

TEACHING LESSONS LEARNED

This is a continuing series of quarterly articles on lessons learned and best practices in civil engineering education. The intent of the series is to reinforce good practices, describe new or developing practices, and provide a forum for what works well and what does not. It is hoped that this series will be an important quarterly read for all civil engineering educators and all those interested in what's going on in civil engineering education today. Authors and topics will vary from issue to issue. Contact Associate Editor Mark Evans if you wish to contribute to an upcoming issue.

USING WORKSHOP-TRAINING TECHNIQUES IN THE ENGINEERING CLASSROOM

Introduction

This article outlines workshop training techniques and strategies that can be applied to engineering classrooms. Many of the techniques described in the following sections contain insights that the writer has gained as a trainer and design team member for the Family Community Leadership (FCL) Training of Leaders program, sponsored by the University of Hawaii College of Tropical Agriculture and Human Resources Cooperative Extension Service and the Hawaii Association for Family & Community Education.

When the writer first became an FCL trainer, it seemed that teaching was merely a presentation of content through lecturing. Through first-hand experiences and working with team members who are professional trainers, the writer now realizes that effective trainers must do many things to facilitate learning and improve the learning environment in addition to understanding the course material. This article provides a perspective from a professional engineer with 15 years of experience, who has also been a substitute lecturer and guest lecturer at the University of Hawaii.

Why Change?

Educational techniques discussed in this article have been evolving over many years from a purely content-oriented instructional mode to one that also places importance on the learning environment and the learners themselves. This approach places emphasis on how the material is presented in addition to what is presented.

The National Highway Institute (2000) is currently certifying its instructors to improve teaching methods: "NHI is changing the format of its courses from an 'information-centered' to a 'learner-centered' format. A skilled trainer will emphasize the use of learner-centered techniques, such as problem-solving analysis, discussion, and experimentation exercises that tap into the knowledge and skills that an adult learner brings to the classroom."

Felder (1996) also recognizes the importance of focusing on the learner. "In traditional instruction, the teacher's

primary functions are lecturing, designing assignments and tests, and grading; in SCI [student-centered instruction], the teacher still has these functions but also provides students with opportunities to learn independently and from one another and coaches them in the skills they need to so effectively."

Expand Your Comfort Zone

Effective trainers need to stretch their comfort zones to explore teaching methods that may be contrary to their own personal preferences. Comfort zones define those boundaries wherein we feel comfortable operating and where we want to hide during times of duress. While a particular teaching technique may be comfortable, it may not be the ideal style to use in educating students. To reach out to all learners, trainers may have to practice using techniques that may be contrary to their preferred style of delivery. Comfort zones can be expanded after a period of practice. For example, being expressive and enthusiastic may be difficult for some, but these are characteristics that trainers need to practice in order to make them part of their comfort zones.

Create a Frame

The trainer's first step is to create a frame for the picture being presented by setting the context of the material. An effective trainer creates a meaningful link between the subject and its relevance to the participants. It involves preparation similar to that used for the introduction of a speech. Borden (1935) states that to create an effective introduction, one must "picture your listeners as looking uneasily at their watches, stifling yawns and giving vent to a unanimous 'Ho-Hum!'" The key steps in creating a frame involve tying the topic to the following questions:

- Why is this important (to the participant)?
- How will knowing this benefit (the participant)?

A trainer also needs to link different subjects together to produce a smooth transition when shifting to another topic. This process involves creating a frame from the previous topic to the new topic to show the relationship between the two subjects and to provide insight to how they are related to the bigger picture.

Understand Learning Styles

The trainer's goal is to facilitate learning through creative use of media to reach different types of learners. There are many theories on learning styles. Felder (1993) theorizes that there are five types of learning styles—inductive and deductive, active and reflective, sequential and global understanding, active and reflective processing, sensing and intuitive perception and visual and verbal input—while Gardner (1993) theorizes that there are up to

seven learning styles—verbal/linguistic, logical/mathematical, visual/spatial, body/kinesthetic, musical/rhythmic, interpersonal, and intrapersonal.

The key is to realize that people learn and absorb information in different ways and at different rates. It is equally important to realize that these styles are rough distinctions and not absolute categories, and people may have more than one learning-style preference. A trainer should also be aware that there are at least three basic types of learning styles—visual, auditory, and kinesthetic. Visual learners use their eyes; auditory learners use their ears; and kinesthetic learners through feeling, touch, or doing. An effective trainer designs lessons to accommodate different learning styles.

Read Nonverbal Cues

Reading nonverbal cues from participants provides immediate feedback on how the material is being received and allows adjustments to be made. If the energy of the group is low, as would be after lunch, the trainer could start off with a hands-on exercise to raise the group's energy instead of diving directly into a lecture. Consider having students stretch to get their blood circulating and to break the monotony after a lengthy lecture if energy levels appear low. People are more receptive to learning when they are comfortable as opposed to being tired and cramped.

The energy level of the class is also proportional to the energy that the trainer projects. The best advice about teaching styles is to not worry about projecting a visual, auditory, or kinesthetic teaching style, but to simply project energy and enthusiasm. Participants can also read nonverbal cues and always seem to be aware whether or not the instructor is genuinely enthusiastic about the subject matter.

Implement Course Corrections

Course corrections are normal events during training workshops. Be flexible. Many things happen that can change the direction of the discussion, and trainers need to be prepared to modify the lesson to suit the situation. Participants can often venture into very meaningful discussions or raise pertinent questions about the subject just covered. These insights are often more valuable to the participants and need to be accommodated. Trainers need to be prepared to modify their lesson plans to allow this discussion to continue.

When preparing a lesson plan, distinctions need to be made between items that are essential and items that are nice to have. If time becomes a factor, nonessential items can be skipped completely. Another technique in preparation is to reduce important items to concise key concepts or bullet points that can be quickly covered when time runs short. There is little benefit to overloading participants with volumes of information in a short period of time. It is better to have them learn a few concepts and

learn them well. The keys are that preparation is essential prior to the workshop and flexibility is essential during the workshop.

Facilitate Success

An effective trainer draws out the genius from within each individual by creating rapport and empowering the participants so that they want to learn. This is accomplished by creating a safe atmosphere for learning—by not judging, ridiculing, or criticizing when participants ask questions or make statements and by protecting them from other participants' criticisms or ridicule. When a participant tries to make a point and is not coming across clearly, the most open phrase in a trainer's vocabulary is, "say more!" This simple phrase conveys to the person that what they have to say is important to everyone in the class and encourages participation. The underlying tone is more open and inviting than saying "I don't understand, could you please clarify your point?"

Use Icebreakers

Learning everyone's name and calling them by name also builds trust and rapport between the trainer and the participants. It also provides the participants with the opportunity to learn each other's names, which leads to networking. Using icebreakers, similar to those used in conducting effective meetings, by having each participant state their name and a favorite color (or food—be creative!) is a fun way to start class and allows everyone to get to know each other. This relatively simple exercise can build community within a group when used on a regular basis.

Use Flip Charts

Flip charts are an extremely useful tool in reinforcing key concepts. Although rather primitive, flip charts can highlight key points, equations, or concepts more effectively than computer-generated text slides, chalkboards, white boards, and view graphs. Once a chalkboard is erased or slides are changed, the concept remains only in the participant's notes or memory. However, a sheet with a key concept can be posted on another part of the classroom wall to provide lasting reinforcement. When using flip charts, it is more effective to tear a sheet off and tape it on the wall when it is full rather than flipping to the next sheet. A sheet from a previous session can also be posted on the wall during following sessions to reinforce key concepts.

Scribe Effectively

Using space and color effectively and writing legibly are key elements of scribing. Listing items in the same color and using every square inch of the writing area makes reading extremely difficult. Alternating colors when scribing lists makes them easier to read and provides

a pleasant visual effect. Test color and spacing schemes; choose colors that contrast with the media and are visible from all parts of the room and visible under different lighting conditions.

Water-based colored markers seem to work the best on flip chart paper. Colors to avoid when writing on flip chart paper include yellow, orange, and pink, as they are difficult to read from a distance. Colors that work best are blue, green, black, brown, purple, and red. Red is best used for highlighting key concepts.

Use Appropriate Seating Arrangements

The classroom seating arrangement, an important element in creating an effective learning environment, is often overlooked. If the seating is such that the participants cannot see or hear the trainer, the points made in an excellent presentation or lecture will be lost.

Three types of seating can be used for different types of activities.

Content-based presentations work best with a semicircular seating arrangement. This seating format enables the trainer to establish eye contact with all of the participants and allows the trainer to observe nonverbal cues from the participants. This seating style also allows all of the participants to focus on the presentation with minimal obstruction and promotes interaction and discussion between participants themselves.

A circular seating arrangement is ideal for group discussions; it promotes open dialogue and encourages participation through equity and respect, as everyone in the class including the trainer is part of the circle. Meaningful and productive discussions or exchanges can better happen when participants are able to make eye contact with each other.

Another kind of seating arrangement is ideal for multimedia presentations such as view graphs, computer-generated projections, and video. The room is arranged in a chevron-type or “V”-shaped seating arrangement two or three rows deep with the projector at the apex to minimize view obstruction.

In any of the three seating arrangements, keep seats relatively close together and near the presentation area to create a more intimate setting between the participants and the trainer. Have participants change seats on a routine basis to keep them from sitting in the same place or with the same group of people—then they can network with everyone in the class. Changing one’s perspective can allow one to see things in a completely different manner. In a scene in the movie *Dead Poet’s Society*, Robin Williams had each student stand on the teacher’s desk to gain a new perspective.

Use Group Teach-Backs

Group teach-backs involve assigning problems to different groups and requiring each group to present their solution back to the class. Teach-backs allow participants

to apply their new knowledge and provide the opportunity to learn from one another during the group problem-solving process. Asking questions and questioning a peer during group discussions is safer and less threatening than questioning a trainer. The trainer circulates around the room to provide assistance or to clarify concepts as each group discusses a problem and works on the solution. The writer used this technique recently while serving as a substitute instructor in a transportation engineering class. The original plan was to lecture on the theory and work through two sample problems in the text. Instead, a short presentation was made on the theory and the class was separated into two groups. Each group was required to solve one problem and present the solution to the class. The professor called the writer the following week to mention that he received many positive comments from his class about the group teach-back method and planned to use it in future classes.

Group teach-backs can also be used for reading assignments. The participants can be broken into groups with each group being responsible for covering several key concepts in the reading material as a homework assignment. A group teach-back can also be an effective tool when there is not enough time in class to complete the trainer’s presentation. Various portions of the content that are not covered in class can be assigned to groups who will meet, read the material, and prepare a short presentation for the class’s next session.

Use Group Debriefings

Another tool that trainers use is a group debriefing at the conclusion of a content-rich teaching piece. A simple question posed to and answered by everyone in the class, “What is one concept that you learned and how can you apply it?” allows the participants to reframe the subject matter in their own words and benefit from the insights and interpretations of their peers. Scribing these insights onto a flip chart also reinforces the lessons learned.

Use Paired-Sharing

A variation on the group debriefing is to have the participants break into pairs and share their thoughts with one another if time becomes a factor. After both partners are done sharing, the trainer can ask for some of the participants to share their insights with the entire class. Paired-sharing can also be used to raise the energy level of the group if the nonverbal cues tell the trainer that the group is tired, bored, or experiencing information overload. The paired-sharing exercise provides a break and a change of pace for the participants, allowing them to actively participate and to listen to their partner.

Teach as a Team

Training workshops often use a team training approach, where a team develops the material and lesson plan. Available team members (those not on the floor presenting)

monitor verbal cues, assist with hand-outs or audio visual aids, help with group teach-backs, and keep track of time. A tag-team presentation approach using two or more trainers provides variety, as trainers each have unique teaching styles and strengths.

Use After-Action Reviews

Effective trainers always ask participants for feedback to improve their teaching styles and methods. An effective framework for constructive feedback, referred to as “After-action reviews,” are based on concepts presented by Sullivan and Harper (1996), which can be summarized by asking three simple questions:

- What worked?
- Why did it work?
- How can the process be improved?

These questions can be a topic of discussion or could be distributed on a questionnaire after major portions of the subject material have been covered. There must be a high trust built between the participants and the trainer to conduct an after-action review as a class discussion, but it can yield beneficial and candid feedback.

Summary

The ideas presented herein represent some of the methods used by the TOL training team. These teaching techniques—group teach-backs, group debriefings, paired-sharing, team teaching, and after-action reviews—may appear quite different from the traditional delivery methods of classroom instruction. Other techniques that focus on the learner and the classroom environment, namely,

expanding comfort zones, creating a frame, understanding learning styles, reading nonverbal cues, implementing course corrections, facilitating success, and using ice-breakers, can also be used by trainers or educators. Other enhancements that can be made to the physical learning environment, including use of flip charts, effective scribing, and use of appropriate seating arrangements, can also be effective. These strategies and techniques provide a model of instruction that can be applied in the engineering classroom for those who wish to stretch their comfort zones for their instructional methods.

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The opinions expressed herein are strictly those of the writer and are intended to promote meaningful discussion.

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