or planning team and could not (or did not) convey in them the same degree of enthusiasm that they appeared to feel themselves.

To address these barriers, we recommended that the program provide more assistance to training attendees after the training. We called this assistance “decision support” and suggested several possible ways of providing such support.

Program Adjustments

The program staff responded to the evaluation results by:

- adding design assistance for engineers (to similar services that already existed for architects who wanted a daylighting expert to review and comment on their early plans);
- incorporated more options for attendees to receive support and materials from the program when addressing their design and project teams; and
- built these changes into a subsequent public benefits program that was designed to promote high performance construction in the commercial sector.

In addition, initial funders of the Daylighting Collaborative agreed to supplement the public benefits program with a newly funded program designed to provide facilitation services to design professionals seeking to attempt daylighting or high performance construction.

These program changes were made possible by:

- openness by the program team to the evaluation results and to program changes;
- close coordination and frequent communication between the evaluation manager and the program team (facilitated by the fact that the program and the evaluation were conducted within the same organization);
- timing of the evaluation when program adjustments could still be completed;
- presentation of evaluation results to funders as an opportunity to improve the program rather than a critique of what is not working; and

- funders who paid attention to evaluation results.

Conclusions

This evaluation of a training-dominated daylighting program demonstrates several components of a complete education and training evaluation, including:

- **day-of-training questionnaires** – A day-of-training questionnaire provided immediate feedback about participant satisfaction and planned actions by attendees.
- **a consistent evaluation system** – Comparison of these results to historic averages for similar audiences provided context and highlighted the value of the training to its participants.
- **follow-up interviews/surveys** – Follow-up surveys provided information about what changes training attendees had made in their practices, while follow-up interviews provided deeper information about these revised practices and continued barriers to the desired behavior.
- **assessment against broader program goals** – Comparison of evaluation results to the program's overall objectives helped to provide an assessment of the program itself, rather than only its training component. Thereby, we were able to recommend non-training program activities needed to accomplish the program's goals.

Although each of these components has value in itself, together they form a comprehensive evaluation system for education and training events. When possible, education and training events that are critical to a program's success should include a mix of immediate and follow-up evaluation activities that address some or all of the levels of training evaluation discussed in the literature.

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